LEWISVILLE

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BIG MOVE 9: SUSTAINABILITY

JANUARY 11, 2016

Big Move 9: Sustainability

"Before Lewisville's 100th birthday – create a community that is sustainable enough so it's still desirable to people and businesses when Lewisville turns 150."

Big Move 9: Sustainability

- Sustainability is a complex puzzle.
  - It touches all aspects of City operations
  - It also relates to actions by Lewisville residents, businesses and property owners.
- Lewisville has been taking steps that make it more sustainable because they also make good sense for the City's operations and budget.
- Lewisville's approach to sustainability is to be both environmentally responsible AND fiscally wise.
  - Investment for sustainability must also consider cost-effectiveness.

Today's Presentations – Parts of the Puzzle

- Lewisville 2025's Big Move #9 – Sustainability
- Results of work on Action Priorities
  - Resource & Efficiency Assessment – essential first step for City facilities and operations
  - Sustainable Purchasing – enhancements to internal operations and procedures
  - International Green Construction Code (IgCC) 2015 – improvements to construction practices for City and community
- Key recommendations for each

Sustainability & Lewisville 2025

01 Green Centerpiece
02 Extending the Green
03 Old Town
04 Thriving Neighborhoods
05 New Neighborhood Choices
06 Employment Centers
07 Identity Focal Points
08 Marketing and Communications
09 Sustainability

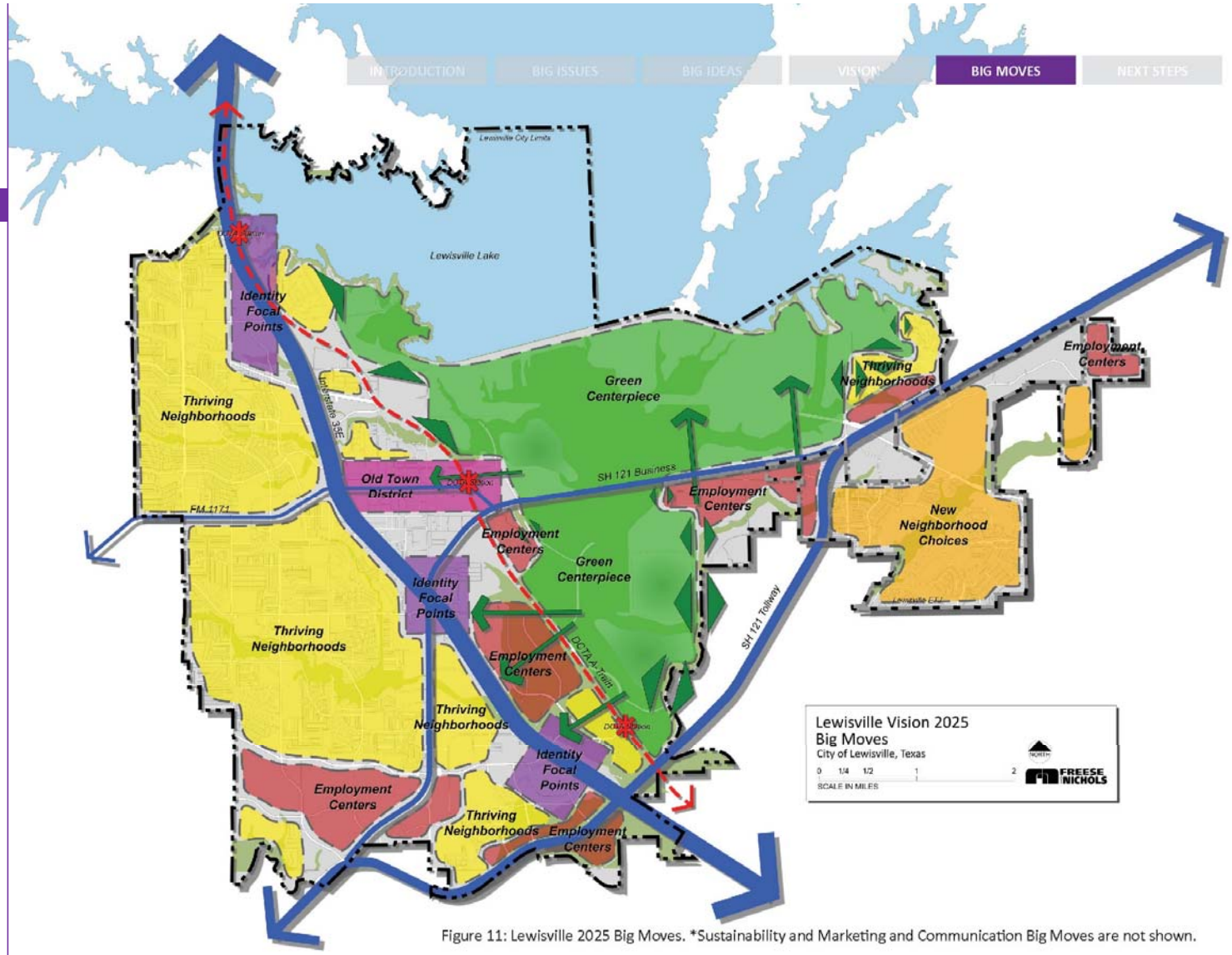

Figure 11: Lewisville 2025 Big Moves. *Sustainability and Marketing and Communication Big Moves are not shown.

Big Move 9: Sustainability Definition

- Sustainability means that limited resources (such as land, water, energy, clean air, natural assets and public funds) are used efficiently to provide a desirable quality of life and business climate that today's residents and businesses need and want, without reducing Lewisville's ability to provide that same quality of life and business climate so future generations of residents and businesses can succeed here too.

Big Move 9: Sustainability Action Priorities

1. Conduct an audit of existing City sites, facilities and vehicle fleet.
2. Establish or enhance design standards for new City sites and facilities, as well as private developments.
3. Evaluate and revise City rates and service procedures to encourage sustainability.
4. Enable Lewisville residents and businesses to make sustainable mobility choices.
5. Use economic development to make Lewisville's economy more resilient.
6. Find creative ways to engage the community, particularly children and young adults, to take advantage of their ideas and interest in sustainability.
7. Include sustainable living in the educational programs offered by the City, LISD, KLB and others.

Action Priority 1: Conduct an audit of existing City sites, facilities and vehicle fleet.

- ☑ Identify the potential for more efficient energy and water use, on-site energy generation and water collection, and site enhancements that help City customers and users access services in a more sustainable way.
- ☑ The audit should identify changes that provide the best results (reduced resource use and cost savings).
- ☑ Begin implementing those changes that are cost-effective.

Action Priority 2: Establish or enhance design standards for new City sites and facilities, as well as private developments.

- ☑Investments in new City sites & facilities designed so they are more sustainable.
- ☑The City can set an example for other new public & private development.
- ☑Design standards could be based on Green Code or similar systems.
- ☑Enact changes that increase the sustainability of new private development & redevelopment.
- ☑Use a mix of education, incentives, guidelines & changes to building codes & development requirements.
- ☑Include information about Lewisville's 'green' building in economic development attraction efforts.
- ☑A task force or working group of community members, development & design professionals & City staff could take the lead on this effort.

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BIG MOVE 9: SUSTAINABILITY

RESOURCE & EFFICIENCY ASSESSMENT

City Council Special Session, January 11, 2016

Action Priority 1: Conduct an audit of existing City sites, facilities and vehicle fleet.

Assessment Process

- Conducted by Transform Global with Linnean Solutions
- Analysis began in early 2015
- Steps included:
  - Year-long data collection
    - Extensive review of energy and budget records, staff interviews, site visits
  - Evaluation
    - Past efforts
    - Comparison with 'best practices' and other cities' experience
  - Review and discussion of results
    - Staff workshop, October 2015
  - Report completion

Topics Addressed

- Resource Use Efficiency
  - A summation of all individual topics
  - Efficiency leads to reduced emissions
- Individual Topics
  - Energy
  - Water
  - Buildings
  - City Fleet
  - Parks, Green Space and Landscaping
  - Solid Waste and Recycling

Results

- ☐Accomplishments to date
- ☐Comparison with benchmarks
- ☐Understanding of costs and benefits
- ☐Recommendations

Accomplishments to date

- Energy saving practices:
  - Energy-saving retrofits:
    - LED lighting upgrades
    - Window Shading
    - Motion Sensors
  - HVAC maintenance practices
  - Energy management systems
  - Reduced water use
  - Energy Star purchases
  - Energy Sources: high % renewable
  - Renewable Energy

Accomplishments to date

- Water conservation
  - Water conservation policy for irrigation
  - Water conservation technology (e.g. auto shut-off)
  - Irrigation management
  - Smart Meter irrigation systems
  - Pump stations: efficient equipment
  - Impervious surface data
  - Storm water management plan
  - Smart Meter (Capstone) pilot program

Accomplishments to date

- Fleet efficiency
  - Idling bulletin: restricts long-term idling
  - Fleet activity modification directive: air pollution alert procedures
  - GPS tracking system: data to aid efficiency efforts
  - Ultra-low sulfur diesel for equipment
  - Bike patrols
  - Fleet materials recycling: tires, fluids
  - Fleet vehicle efficiency considered in replacement policy
  - Clean Fleet Policy: registered with NCTCOG program
  - Alternative fueled vehicles: 2 Prius owned, 2 on order

Accomplishments to date

- Parks and green space
  - Parks master plan provides guidelines for an excellent park system
  - Lewisville is a Tree City USA
  - Railroad Park irrigation from lake water
  - Smartscape landscape ordinance in progress (NCTCOG model)
  - LLELA: 2,000 acre nature preserve
  - Storm water runoff managed at City parks
  - Smart irrigation in some locations, being expanded

Accomplishments to date

- Recycling:
  - The City recycles anything reusable or recoverable, including:
    - Electronic waste
    - Ammunition boxes and cartridges
    - Tires, Motor oil, and automotive fluids
    - Cooking oil
    - Concrete (crushed and used as flex base)
    - Lead acid batteries
    - Toner cartridges
    - Scrap metal, including fire hydrants and water meters
  - The City is installing recycling receptacles in all parks. Decorative outdoor recycling containers have been added to the Old Town area in Ferguson Plaza, MCL Grand Theater courtyard and on Main Street.

Accomplishments to date

- Solid Waste Management
  - Waste Management provides recycling services to 11 City buildings.
  - This includes recycling of paper, cardboard, and plastic.
- Going Paperless
  - The City has implemented reforms to maximize paperless processes.
- Solar Powered Compactors
  - The City has two solar powered Big Bellies at Railroad Park.

Comparison with Benchmarks

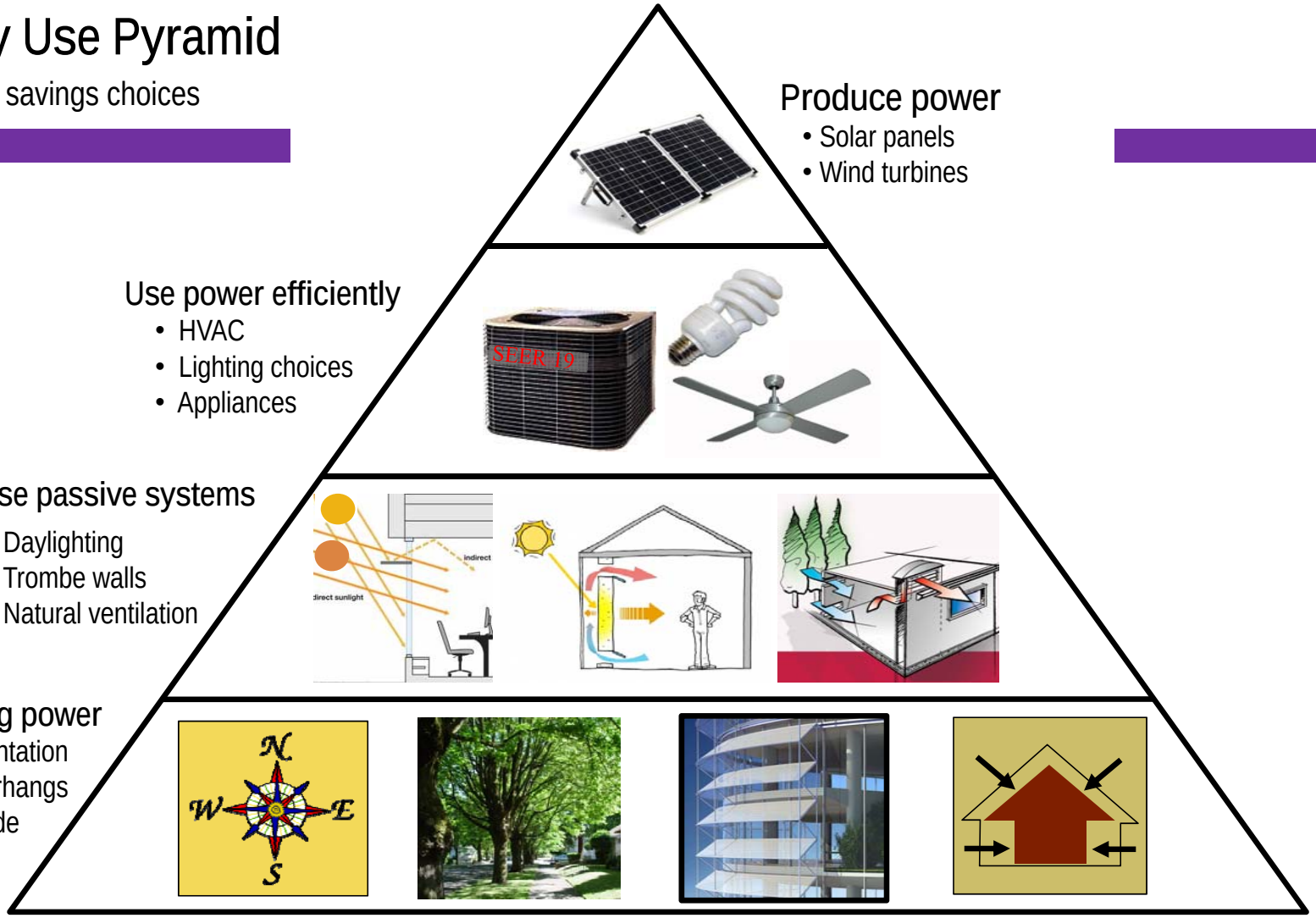
- The Lewisville community's per capita water use (129 GPCD in 2014) is the lowest of all large cities in north Texas, thus reducing the City's energy use in water processing and distribution.
- Water use at individual buildings and sites is, on average, near benchmark levels for areas with low density planting.
- Due to negotiated electricity agreements, Lewisville utilizes power with a higher % renewable energy than the state or national averages.
- Most of the City buildings are about equal to national averages for energy use, a few are above, and several are below, providing targets for further examination.

Comparison of Costs and Benefits

- The energy use pyramid summarizes the approach to resource use efficiency that generally provides the greatest benefit for the cost.
  - **First:** Simple moves that eliminate the need for power use
  - **Second:** Use systems for lighting, ventilation, heating and cooling that do not require power
  - **Third:** Use only very efficient powered systems
  - **Last:** Consider alternative power sources

The Energy Use Pyramid

A guide to energy savings choices



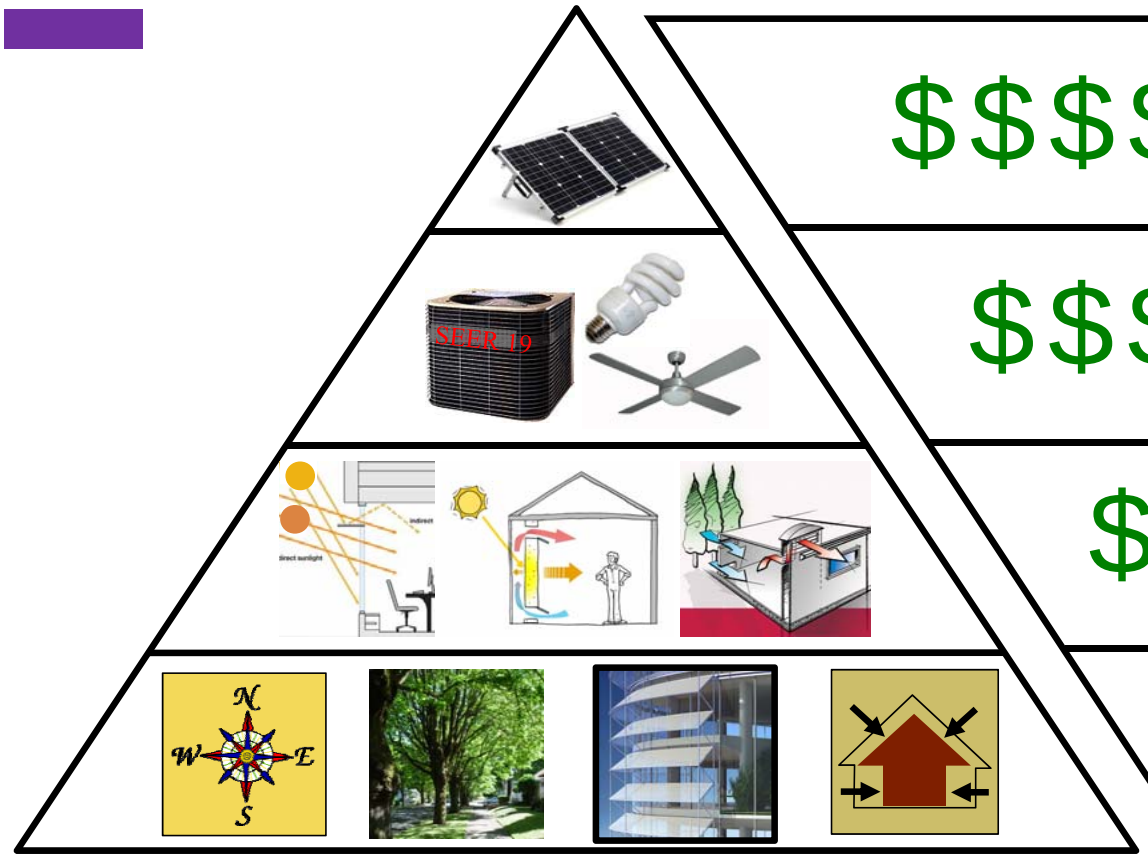
Produce power
- Solar panels
- Wind turbines

Use power efficiently
- HVAC
- Lighting choices
- Appliances

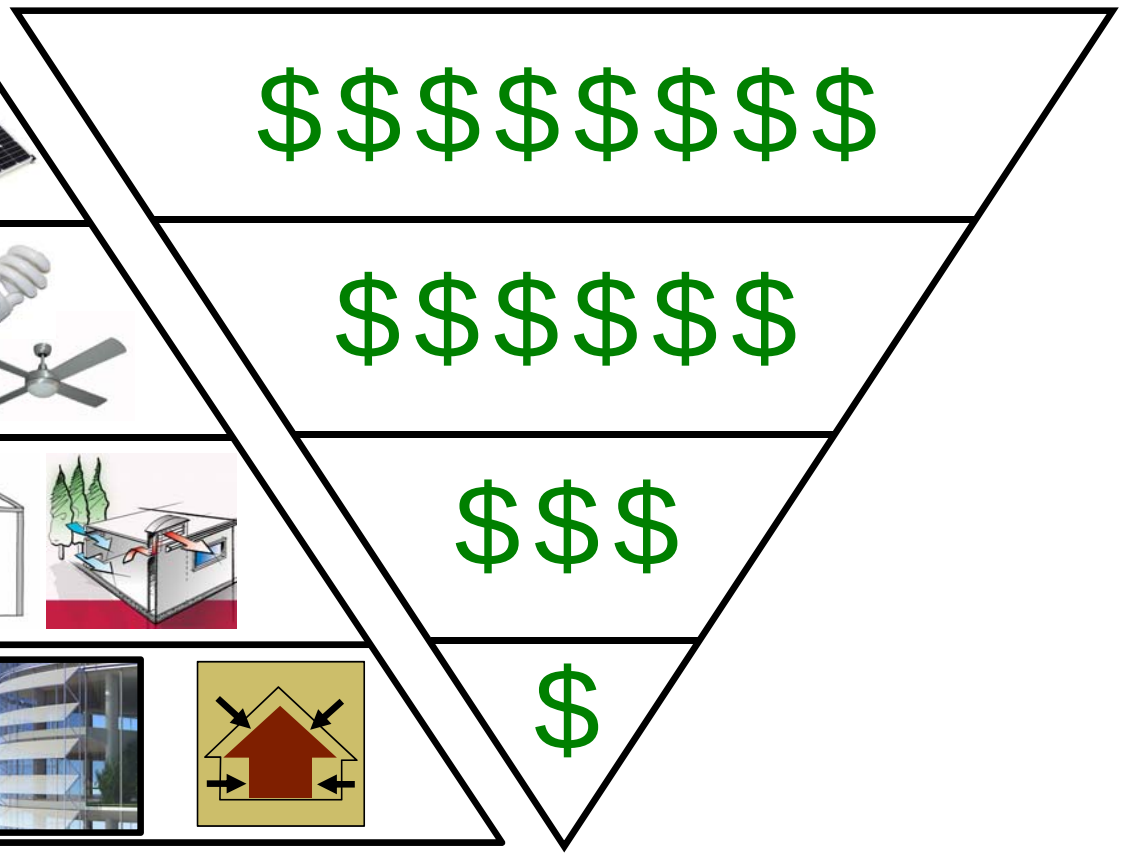
Use passive systems
- Daylighting
- Trombe walls
- Natural ventilation

Avoid using power
- Orientation
- Overhangs
- Shade
- Size

The Energy Use Pyramid



The Cost Pyramid



Major Recommendations

Major Recommendations

1. Lead through *Lewisville 2025* implementation
2. Involve stakeholders at all levels
3. Reduce consumption first
4. Pursue alternative energy sources second

1. Lead through *Lewisville 2025* implementation

- Use the City's initiatives that implement *Lewisville 2025* as the foundation for more active leadership on issues at the regional, state and national level.
  A. Serve on committees (NLC, ICMA, TML, NCTCOG, etc.).
  B. Compete in awards and recognition programs.
  C. Document results so Lewisville can share best practices with other cities.
  D. Advocate changes by energy providers – such as increasing CoServ's low % of renewable energy sources – through TCAP leadership.
  E. Advocate changes in Texas New Mexico Power (TNMP) tariff rates to incentivize a switch to LED street lighting.

2. Involve stakeholders at all levels

- Continue the engagement of City of Lewisville's elected officials, citizens and staff in efforts to implement sustainable practices.
  A. Provide City Council and the Lewisville 2025 Advisory Committee with periodic reports on progress and results.
  B. Complete a set of metrics to document cost and resource use reductions.
  C. Involve staff throughout the organization in developing metrics and tracking progress.
  D. Include education on energy use, water use and recycling in staff training programs.
  E. Create recognition or incentive programs to encourage resource use reduction.
  F. Use interdepartmental teams to implement these recommendations.

3. Reduce consumption first – basic approach

- The most sustainable approach to limited resources is to begin by reducing consumption.
- For the City, the largest resource users are:
  - For electricity:
    - City buildings.
    - Water/wastewater systems.
  - For other forms of energy: the vehicle fleet.
  - For water: irrigation.
- Major recommendations focus on these first.
- Additional recommendations cover other areas of resource use.

3. Reduce consumption first – new buildings and major retrofits

- Finding:
  - The design of new construction or renovation offers very important and cost-effective opportunities to avoid using energy.
- Recommendations (with examples):

A. Use green building design for new facilities.
   - Multi-generational Recreation Center

B. Incorporate green building design features in building retrofits.
   - Fire Stations 2 & 6

3. Reduce consumption first – existing buildings

- Findings:
  - This assessment identifies some high use buildings that need detailed investigation – specific functions may require higher resource use than average.
  - It also includes actions that can be taken at all City buildings.
- Recommendations (with examples):

C. Investigate high use buildings for water & energy savings.
  - Hedrick House
  - MCL Grand

D. Refine building operations and procedures in all buildings.
  - Climate control standards
  - Water consumption

3. Reduce consumption first – water/wastewater

- Findings:
  - Higher water consumption in the community increases energy consumption by these systems. Castle Hills' consumption is higher than Lewisville's.
  - City's past investments have reduced energy use, water consumption at City facilities and water loss from leaks in the systems.
  - Staff has detailed analysis and a schedule for replacement of aging pumps and other equipment with more efficient versions.
- Recommendations:

E. Consider accelerating the replacement schedule to get reductions sooner.

F. Develop strategy to minimize increased energy consumption by these systems as the Castle Hills districts are annexed.

3. Reduce consumption first – vehicle fleet

- Findings:
  - The City has an extensive process for evaluating requests for new or replacement vehicles. Fuel efficiency is considered in these decisions.
  - City policies and directives support vehicle use that reduces fuel use and emissions.
- Recommendations:

G. Continue these existing practices and look for ways to enhance them.

H. Use the new vehicle GPS tracking system to identify additional ways to reduce fuel use and emissions.

3. Reduce consumption first – City water use

- Findings:
  - Lewisville's past water conservation efforts have already had significant impacts. From 2013 to 2014, City policies have helped reduce water consumption in the Lewisville community by 2 million gallons.
  - The City's own water use serves as an example to the community.
- Recommendations:

I. Expand use of smart irrigation systems for parks & other City sites.

J. Increase use of efficient fixtures in City buildings.

3. Reduce consumption first – other areas

- Findings:
  - The City already has environmentally focused directives in some areas.
- Recommendation:

K. Complete and implement a Green Purchasing Directive.

L. Complete and adopt the Smartscape landscape ordinance.

M. Formalize and enhance an internal Recycling Directive.

4. Pursue alternative energy sources next

- Findings:
  - Solar – North Texas has good solar potential and the costs of solar technology are going down.
  - Wind – North Texas' wind speeds are not usually high enough to make this technology cost effective.
  - Other sources (such as bio-energy) could hold some potential.
- Recommendations:

A. Determine Council desire to include renewable energy component in future negotiations for electric power for City facilities and what % should be sought.

B. Create a phased Renewable Energy Portfolio strategy.

C. Focus on more detailed investigation of solar opportunities at City facilities.

D. Evaluation of other alternative sources should be pursued as a lower priority.

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BIG MOVE 9: SUSTAINABILITY

SUSTAINABLE PURCHASING

City Council Special Session, January 11, 2016

Action Priority 1: Conduct an audit of existing City sites, facilities and vehicle fleet.

Sustainable Purchasing and 2025 Plan

- 2025 Big Move #9 directs City to analyze its resource use and reduce consumption.
- Current purchasing directives define the <u>process</u> for making purchases but do not guide product/service selection based on resource use factors.
- Development of sustainable purchasing guidelines helps meet 2025 sustainability goals.

Sustainable Purchasing - Purpose

- Procurement practices should **integrate** City's **environmental**, **fiscal**, and **social goals.**

- Product and service selections should **balance** environmental **impacts** with fiscal responsibility and social equity.

Sustainable Purchasing

- Analyzing Current Resource Use with Focus on Sustainability
  - What do we spend our money on?
  - How much are we spending?
  - Who are we buying from?
  - What do we require of our vendors?
  - Are we managing products appropriately at end of life?

Sustainable Purchasing – Factors to Consider

- Sustainability factors that influence purchasing decisions should be identified and fully considered.
  - Environmental factors - toxicity, waste generation and disposal, emissions, recycled content, energy consumption
  - Fiscal factors – budget constraints, total life cycle costs, buying power
  - Social equity factors – Historically Underutilized Businesses (HUB), local vendors, health and safety, ergonomics

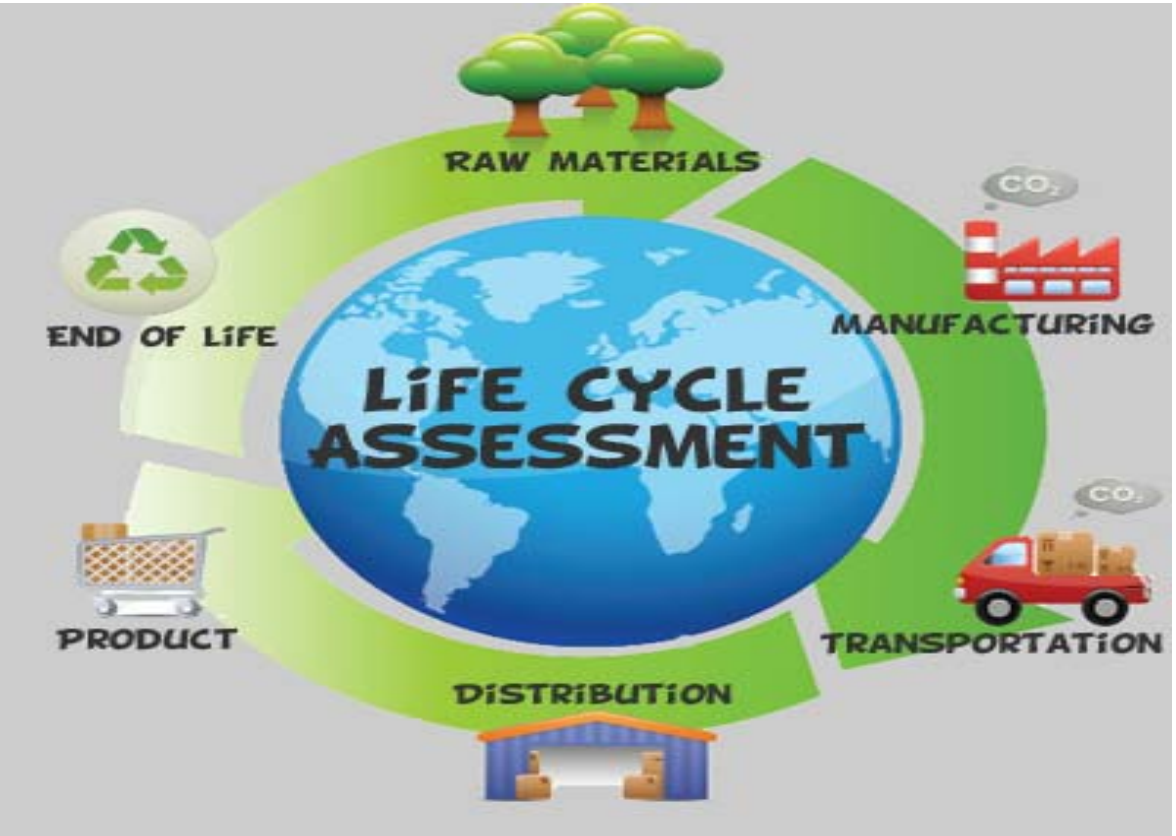
Sustainable Purchasing – Factors to Consider

- Comply with federal, state, local regulations (purchasing laws, disposal requirements)
  - Texas Solid Waste Act requires government agencies to give preference to products made of recycled materials if they meet quality specifications
- Consider lifetime impacts of products (material extraction, transportation, manufacturing, use, and proper disposal)
- Meet specifications of user (quality, lead time)
- Encourage competition (vendors with corporate sustainability commitments, product stewardship)
- Establish pricing parameters (how much is too much for “green”)

Sustainable Purchasing - Life Cycle Assessment

- Comprehensive examination of a product's environmental impacts throughout its lifetime
- How does it impact purchasing practices?
  - Creates opportunity for more sustainable decision-making
  - Redefines "best value"

Life Cycle Assessment



Sustainable Purchasing - Implementation Opportunities

- Current Contracts – Office Products
- Pending Contracts – Janitorial Services

Sustainable Purchasing – Office Products Vendor

- Staples is current office products vendor
  - Contract in place for next five years through City interlocal agreement with Tarrant County
  - Strong corporate sustainability commitment and eco-friendly product lines
  - Recycles ink and toner cartridges and electronics
  - Usage reports and analytics to understand purchasing behavior of staff
  - Training assistance
    - Lunch and Learn – Staples provides free training programs for City staff about sustainable choices
    - Earth Day event for Employees - Staples can assist with education and demonstrations of products
- City staff analyzing top 50 products purchased in 2014 and working with Staples to identify environmentally-friendly options (recycled content, toxicity, recyclable, packaging, etc.); no Styrofoam™

Sustainable Purchasing – Office Products Vendor

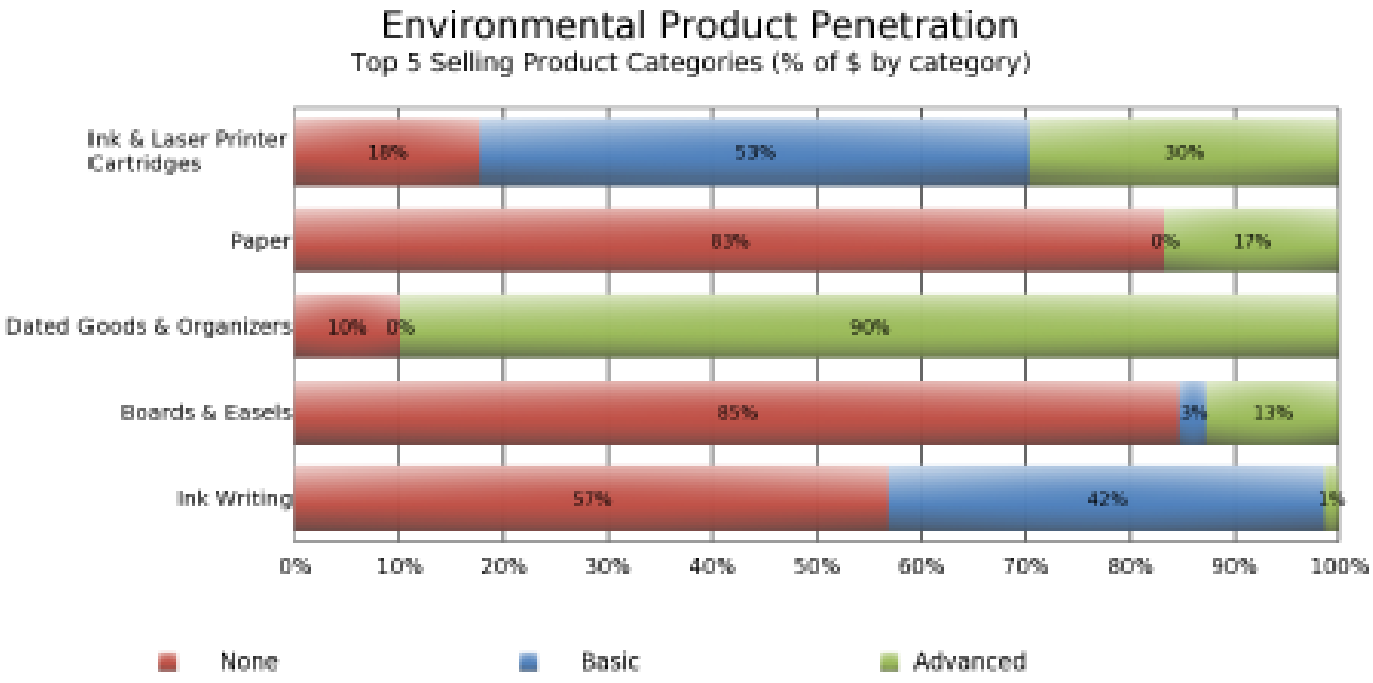
	Good		Better		Green		Executive	
	SKU	Description	SKU	Description	SKU	Description	SKU	Description
Desk Organizer	932873	Staples® Rotary Desk Organizer, 7 Compartments, Black, 7 1/4"H x 5 1/2"D	515104	Staples® Mesh Desk Set, Office Manager, 5 Compartments, Black, 5 1/4"H x 5 1/2"W x 5"D	N/A	N/A	1234094	Staples® Desktop Organizer Mission Black
Binder	82656	Staples® Standard View Binder with D-Rings, White, 220 Sheet Capacity, 1" Ring	82696	Staples® Heavy-Duty View Binder with D-Rings, White, 220 Sheet Capacity, 1" Ring	959726	Sustainable Earth™ by Staples Recyclable Binder, Black, 200 Sheet Capacity, 1"	648812	Staples Better® Binder, Heavy-Duty, White, 275-Sheet Capacity, 1"
Divider	493303	Staples® Insertable Tab Dividers, 8-Tab, Multicolor, 8 1/2" x 11", 6/Pk	486276	Staples® Write-On Reference Dividers, 8-Tab Set, Multicolor, 8 1/2" x 11"	N/A	N/A	953697	Staples® Better® Fixed Tab Dividers, 8-Tab Set, Multicolor, 8 1/2" x 11"
Notebook	849372	Staples® 1-Subject Wirebound Notebook, College Ruled, 100 Sheets, 8 1/2" x 11", 3/Pk	918953	Staples® Accel® Strong Wirebound 1-Subject Notebooks, 8 1/2" x 11", College Ruled, 100 Sheets	749565	Sustainable Earth™ by Staples® 1-Subject Notebook, College Ruled, 9" x 6", 100 Sheets	213145	M by Staples™ Arc Customizable Leather Notebook w/Closure, Letter, Black, 60 Sheets
Copy Paper	135848	Staples® Copy Paper, LETTER-Size, 92 Brightness, 20 lb., 1 Case, 5,000 sheets	513096	Staples® Multipurpose Paper, LETTER-Size, 96 Brightness, 20 lb., 5,000 Sheets/Ct	375577	Sustainable Earth by Staples™ Bagasse Copy Paper, LETTER-Size, 92 Brightness, 20 lb., 5,000/Ct	897802	Staples® Copy Select Paper, LETTER-Size, 94 Brightness, 20 lb., 5,000 Sheets/Ct
Envelope	200519	Staples® Gummed Privacy-Tint #10 Business, White, 500/Bx	381912	Staples® EasyClose #10 Business White, 500/Bx	871072	Sustainable Earth™ by Staples® Gummed 100% Recycled Privacy-Tint #10 Business, White, 500/Bx	787385	Staples® EasyClose Privacy-Tint #10 Business White, 500/Bx

STAPLES BRAND PRODUCTS

For full assortment please contact your Account Manager or StaplesAdvantage.com

STAPLES Advantage

Sustainable Purchasing – Office Products Vendor



Sustainable Purchasing – Office Products Vendor

Environmental Report *Report Date Range: 1/1/15 - 12/31/15* *Report Run Date: 1/4/16*

Environmental Report

Div: {[Maximum of Div]}

Master Customer: CITY OF LEWISVILLE 70111676

Total Volume	3,955.53	(lbs)
Total Post Consumer Recycled Content	1,324.17	(lbs)
Average Post Consumer Recycled Content	33.48	(%)
Greenhouse gas emissions reduced (CO2) equivalents	1,470.49	(lbs)
Equivalent number of average US cars not driven per year	0.14	(cars)
Water saved	6,749.95	(gallons)
Trees saved	11.26	(trees)
Wood Resources saved	4,594.87	(lbs)
Total energy (BTUs) saved	11,255,437.18	(BTUs)
Energy equivalent to oil saved	80.40	(gallons)
Equivalent number of average US Homes heated per year	0.29	(homes)
Energy equivalent to electricity saved	3,204.85	(Kwh)
Equivalent number of average US homes powered per year	0.28	(homes)

Environmental impact estimates were made using the Environmental Defense Paper Calculator and publicly available US DOE data. For more information visit http://www.papercalculator.org

Sustainable Purchasing - Janitorial Services Contract

- Texas Solid Waste Act requires government agencies to establish recycling programs in public facilities
- Currently developing Request for Proposals for new contract term
- Staff to include sustainability focus in specification development
  - Experience with handling recycling and using green procedures
  - Alternatives for eco-friendly cleaning products
  - Third party “green” certifications
  - Training for contractor employees on green initiatives

Sustainable Purchasing - Janitorial Services Contract

Vendor Sustainability Questionnaire in RFP

- Corporate Environmental Policy & Practices
- Sustainable Sourcing Practices
- Green Product Labeling/Online Ordering
- Supplier Diversity Offering & Practices
- Green Cleaning Training Experience
- Contract Outreach Experience & Plan
- Packaging and Transportation Practices

Source: Responsible Purchasing Network, May 2015

Sustainable Purchasing – Next Steps

- ☐ Form interdepartmental Green Team to provide internal stakeholder involvement
- ☐ Continued data collection on current purchasing practices
- ☐ Complete Sustainable Purchasing Directive

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BIG MOVE 9: SUSTAINABILITY

INTERNATIONAL GREEN CONSTRUCTION CODE (IGCC) 2015

City Council Special Session, January 11, 2016

Action Priority 2: Establish or enhance design standards for new City sites and facilities, as well as private developments.

International Green Construction Code (IgCC) 2015

The link to the 2025 Plan

Excerpts From Big Move #9 Sustainability

- limited resources (such as land, water, energy, clean air, natural assets, and public funds) are used efficiently to provide a desirable quality of life and business climate that today's residents and businesses need and want
- Ability to provide that same quality of life and business climate so future generations of residents and businesses can succeed here too.
- Along with the Green Centerpiece Big Move, sustainability can change the perception of this community's character.
- This Big Move places emphasis on green to help differentiate Lewisville from other communities.
- This new sustainable focus is very desirable to the younger residents Lewisville seeks to attract.
- Sustainability also relates to many aspects of City operations and community design, so this Big Move provides a framework for all areas of City business and reduces the City's demands on limited resources.
- Ultimately, it preserves Lewisville's competitiveness for those aspects of sustainability that the market now expects to see.
- Steps to achieve Diversity Goal 2, Build on Lewisville's Natural Assets, directly support this Big Move.
- Goal 1 for Connectivity, Improve Public Transportation, is important to this Big Move because current and future residents want mobility choices, and because trips taken on public transportation will help reduce energy use
- Improve Energy and Water Efficiency in Existing and Future Public and Private Development, make Lewisville's use of these limited resources more sustainable.
- New Parks and Trails, uses natural assets and development patterns to give Lewisville residents access to healthy lifestyles, while retaining important natural assets.

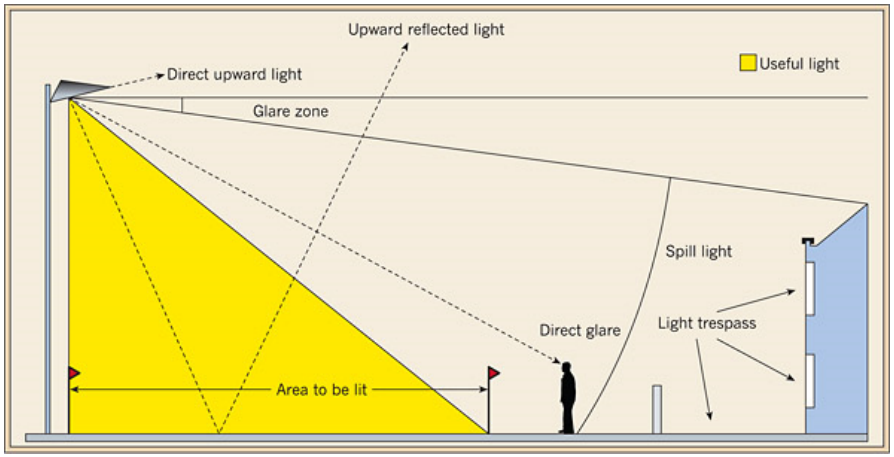
International Green Construction Code (IgCC) 2015

- Adoptable, Mandatory, Enforceable Code
  - NCTCOG – Resumed Energy & Green Code Committee – November 2015
  - Next Meeting January 21, 2016 (Staff has a Seat on the Committee)
  - Staff to Review & Determine Amendments toward Adoption
  - In Depth Review with City Council (June or July 2016)
- Intent is to Reduce Negative Impacts of the Built Environment on Natural Environment
- *Addresses Conservation of*
  - *Natural Resources*
  - *Materials*
  - *Energy*
  - *Water*
  - *Air & Indoor Environmental Quality*
- <u>Minimum Codes Customizable to Local Needs</u>
  - "Pick Your Shade of Green" - Areas of Emphasis
    - Balance Between Costs, Impacts on Business and Impacts on the Environment

International Green Construction Code (IgCC) 2015

- Storm Water – Storm Water Pollution Protection Plan (SWPPP)
- Landscaping (Smartscape), Irrigation (TCEQ), Soil Management
  - Staff is Developing a Separate Landscape Ordinance to Present to City Council
- Building Site Waste & Limits on Construction Waste
- Outlines Energy Requirements
  - Mechanical, Electrical, Plumbing, Appliances, Renewable Energy, Rainwater/Greywater/Reclaimed Water Collection
- Indoor Environmental Quality
  - Lighting, Finishes, HVAC, Acoustics, Daylighting, & Volatile Organic Compounds (VOC's)Indoor Environmental Quality
- Provisions for Existing Buildings
- Transportation Impacts, Heat Island Mitigation & Site Lighting

International **Green Construction Code (IgCC) 2015**



Backlight, Up light & Glare (BUG Method)

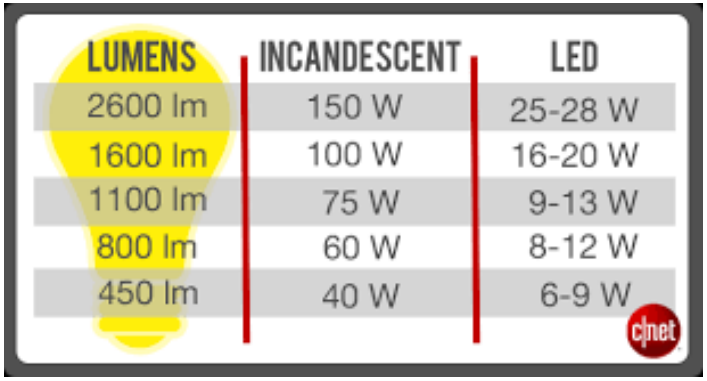
International Green Construction Code (IgCC) 2015

[E] TABLE 409.1.1
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of national parks, state parks, forest land and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High-activity commercial districts in major metropolitan areas as designated by the local jurisdiction

<u>Site Lighting</u>

- Designed to Minimize Wasted Light, Light Trespass & Glare
- Photometric Plans Required
- Maximum Number of Lumens for a Use Described in Each Zone



LUMENS	INCANDESCENT	LED
2600 lm	150 W	25-28 W
1600 lm	100 W	16-20 W
1100 lm	75 W	9-13 W
800 lm	60 W	8-12 W
450 lm	40 W	6-9 W

International Green Construction Code (IgCC) 2015

Some Texas Cities Have Adopted Various Aspects Of Green Codes

1. City of Dallas Green Code Highlights Amended 2012 IgCC – Phase I New Construction, Adopted September 26, 2012
   - Meet Requirements of the Dallas Green Construction Code, Be LEED Certifiable, Be Green Built Texas Certifiable (Residential)
   - Reduce Water Usage by 20 Percent from Plumbing Code Baseline
     - Faucets and Showers Less Than or Equal to 2.0 GPM
     - Toilets Less Than or Equal to 1.3 GPM
     - Energy Star Appliances
   - Achieve Energy Efficiency 15 Percent Above Energy Code
   - Construction Recycle 50% (30% Reuse)
   - Site Lighting Standards (Mainly Downward)
   - Interior Air Quality Standards
   - Connectivity (Modes of Transportation)

International Green Construction Code (IgCC) 2015

2. City of Frisco - Code Highlights - Adopted 2007
   - ENERGY STAR Designation,
   - 15% Increase in Energy Efficiency Above the Most Recent State Energy Conservation Office Approved Texas Building Energy Code Provided with High Efficacy Lighting for 75% of All Fixtures, or
   - Dallas Builders Association's GREEN BUILT TEXAS 3.0 designation (Residential)
   - Residential Requirements Replaced with the Adoption of 2012 ICC Codes

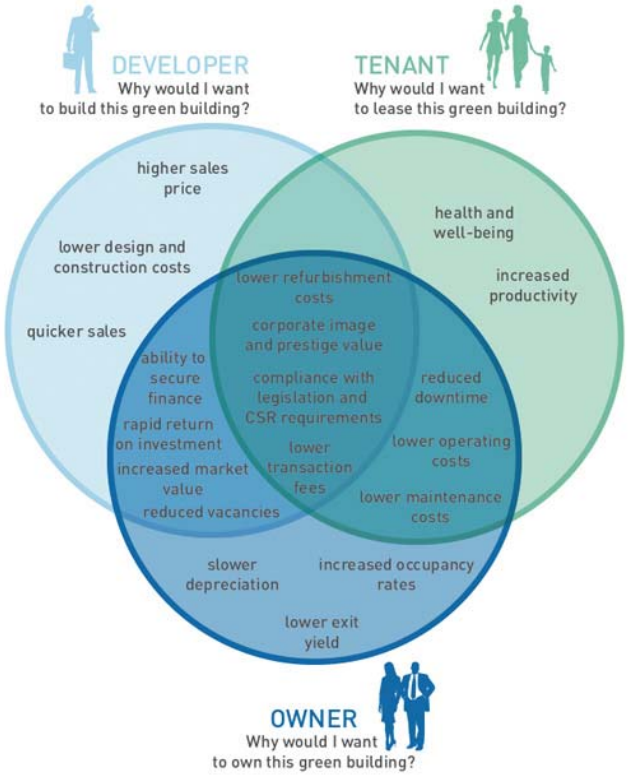
International Green Construction Code (IgCC) 2015

Other Texas Cities – Highlights (Green Code and Other Versions)

3. Austin – In 1990 Developed Nation's First Green Building Program – Star Rating & LEED criteria (DOE). In February 2007, the city council passed the Austin Climate Protection Plan, calling for reducing energy used in single-family homes by 65% and all other public and private buildings by 75% by 2015 - New Ordinance Adopted the 2015 International Energy Conservation Code.
4. San Antonio – Build San Antonio Green Program – Voluntary, 3 Levels - 15, 25 & 50 % above the 2015 International Energy Code – Third Party Certification
5. Houston – Green Build Resource Center – LEED Design – Tax Incentives
6. Other Cities May Have various Aspects of Green Code

International Green Construction Code (IgCC) 2015

The Business Case For Green Building – World Green Building Council (2013)



Costs/Benefits

International Green Construction Code (IgCC) 2015

- Potential Costs/Impacts
  - A 2004 study by Davis Langdon Adamson, a construction cost-planning and management company, found that the first costs of constructing a sustainable building tend to match or only slightly exceed those of comparable non-green buildings.
  - LEED-certified green buildings are a minimum of 1–2 percent more expensive to construct than traditional buildings. (Sternsweaver.com)
  - Lewisville Staff Research Indicates Maximum of 3 to 5% increase in Construction Costs.
  - The top two reasons for building green: client demand (35%) and market demand (33%). (USGBC.Org)

International Green Construction Code (IgCC) 2015

- COMMERCIAL - Potential Costs/Impacts

  - Owners of green buildings reported that their ROI improved by 19.2% on average for existing building green projects and 9.9% on average for new projects.
  - One major hotel project spent an estimated $184,000 for building energy efficiency improvements and has realized a yearly savings of $58,035, yielding a 3.17 year break-even point.
  - A new CoStar report indicated that while traditional (non-LEED or non-ENERGY STAR certified) Los Angeles buildings command an average of $2.16/ft2, tenants were willing to pay $2.69/ft2 for ENERGY STAR certified buildings and $2.91/ft2 for LEED certified spaces. The increased cost of rent appeared to have little effect on vacancy rates, which remained relatively constant with the general market over the 5-year evaluation period.
  - Additionally, Los Angeles ENERGY STAR and LEED certified buildings showed a distinct advantage in terms of sell-price and asking price. In the past year, the asking price for non-green buildings in the Los Angeles area was $220/ft2 relative to an average market sales price $244/ft2.LEED certified buildings in LA averaged $140/ft2 in asking price, but sold for an average cost of $329/ft2.
  - Operating costs decreased by 13.6% for new construction and 8.5% for existing building projects.
  - Building value increased by 10.9% for new construction and 6.8% for existing building projects. Increased asset valuation: New green building projects 5%; Green building retrofits 4%.
  - LEED-certified buildings have been proven to use 25% less energy and a 19% reduction in aggregate operational costs in comparison to non-certified buildings.

WWW.usgbc.Org

International Green Construction Code (IgCC) 2015

- RESIDENTIAL - Potential Costs/Impacts
  - Recent studies confirm that, as of January 2015, the market for houses with green certifications is 10 to 14 percent more than for comparable homes without them.
  - 62% of those building new single family homes report that they are doing more than 15% of their projects green. By 2018, that percentage increases to 84%.
  - 73% of single-family builders and 68% of multifamily builders say consumers will pay more for green homes. Harris Interactive poll of over 2,000 Americans found that nearly half (49%) consider eco-friendly features more important than luxury items in a home (31%).
  - It is estimated that by 2016 the green single-family housing market will represent 26%-33% of the market. This represents an opportunity ranging from $80 billion to $101 billion based on current forecasts.
  - In a recent survey, 54% of those building new multifamily projects report that they are doing more than 15% of their projects green. This number is expected to surge exponentially with that percentage rising to 79% by 2018. Firms that do not begin making preparations for a significant uptick in the green residential market risk being locked into an increasingly uncompetitive segment of the residential market. Multifamily green residential projects were one of the earliest sectors to recover after the 2009 downturn, with 23% growth in 2010. A high level of growth has been sustained since, with the market rising steadily from $18 billion in 2009 to $48 billion in 2013. This represents high market resiliency even in the face of severe economic challenges, underscoring the high degree of consumer demand for green residential spaces.

WWW.usgbc.Org

International Green Construction Code (IgCC) 2015

- All Other Codes – Building, Fire, Mechanical, Plumbing Codes etc. to City Council for Adoption in February 2016

- Staff Recommendation – Adoption of 2015 Codes in February 2016, Host In Depth Workshop for City Council on IgCC Mid Year Towards Adoption Pending NCTCOG Amendments and Recommendations

International Green Construction Code (IgCC) 2015

- Three Year Code Review Cycle
- IgCC 2018 Will Be Next Revision
- Collaboration of Effort for One Green Code
  - ICC – International Code Council
  - ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers
  - AIA – American Institute of Architects
  - IES – Illuminating Engineering Society
  - USGBC - United States Green Building Council

LEWISVILLE

Deep Roots. Broad Wings. Bright Future.

BIG MOVE 9: SUSTAINABILITY

RECAP

City Council Special Session, January 11, 2016

Achieving *Lewisville 2025's* Big Move #9

- Resource & Efficiency Assessment
  - Lead through *Lewisville 2025* implementation
  - Involve stakeholders at all levels
  - Reduce consumption first
  - Pursue alternative energy sources second
- Sustainable Purchasing
  - Revise administrative directives for 'green' purchases of goods & services
- International Green Construction Code (IgCC) 2015
  - Adopt basic 2015 codes in February 2016
  - Consider IgCC in June 2016

Questions and Discussion

Resource & Efficiency Assessment

LEWISVILLE, TEXAS

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Revised:

January 6, 2016

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1.0 Executive Summary

The City of Lewisville commissioned this Resource and Efficiency Assessment to provide an understanding of the efficiency of resource use and the environmental impact of the city's operations. This analysis provides a snapshot of resources used by municipal facilities and properties in the City of Lewisville. The intention was to analyze current performance indicators to understand current levels of resource efficiency, and to pinpoint areas for possible improvement. This report is prepared as a tool to allow City Council and City staff to prioritize areas of focus. The analysis is based on the best available information, both from the City of Lewisville and from sources outside of Lewisville**.** The data used is primarily the annual reporting from 2014. A list of the significant environmentally beneficial efforts already in place is included in Section 1.2.

The recommendations that are provided based on this analysis suggest ways to reduce resource use by the City, in some cases also reducing costs. In many cases, these are strategies for resource use reduction that are clear from the analysis. Other strategies are less obvious, but still quantifiable, and offer long-term economic benefits to the City, or benefits in quality of life for residents.

The primary targets for energy use reduction are electricity used in buildings and power used to process water. Various methods to approach both issues are discussed. Renewable energy is a good option for Lewisville to consider, and while wind energy may not be an economical solution, solar panels may be a viable alternative.

Water supply is crucial for this area, and ways that Lewisville can more efficiently manage its water resources are outlined. As such a large measure of energy is used to process water, reductions in water use have multiple benefits, also saving cost and emissions.

The City's buildings are a major source of resource use: energy, water and materials. Comparisons between Lewisville's building and national averages are given to identify the best candidates for significant improvement. General and specific recommendations are given for improvements.

The City's fleet is a diverse collection of vehicles, with a range of efficiencies. Lewisville has a vehicle replacement directive in place that considers financial and operational needs. While fuel efficiency is also considered in vehicle replacement, the directive does not specifically address it.

The City's parks, and the nature preserve of LLELA, are its most unique resource. The issues of maintaining and enhancing their usefulness and value are combined with issues of environmental impact. These issues are closely related to the management of storm water, which is also discussed. The smart management of storm water can be the most cost effective and environmentally supportive way to enhance to parks, and can reduce irrigation water use, and therefore energy use. LLELA is specifically targeted as a contributor to the "Green Centerpiece."

The current handling of solid waste management is analyzed. A plan to improve waste recycling is presented.

A summary of major recommendations is included below.

1.1 Summary of Major Recommendations

1. **Lead through *Lewisville 2025* implementation.** Use the City's initiatives that implement *Lewisville 2025* as the foundation for more active leadership on issues at the regional, state and national level.
    a. Serve on committees (NLC, ICMA, TML, NCTCOG, etc.).
    b. Compete in awards and recognition programs.
    c. Document results so Lewisville can share best practices with other cities.
    d. Advocate changes by energy providers – such as increasing CoServ's low % of renewable energy sources – through TCAP leadership.
    e. Advocate changes in GEXA tariff rates to incentivize a switch to LED street lighting.

2. **Involve stakeholders at all levels.** Continue the engagement of City of Lewisville's elected officials, citizens and staff in efforts to implement sustainable practices.
    a. Provide City Council and the Lewisville 2025 Advisory Committee with periodic reports on progress and results.
    b. Complete a set of metrics to document cost and resource use reductions.
    c. Involve staff throughout the organization in developing metrics and tracking progress.
    d. Include education on energy use, water use and recycling in staff training programs.
    e. Create recognition or incentive programs to encourage resource use reduction.
    f. Use interdepartmental teams to implement these recommendations.

3. **Reduce consumption first.** The most sustainable approach to limited resources is to begin by reducing consumption. These are the actions included on the first three levels of the Energy Use Pyramid.
    a. Use green building design for new facilities.
    b. Incorporate green building design features in building retrofits.
    c. Investigate high use buildings for water & energy savings.
    d. Refine building operations and procedures in all buildings.
    e. Consider accelerating the water & wastewater equipment replacement schedule to get energy use reductions sooner.
    f. Develop strategy to minimize increased energy consumption by the water & wastewater systems as the Castle Hills districts are annexed.
    g. Continue existing vehicle replacement practices that consider fuel economy in vehicle purchases, and look for ways to enhance these practices.
    h. Use the new vehicle GPS tracking system to identify additional ways to reduce fuel use and emissions.
    i. Expand use of smart irrigation systems for parks & other City sites.
    j. Increase use of efficient fixtures in City buildings.
    k. Complete and implement a Green Purchasing Directive.
    l. Adopt the Smartscape landscape ordinance.
    m. Formalize and enhance the internal Recycling Directive.

4. **Pursue alternative sources second.** This is the last level for action on the Energy Use Pyramid.
    a. Determine Council desire to include renewable energy component in future negotiations for electric power for City facilities and what % should be sought.
    b. Create a phased Renewable Energy Portfolio strategy.
    c. Focus on more detailed investigation of solar opportunities at City facilities.
    d. Evaluation of other alternative sources should be pursued as a lower priority.

1.2 List of Accomplishments

The City of Lewisville has focused on efficiency and reduced environmental impact for many years. Measures have been implemented in many areas to realize achievements, and to achieve significant levels of efficiency. Some of the accomplishments are listed below.

Energy

The City has worked for many years to reduce energy consumptions rates through performance contracts and retrofits. The City also enjoys a high quantity of renewable energy through its energy provider.

HVAC Systems:	The City follows a regular routine maintenance schedule (cleaning and filter replacement) for City owned HVAC units, and has outsourced maintenance activities to ensure optimal performance of the units.
EMS Systems:	The City has employed EMS systems (Schneider and TRANE) for six facilities, with more planned. The systems monitor energy consumption for most buildings.
Water Systems:	There is a scheduled replacement of pumping equipment to increase efficiency.
Energy Retrofits:	The City has completed (or is in the process of completing) numerous HVAC & LED retrofits. Retrofits include indoor and outdoor lighting, as well as traffic signal lighting upgrades. Lewisville has been able to receive rebates on the cost of re-lamping the interior fixtures of several buildings. These rebates are available from TNMP from their funds for efficiency projects.
Energy Star:	The City's practice is to purchase Energy Star appliances and equipment, when possible. Energy Star purchasing will be part of a green purchasing program, currently being drafted.
Energy Sources:	Due to purchasing agreements, 93% of the City's electricity comes from GEXA which uses 48% renewable sources and 52% natural gas. The other 7% comes from CoServ which uses 75% natural gas, 24% coal generation and 1% wind.
Motion Sensors:	The City has installed motion sensors throughout miscellaneous buildings.
Renewable Energy:	Railroad Park has a solar powered stop sign as an added safety feature. Of the 67 school zone beacons, 88% are solar powered, and the rest will be by February, 2016. There are two solar powered outdoor lights located at the MC Grand Theater. There is one solar powered outdoor light on Mill St. at Tennie.
Window Shading:	There are a number of city buildings that have window tinting or screening, to reduce heat gain and internal glare.

Water

When the City of Lewisville was established in 1925 it was centered on a single water well. Now, nestled beside Lake Lewisville, water resources and water quality are even more important to the Lewisville culture, and the City puts forth much effort to preserve this very important resource.

Water Conservation Policy:	The City has in place a Water Conservation and Emergency Water Management Plan with Stage 1 in effect at all times. During dry periods, additional water savings could be realized by increasing to Stages 2 or 3, as required. This plan applies to the entire city, including all municipal buildings. From FY 2013 to FY 2014, city-wide water consumption was reduced by 2 million gallons.
Water Conservation Technology:	The City has installed automatic shut-off fixtures in some City buildings.
Irrigation:	The City has a master-controlled irrigation system, linked to a local weather station to mitigate unnecessary watering.
Smart Meter Technology:	The City has completed a pilot program utilizing the Capstone smart meter to enhance leak detection capabilities and reduce costs and water loss due to leaks. These meters can also be used by the water user to monitor and adjust water usage to reduce water consumption. By reducing trips by personnel for meter control, automobile emissions are also reduced.
Pump Stations:	Public Services studied 17 drainage areas to assess current infrastructure and long-range needs.
Impervious Surface Data:	In 2013, the City initiated a comprehensive GIS study to document impervious surfaces. This database of impervious surface data can be used as basis for determining possible storm water utility fees for all water customers in Lewisville. This data now exists, but it is not connected to any implementation policy.
Storm Water Management Plan:	The City has a Storm Water Management Plan that Includes public education and outreach, applicable Smartscape landscaping methods, public participation, employee training, a storm water hotline, annual cleanups/collections, illicit discharge detection and elimination protocols, construction site runoff controls, and pollution prevention/good housekeeping standards.

City Buildings

The City has undertaken energy retrofits to multiple buildings, and plans additional retrofits and upgrades for additional improvements in efficiency.

Animal Services:	Building's HVAC system was upgraded, and the facility uses software to manage the lighting scheme in the building.

City Hall:	Completed LED upgrade in atrium.
Herring Recreation Center:	Basketball courts are in the process of receiving LED retrofits. The roof was replaced for efficiency improvement.
Fire Stations:	All heating uses natural gas. All Fire Stations have completed various upgrades to promote energy efficiency, including installing LEDs. Fire Station 2 and Fire Station 6 are being totally remodeled and will be upgraded.
City Facilities:	Replacing indoor and outdoor bulbs with LED technologies as needed. Has installed solar shades on south and west-facing windows of certain buildings.

City Fleet

The City has implemented numerous initiatives to reduce costs and environmental impact of the City's Fleet.

Idling Bulletin:	The City's Idling Bulletin, authorized by Administrative Directive 4.2.3, directs that idling time for non-emergency vehicles to be limited to five minutes.
Fleet Activity Modification Directive:	Administrative Directive 1.15.1, Air Pollution Alert Procedures, applies to high ozone days and mandates that no fueling of vehicles or equipment will occur until after 12 noon. The policy also requires all staff to limit driving, and that there will be no burning, painting, asphalt overlay, or running small engines until after 10:00 am. The City is also changing its work methods to minimize the use of heavy equipment such as backhoes.
GPS Tracking System:	The City has recently purchased a GPS tracking system to monitor vehicle use and installed the technology on approximately 97% of City vehicles.
Ultra-Low Sulfur Diesel:	The City uses ultra-low sulfur diesel in applicable vehicles and equipment.
Bike Patrols:	Police have four bikes that they use approximately four to five times per month.
Fleet Materials Recycling:	Fleet Operations recycles vehicle fluids and/or properly manages the discarded materials as hazardous materials, when appropriate. Used tires are also recycled.
Fleet Vehicle Efficiency:	The City currently has four alternative fuel vehicles – two LPG forklifts and two Prius cars, and is currently in the process of purchasing two more. .
Clean Fleet Policy:	The City passed a resolution in support of the revised Clean Fleet Policy from the North Central Texas Council of Governments. The policy is being implemented and documentation has been submitted to NCTCOG.

Vehicle Replacement: The City seeks to purchase the smallest class of vehicle possible to meet assignment. The City replaces unused/underused higher-emitting vehicles first. The City has drafted an Equipment Replacement Evaluation Criteria framework that includes minimum miles usage goals.

Fleet Data Collection: The City tracks its fleet vehicles by type, department, fuel type, and fuel consumption rate to allow easy identification of potential efficiency improvements. Data can be used to identify potential vehicle replacement, with vehicles that have a higher MPG rating. Data also supports regular budgeted vehicle replacement, ensuring vehicle MPG efficiency and understanding of overall fleet efficiency and environmental impact. The City also tracks preventative maintenance and vehicle repairs, providing greater understanding of aggregate costs.

Parks, Green Space, & Landscaping

The City has accomplished much to enhance its natural environment amenities and the infrastructure that supports resident use.

LLELA: LLELA is a nature preserve of over 2,000 acres that provides outdoor learning experience and focuses on research and restoration. The City capitalizes on its operation of LLELA to promote environmental education and awareness.

Storm Water Runoff: The City manages storm water runoff at some parks. Railroad Park runoff is directed back into the on-site lakes for reuse as irrigation. Excess water is released into the Trinity River.

Irrigation: Parks and landscaping irrigation follows the City's Commercial Guidelines for summer watering: watering occurs at night, zones are run no more than twice per week, and median watering is reduced significantly. Railroad Park is also irrigated using water from the Trinity River and onsite water reservoirs. No potable water is used.

Trees: Lewisville is a Tree City USA. Tree planting and maintenance follows the City's landscaping code, which includes: a tree removal and replacement schedule, tree maintenance standards, an approved tree list, tree valuation, and protected tree list. In addition, the City plants drought tolerant trees that are also less susceptible to storm damage.

Landscaping: The City is developing a Landscaping Ordinance that will define a Smartscape-type landscaping application for the City. The City's mowing schedule is adjusted to minimize unnecessary mowing.

Keep Lewisville Beautiful: This award-winning organization partners with the City of Lewisville on projects that help make Lewisville a better place to live and work.
Over the last few years, Keep Lewisville Beautiful has sponsored a number of

environmental projects, such as:

- Citywide cleanups and Waterway cleanups
- Litter Abatement Programs
- Arbor Day and Tree plantings
- Christmas Tree Recycling

Planning: The City has parks and trails master plans that are recent, viable, and relevant.

Energy: Lighting for parks is limited, and where it does exist, City personnel are replacing less efficient lighting fixtures with more efficient technologies.

Creek Cleanup: City crews do clean-ups of creeks to preserve natural water quality. The City is buying a chipper to mulch debris on site when conducting creek clean-up activities.

Solid Waste & Recycling

Service: Waste Management provides solid waste services to all City facilities and recycling services to 11 city buildings. This includes recycling of paper, cardboard, and plastic.

Recycling: The City has extensive efforts to recycle anything reusable or recoverable. In addition to diverting recyclable waste, the City recycles the following products locally:

- Electronic waste
- Ammunition boxes and cartridges
- Tires, Motor oil, and automotive fluids
- Concrete (crushed and used as flex base)
- Scrap metal, including fire hydrants and water meters
- Lead acid batteries
- Cooking oil
- Toner cartridges

Going Paperless: The City has implemented several programs to minimize use of paper copies of forms and documents.

- Public records have been moved to Laserfishe
- Human Resources uses electronic employee forms and documents;
- Capability for electronic payments to the City is widely used
- Electronic Plan Review process is used for review of development activity

Recycling The City is installing recycling receptacles in all parks. Decorative outdoor recycling containers have been added to the Old Town area in Ferguson Plaza, MCL Grand Theater courtyard and on Main Street

Solar Power: The City has two solar powered Big Bellies for compacting trash at Railroad Park, in addition to all the other receptacles.

2.0 Overall Resource Efficiency

2.1 Introduction

Increasingly, municipalities are becoming conscious of their environmental impact. Many have learned that the preservation of natural resources and a holistic approach to governance promotes sustainable behaviors in all areas of the community. Some are taking a leadership position in spearheading efforts to reduce their resource use, and their carbon footprint, and as a result, provide their residents a healthier and more prosperous community. The City of Lewisville is one of these leading cities.

By designing and implementing sustainable practices that complement one another, the City of Lewisville proactively reduces its overall carbon footprint. These practices will also reduce waste in its operations, help it realize cost-savings, and promote an enhanced cultural identity among City employees and throughout the community.

2.2 Assessment Approach

The Resource & Efficiency Assessment (REA) evaluated the City of Lewisville's resource use as a result of its activities. This section defines the approach used to collect, organize, and analyze the information and data acquired for the assessment. The findings and recommendations of this assessment will help City leadership identify waste, realize cost-savings, decrease environmental impact, and enhance the community culture.

Data Collection

Information collected for the assessment varies dependent upon the area being analyzed. Generally, the data collection included quantitative and qualitative data from site visits, interviews, solicited questions, municipality records, and the City's web site. For a detailed list of information collected, see the Appendix.

Data Analysis

The following evaluation components were identified in the assessment's inaugural phase and were investigated for this study. Evaluation of these components was conducted at both the macro and micro levels. Each area was examined to determine the quantity of carbon emissions resulting from related activities. Emissions were measured in metric tons of carbon dioxide equivalent (MT CO_2e).

- Electricity
- City Fleet
- Natural Gas
- Wastewater
- Solid Waste
- Fertilizer

2.3 Observations

Total Carbon Emissions, as a Marker of Energy Use

The quantity of emissions were determined for electricity, fuel burned by the City's fleet of vehicles and equipment, solid waste, natural gas, wastewater from the buildings owned by the City, and fertilizer. Although the emissions quantities accurately represent each area, they do not represent the total carbon footprint of the City, as employee travel and commuting activities were not included. Figure 2.1 shows the carbon dioxide equivalent (CO_2e) emissions breakdown by category. The City's total carbon emissions for the areas examined were 6,888 MT CO_2e for FY 2014. Emissions factors were formulated using Clean Air-Cool Planet's Campus Carbon Calculator version 6.9, and from the U.S. Energy Information Administration.[1]

Carbon dioxide equivalent refers to the aggregation of six major greenhouse gases, the most prevalent being Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O). CO_2e was used as the primary emissions unit in this analysis in order to facilitate comparisons across types and sources of emissions.

Lewisville's use of electricity was responsible for the largest portion of emissions for FY 2014, accounting for 55% of emissions. The City's fleet and equipment, including vehicles used for general service and emergency response (fire and police), produced approximately 34% of emissions. Solid waste emissions accounted for approximately 2% of the total, while natural gas use, wastewater, and fertilizer combined for a total of 9% of the City's emissions. Together, electricity production and fleet emissions accounted for approximately 81% of the total, making them the primary targets for potential improvement.

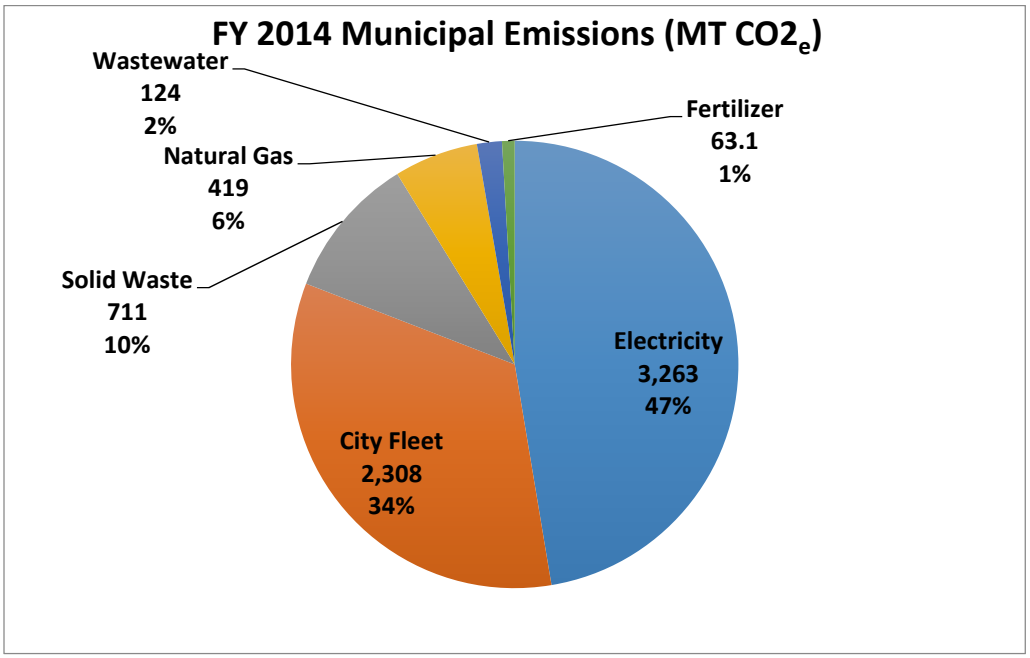


Figure 2.1: FY 2014 City Emissions from Municipal Activity (MT CO_2e) Total = 6,888 MT

Carbon Emissions: Electricity Consumption

More than half of Lewisville's total emissions are attributed to the generation of electricity used by the City. FY 2014's total emissions quantity from electricity production was 3,263 MT CO_2e. Total electricity emissions are divided between several contributing sectors, as shown in Figure 2.2. ***Water Production and Distribution*** describes effort used to treat water for potability and effort needed to move water by lifting, pumping, and booster stations located throughout the city. ***Buildings*** include buildings and structures owned and operated by the municipality that are not part of park facilities or water treatment facilities. ***Public Lighting*** consists of outdoor lighting fixtures including streetlights, traffic lights, parking lot lighting, and athletic field lighting. ***Recreation Centers*** accounts for all electricity consumed by the City's two aquatic parks.

Municipal buildings and structures accounted for 25% of carbon emissions, while the water treatment plants and the water distribution system accounted for a combined total of 50% of emissions. ***Public Lighting*** accounted for 7.3%, and the recreation centers and parks system accounted for a total of 20% of emissions. The emissions from ***Buildings*** represent all the power used to heat, cool, ventilate and light them, as well as all power used by occupants.

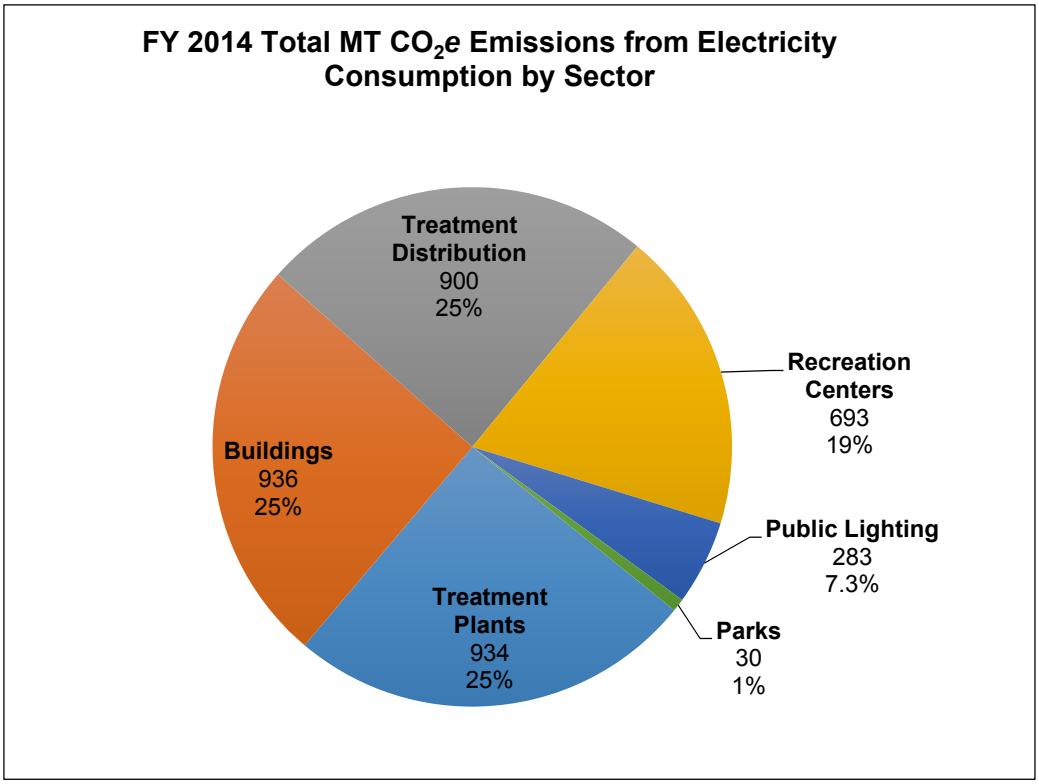


Figure 2.2: FY 2014 Total MT CO_2e Emissions from Electricity Consumption by Sector

Carbon Emissions: Electricity Provider Analysis

Table 2.3 shows a breakdown of the various types of fuels used by electricity providers, and the Texas and national breakdown averages. GEXA, Lewisville's primary electricity provider for buildings, has a lower overall carbon footprint than CoServ, Lewisville's secondary electricity provider. GEXA provides a higher percentage of renewable energy – almost 48% from wind power. Table 2.3 also shows that CoServ receives 24% of its electricity from coal, a particularly high-emissions fuel source. Notably, Lewisville's electricity portfolio consists of much cleaner fuel sources than the Texas and national averages.

Fuel Source	NextEra/GEXA	CoServ	Texas	National
Natural Gas	52%	75%	55%	27%
Coal	0%	24%	23%	39%
Petroleum	0%	0%	0%	2%
Renewables	48%	1%	9%	32%

Table 2.3: Electric Fuel Mix Comparison (2014)

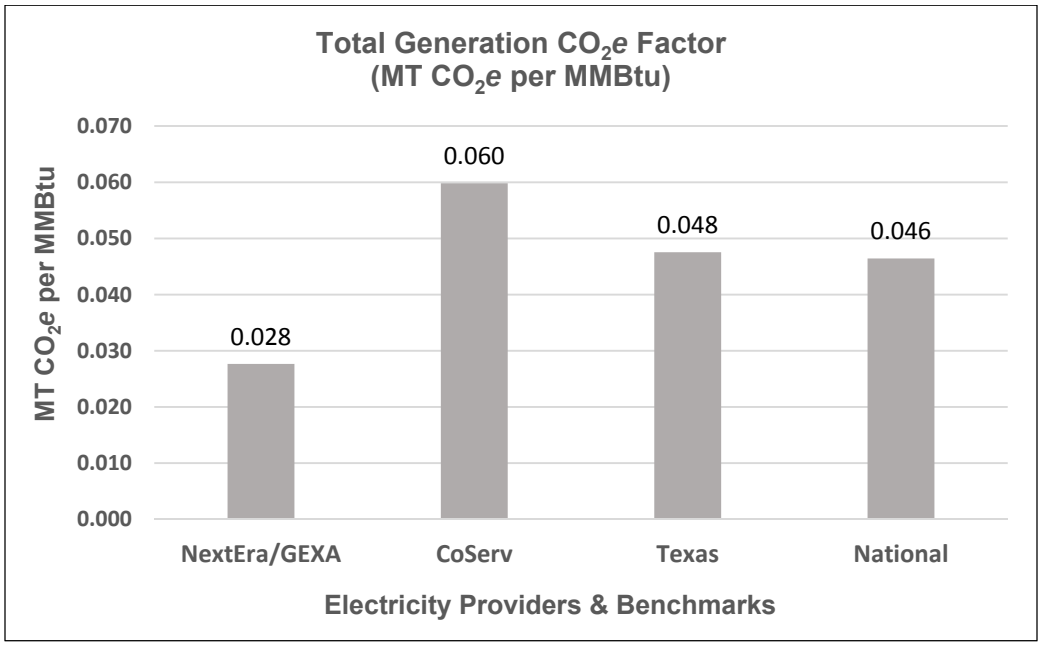


Figure 2.4: Total Generation CO_2e Factor

Figure 2.4 shows the carbon dioxide emissions factors, and demonstrates that the overall emissions factor for NextEra/GEXA is considerably lower than its comparisons.

Carbon Emissions: Fleet Consumption

Lewisville's fleet of vehicles is responsible for 34% of the City's carbon emissions. The diverse fleet includes police and fire emergency vehicles, some construction equipment, and the trucks and cars driven by City employees. The emissions come almost entirely from gasoline and diesel fuel, with a couple of propane-fueled forklifts.

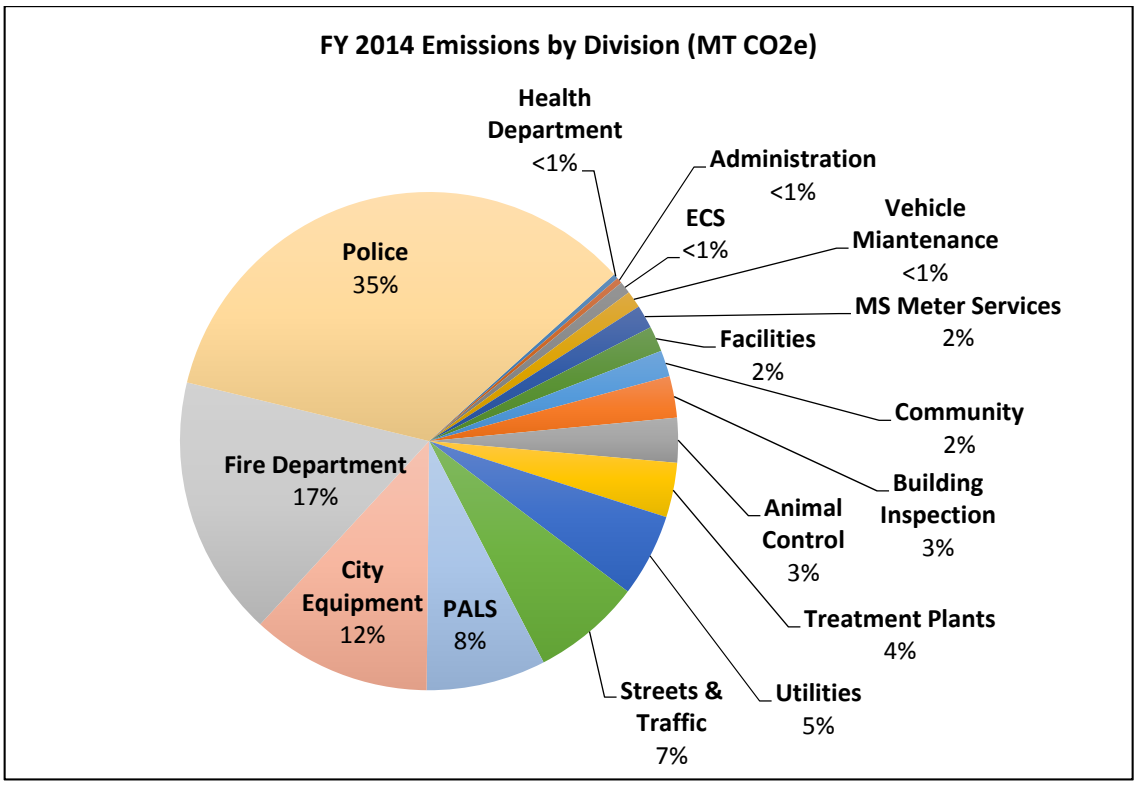


Figure 2.5: FY 2014 Total MT CO_2e Emissions from Fleet Consumption

The City Fleet produced 2,307 MT CO2e during FY 2014. The Police and Fire Departments accounted for 58% of all City Fleet emissions. Refer to Section 6.0 for a full discussion of fuel consumption and vehicle efficiency.

3.0 Energy

3.1 Introduction

Energy security has become one of the most important issues for communities around the globe. It is what fuels economic development, reinforces certain types of lifestyles, and ensures the well-being of a people. Without it, communities will find it difficult to maintain an adequate level of development. Indeed, there are challenges to energy security such as increasing costs, environmental effects from burning fossil fuels, and accessibility. Through sustainable practices and operations, the City of Lewisville can be a leader promoting energy conservation and renewable energy generation.

3.2 Assessment Approach

Data Analysis

The following evaluation components were investigated for energy analysis. Subsequent chapters address energy as it relates to specific areas of the municipalities operations.

- **Energy Consumption Rate** – Evaluation of the rate of consumption by various City operations.
- **Energy Costs** – Identification of costs incurred for energy consumption.
- **Energy Rate Structure** – Evaluation of rate structures for energy purchases from energy providers.
- **Energy Sources** – Research on energy providers.
- **Energy Types** – Delineation of the varying types of energy purchased by the City.
- **Environmental Impact** – Quantity of Greenhouse Gas Emissions (MT CO_2e) resulting from electricity and natural gas consumption and equipment use.
- **Lighting (Public)** – Evaluation of electricity use by public lighting to include parking lot lighting, street lighting, and security lighting.
- **Programs/Policies** – Assessment of associated programs and policies that affect energy purchase, consumption, and efficiency.
- **Renewable Energy** – Evaluation of renewable energy potential for the City of Lewisville.
- **Wastewater Treatment** – Analysis included electricity use at wastewater treatment plant and lift stations. For specific water system analysis, this category was expanded.
- **Water Production, Distribution** – Analysis of electricity use included electricity use at plants, pump stations, and booster stations. For specific water system analysis, this category was expanded.

3.3 Observations

This section offers a discussion on several observations made during the assessment on energy consumption. Several variables were considered. ***Buildings*** included facilities that are frequently occupied, rather than parks or process facilities***. Recreational Facilities*** included parks or recreational settings that have a substantial building component at the facility. ***Parks*** included vegetated settings that have minimal or no building associated with the facility. ***Water Production and Distribution*** included the water purification plants and the pumping and booster stations. ***Wastewater Treatment*** included wastewater treatment facilities and lift stations. ***Public Lighting*** included streetlights, traffic lights, parking lot lighting, and athletic field lighting.

Total Energy Use: Electricity & Natural Gas

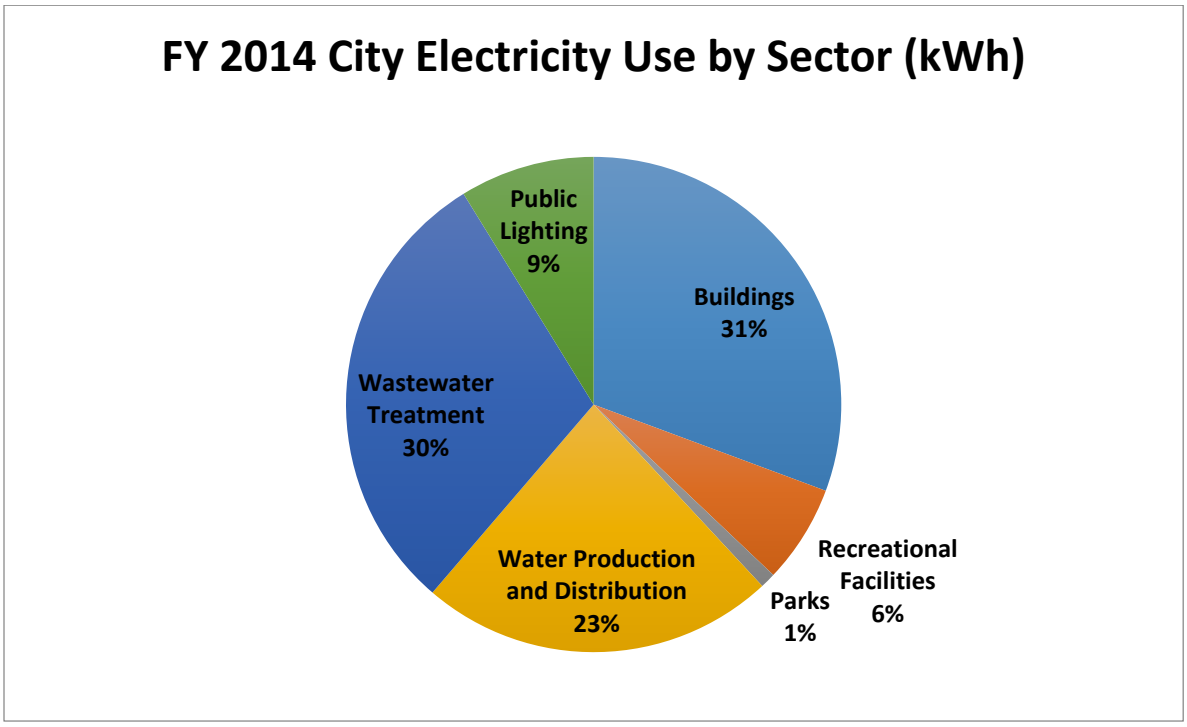


Figure 3.1: FY 2014 Electricity Use by Sector for Municipal Activities (kWh) Total electricity use is 32,003,733 kWh.

Figure 3.1 breaks down the total electricity used in FY 2014. GEXA and CoServ utility data were used for the analysis. The sector with the highest rate of electricity consumption was the water system - treatment plants and water production and distribution system. Combined, these accounted for 53% of all electricity use by the City. Buildings accounted for 31% of municipal electricity use.

	Electricity (kWh)	Cost
Buildings	9,814,971	$1,156,437
Recreation Facilities	2,052,712	$340,339
Parks	323,239	$77,704
Water Production, Distribution	7,419,996	$811,671
Wastewater Treatment	9,573,043	$929,553
Public Lighting	2,819,772	$556,086
Total:	***32,003,733***	***$3,871,790***

*Energy costs and kWh as shown on utility bills.

Table 3.2: Electricity Use & Cost for Municipal Activities (FY 2014)*

Table 3.2 shows electricity use and cost, and correlates directly with Figure 2.2, which shows a breakdown of emissions by sector. Due to the different proportions of fuel burned for electricity used by different sectors, there are differing amounts of emissions. As shown, the water treatment and distribution system accounts for approximately 17 million kWh consumed by the City, which is more than half of the total consumption amount.

Energy Use: Water Processing

Water and Wastewater Systems. Table 3.1 shows that percent total of electricity used in FY 2014 for water treatment/distribution and wastewater treatment was 53%. Figure 3.3 shows the breakdown of the consumption rate by various areas. As the table shows, the wastewater treatment plant used almost 50% of that energy. However, pumps and lift stations also used another 40% of the total energy consumed by water systems.

	kWh	Cost
Water Treatment Plant	1,582,204	$186,204
Wastewater Treatment Plant	8,322,494	$769,203
Lift Stations (waste)	1,250,549	$160,350
Pump/Booster/Storage (water)	5,832,930	$625,467
Total:	***16,988,177***	***$1,741,224***

Table 3.3: Water Utility Electricity Consumption (FY 2014)

Tables 3.1 through 3.4 demonstrate that a significant quantity of electricity is used to treat and move water. Tables 3.3 and 3.4 however, show specifically that the majority of that consumption, and related cost, is associated with moving water to the customer, returning the wastewater from the customer to the wastewater treatment plant, and treating the wastewater. Accordingly, any effect sought to reduce electricity consumption in the water treatment or distribution system, and correlating costs, must focus

on reducing the quantity of water moved to and from the customer. The Lewisville Water Conservation and Emergency Water Management Plan (2014) showed a 10% reduction in water use by all these groups in Lewisville between 2009 and 2014. These reductions helped the City realize over $175,000 in annual energy costs.

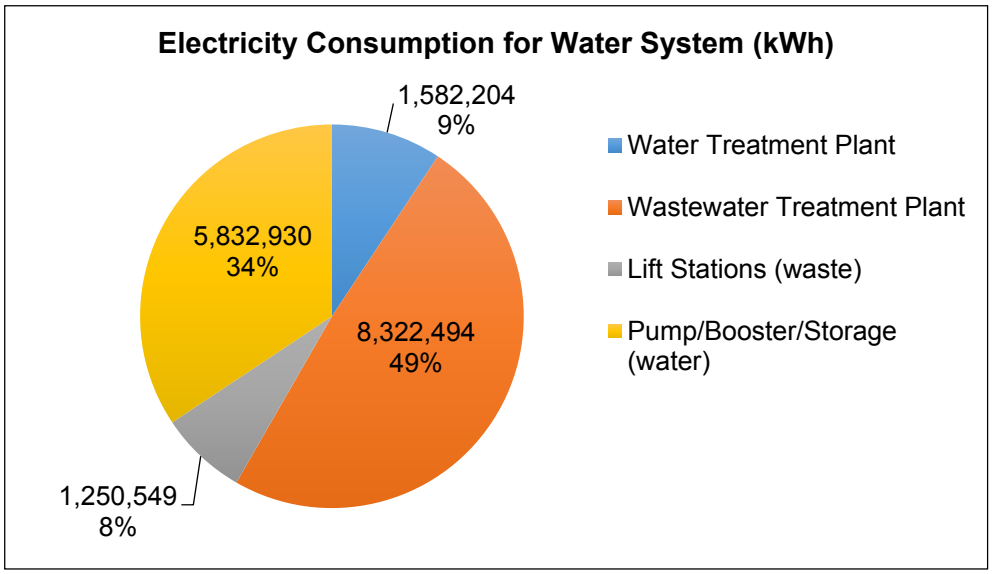


Figure 3.4: Electricity Consumption for Water System
Total electricity use is 16,988,177 kWh.

As Figure 3.5 shows, a relatively modest additional reduction of 10% in total water use for the City of Lewisville, consistent with the Water Conservation and Emergency Water Management Plan, would yield approximately 1.4 million kWh in savings, equating to an additional annual savings of approximately $166,000 in reduced electricity costs.

Conservation measures for water use can clearly lead to reduced costs for water. The issue becomes more complicated when applied to the City's population, as reduced water sales can also have a negative effect on the City's revenue stream. As this report is addressing City use only, the issue will be discussed in the Recommendations chapter as a future discussion topic.

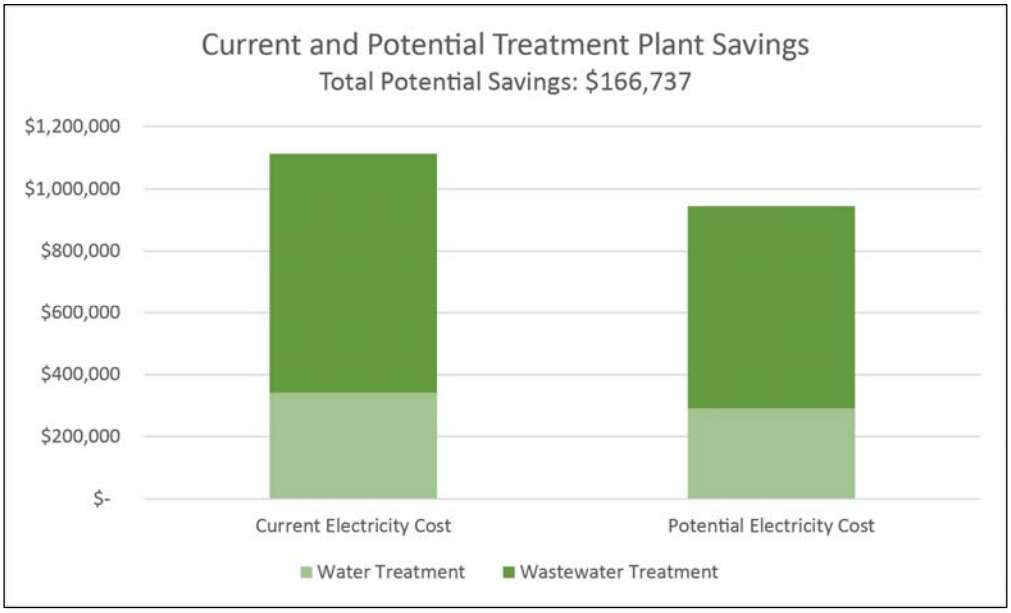


Figure 3.5: Current Cost and Potential Treatment Plant Savings Based on Suggested Energy Conservation Programs

Other areas of potential savings may include replacement equipment for water delivery, such as variable speed pumps for wastewater movement, high efficiency blower systems at the wastewater treatment plant, and optimizing the wastewater aeration process. Since aeration is likely to be the highest energy user in the wastewater treatment system, it would make sense to focus on aeration optimization for energy savings.

The wastewater treatment team in Lewisville has been upgrading to more efficient equipment over the years. Their replacement schedule is dependent upon expected equipment life, and capital budget for upgrades. A review of this schedule may be a way to identify increased efficiency through an acceleration of equipment replacement. A significant energy savings could warrant improved equipment. Several national studies have shown that energy use reductions of 10% from efficiency upgrades are typical, depending upon the starting conditions.[23] This potential 10% reduction of energy use from equipment upgrades would lead to an additional 10% savings in energy costs, of over $150,000.

Energy Use: Natural Gas

Figure 3.6 shows natural gas use by ***Buildings***, utilizing FY 2014 data obtained from the City of Lewisville. It demonstrates that ***Buildings*** accounted for the largest amount of natural gas use with 92% of the total. The cost for natural gas use in ***Buildings*** was $58,309. ***Water Treatment Plant*** accounted for 8% of natural gas used by the City, equating to $4,626 of the total cost for natural gas. No gas was used at the wastewater treatment plant. Because gas is primarily used in buildings for heating and hot water, as well as cooking, these are the areas to target for efficiency improvements.

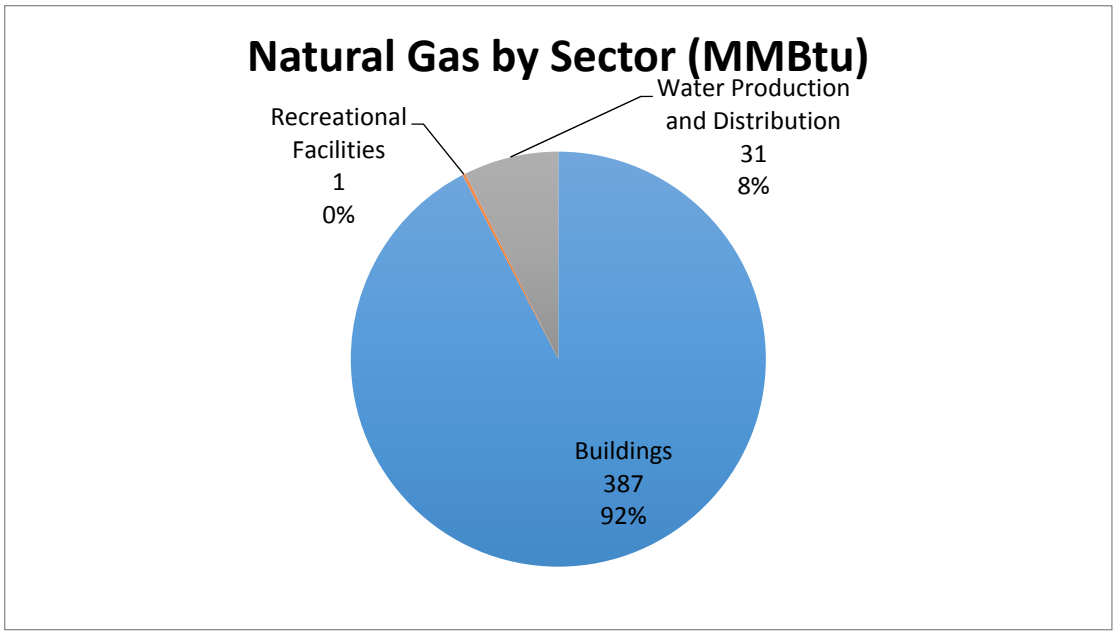


Figure 3.6: Natural Gas Use by Sector for Municipal Properties (MMBtu)[4]

Energy Use: Street Light System

There is considerable opportunity for energy and carbon emissions savings by converting street and traffic lights to LED technology. Reported energy saving from municipalities that have switched to LED lighting range from 45% to 70%.

However, like many other municipalities, Lewisville pays a set tariff for street and traffic light energy use. The tariff rate is based on the number of units and not necessarily on usage. This fee structure means that the City would not realize the benefit of increased efficiency.

In order to realize value from switching street lights to LED, the City would need to negotiate a change in tariff rate for street lighting, once a significant quantity of LED technologies are installed. Potential energy savings are significant, though potential cost-savings may be less so.

3.4 Renewable Energy

Introduction

Purchased energy represents both a significant cost for the City of Lewisville, as well as a major source of environmental emissions. Municipally provided renewable energy could be a source of emission-free electricity, and could represent cost-savings over time. Locally produced power has the additional benefit of being a possible power source during ERCOT grid interruptions. The most feasible sources of renewable power, at either the municipal or the residential scale are solar, wind, geothermal, and biomass.

Solar Energy

North Texas receives a large amount of solar energy and Lewisville is perfectly situated to take advantage of recent cost reductions for solar photovoltaic systems. It may be possible to produce a significant portion of municipal energy needs with solar panels. Solar panels could be especially useful at facilities in which the primary energy use happens during the day, reducing the need for energy from other sources.

The cost effectiveness of utility scale solar generation was recently highlighted in a recent article in the Dallas Morning News.[5] It pointed out that, “Luminant, one of Texas’ largest coal power generators, is joining the rush to build utility-scale solar farms in West Texas in another sign of the technology’s rapidly declining costs.” While the power needs of Lewisville are not of the scale of this solar farm, the cost of solar technology is changing the equation of affordability at all scales. This may make solar energy generation a viable alternative for dependable renewable energy generation, and long-term cost savings for the City.

Figure 3.7: Solar panels used as parking lot shading in Atlanta, GA

Solar Energy Potential

The buildings owned by the City of Lewisville have a large amount of roof area that could possibly be available for solar installations at various service buildings, including the water treatment plant and some maintenance buildings. However, not all roof space is usable for solar. An analysis of the roof-mounted equipment and structural capacity of these buildings would be required to confirm how much area is feasible for solar panel installation.

Figure 3.8: Solar panels on Fire Station #219, City of Mesa, AZ

The available roof area of the 28 City buildings reviewed for this report adds up to approximately 362,900 square feet. If half of that roof area is usable for solar panel installation, 181,450 square feet of solar panels could be installed.

An example solar panel type is shown in Figure 3.8 If this panel type was installed on 50% of the roof area, the City could generate nearly 5 million kWh of power a year. As Table 3.14 shows, this scale could produce approximately 4.7 million kWh annually, which is approximately 14.5% of the total electricity consumed annually by the City. This equates to approximately $570,000 in electricity produced each year. This scale of renewable energy generation would significantly reduce the City's CO_2 emissions and have an estimated payback of 22 years.

Available Roof Area (ft.^{2}):	181,450
Annual kWh/ft.^{2}:	26.3
Annual Electricity Production (kWh):	4,772,135
Cumulative Retail Cost:	$12,600,000
Annual Value of Electricity Produced:	$572,000
Percentage of Total Municipal Electricity Use:	14.5%

Table 3.9: Renewable Energy Production Statistics for Municipal Properties

Solar Energy Financing

The price of solar technology continues to drop, as more companies enter the market. Funding models exist where organizations partner with manufacturers to lease the equipment, therefore mitigating the purchase and installation costs of the technology. Such an approach significantly decreases the total capital investment, while providing the benefits of renewable energy at reduced cost.

While municipalities cannot avail themselves of the standard renewable financing mechanisms, like Property Assessed Clean Energy (PACE), a financial mechanism for homeowners, the City of Lewisville could potentially enter into an agreement with a for-profit organization to install and hold the solar facilities in exchange for using the rebate and tax incentives, much like a power purchase

agreement. Municipalities and schools have used this structure in other states, but further research would be required to determine its applicability for Lewisville.[6] Cities like Austin that have their own energy utility can enter into partnerships with wind-energy producers in western Texas areas to procure renewable energy.

To determine the appropriate type(s) of technology that the City could install, the quantity of technology that could be installed, and the appropriate funding model(s) for renewable energy installations, a comprehensive renewable energy review should be prepared including building sizes and conditions, and availability of affordable technology.

Wind Energy

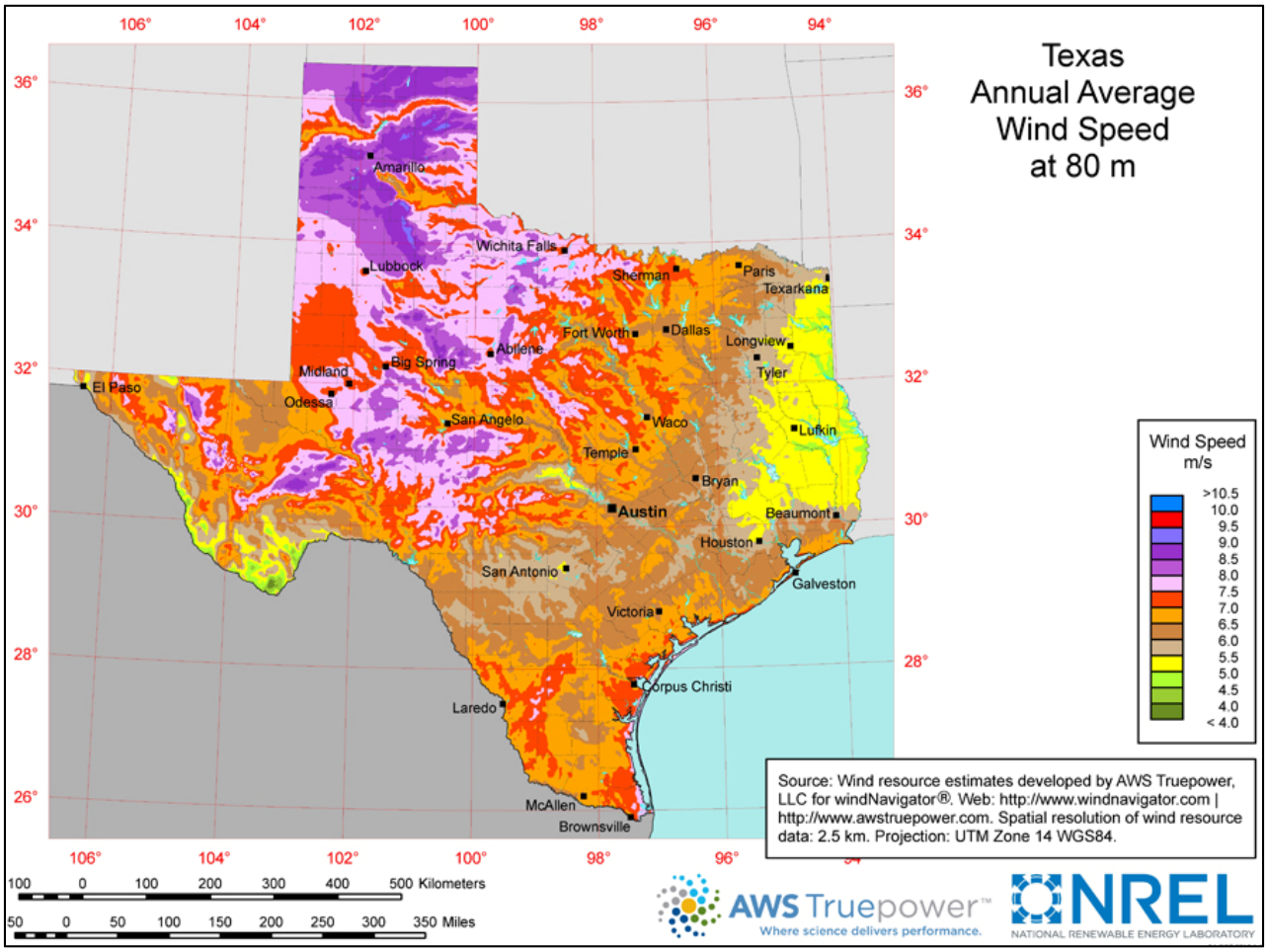


Figure 3.10: Texas Annual Average Wind Speed at 80m

Like solar energy, wind energy can be utilized at either utility scale (big wind) or residential scale (small wind). As this study focuses on only municipal facilities, we will focus on utility scale, but to complete the discussion we have included residential. As was shown in a previous presentation to City Council,

while Texas is the top wind-producing state, wind production capability is not uniformly high, state-wide. The City of Lewisville has potential to generate renewable energy, but the wind energy potential of the North Texas area is not high.

As Figure 3.10 above shows, the northeastern quadrant of Texas has average wind speeds that are marginal in terms of power productivity. (6 Meters per second in wind speed equals 13.5 miles per hour.) Texas' strongest wind power-producing areas are in the northwest and panhandle. For maximum electricity generation, wind turbines require sustained wind speeds in excess of 16 miles per hour, which do not generally occur in the area. Some turbines can create reduced amounts of power at slower speeds. There may be some sites where wind speeds are adequate to support wind turbines. Such sites could be identified by a specific site study of a selected area. Wind generation has been successfully achieved in some cases, with large turbines in wide-open areas.

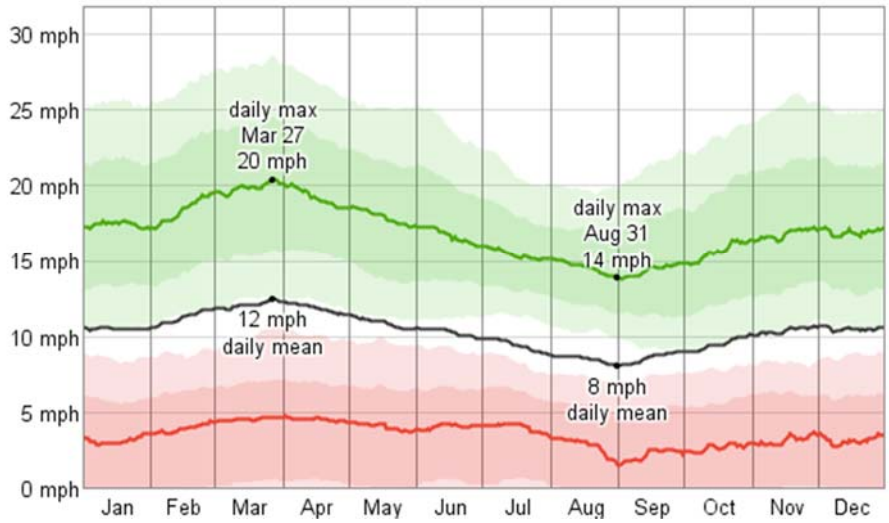


Figure 3.11 Local Wind Speeds for Dallas/Fort Worth Area[7]

Figure 3.11 shows the average wind speeds (black), as well as the average daily maximum (green) and average daily minimum (red). It shows that speeds are seldom in the prime power-producing realm of 16+ mph.

The University of North Texas in Denton has community-scale turbines at the Apogee Stadium. The turbines have been successful in generating some electrical power, but the cost of purchase and installation of similar turbines could equate to a 25-year expected return-on-investment, depending on the electricity cost rate.

It is challenging for cities and other institutions, even large-scale corporations that are not located in prime wind energy areas to fully embrace large scale wind for energy production. Because the investment for wind turbines is significant and the economic return-on-investment is substantial, it is not often chosen as an energy source for municipalities who do not own their own energy utility.

In Lewisville the only areas of unimpeded expanse suitable for wind turbines might be the landfill sites or the wastewater treatment plant. Site-specific wind studies would be needed to verify the potential for community-scale wind production sites. As these areas are adjacent to LLELA and other elements of the Green Centerpiece, the disruption of natural habitat and migration patterns would be a serious consideration.

Figure 3.12: Community-scaled turbines at Apogee Stadium, UNT

Smaller scale wind generation, as appropriate for residential installations, is difficult to prove effective in northeastern Texas. Vertical axis wind turbines could be more appropriate for the residence scale in more densely developed areas, but are less efficient. Shorter turbines are more subject to turbulence from other vertical structures, primarily trees. A turbine installed on a residential site in Fairview, Texas, 22 miles from Lewisville, was eventually removed because the amount of power generated was insufficient (see case study below).

On average, a typical 2,400-ft.^{2} home would require a small turbine with a 5-kilowatt generating capacity to meet all its electricity needs. A machine of this size has a diameter of approximately 18 feet. For good performance, experts recommend that small turbines be installed at a height of at least 30 feet above nearby obstructions such as trees, so a turbine surrounded by 25-foot tall trees would need to be at least 55 feet. Small scale wind generation can also be installed on municipal buildings to take advantage of updrafts common to the built environment.

Figure 3.13: Small-scaled turbine in a rural installation

As installers recommend sites with average wind speeds of at least 16 mph, with no nearby obstructions, it may be challenging to find areas in Lewisville suitable for residential wind. However, to allow either the private sector or the City itself to have options to pursue future wind installations, should technologies improve their feasibility, there should be no zoning codes prohibit it.

Wind turbine costs can vary considerably. The purchase and installation of very small (<1 kW) off-grid turbines generally cost $4,000 to $9,000, and a 100-kW turbine can cost $350,000. The purchase and installation of a system large enough to power an entire home currently costs, on average, $30,000, but the price can range from $10,000 to $70,000 depending on system size, height, and installation expenses. Over the 20+ year life of the turbine, it could pay for itself, based on average electric bills for

Texas ranging from $150 to $250/month. The federal government and many states have rebate or tax credit programs in place to encourage investment in small wind.[8]

Case study: Residential Wind Turbine Test Case

A residential installation in Fairview, TX, utilized a Skystream 3.7 turbine which was rated to generate power at 240 volts. The turbine was tied into a double pole breaker in the home's electric panel. When it produced power, it reduced what was drawn from the grid. If it produced excess power, the meter would credit the home account, due to a "net metering" agreement with the utility provider— Grayson-Collin Co-Op. Not all areas have such agreements available. There was no battery for energy storage.

This unit was one of 40 test homes in the US for this new unit developed by Southwest Windpower and the National Renewable Energy Lab (NREL). North Texas is in a moderate wind zone, with average wind speed of 10.7 mph. With constant average wind speed, the turbine could produce about 300 kWh/month of power.

The site had typical challenges; there were trees too close to the turbine, reducing the output, and making maintenance more difficult than the actual energy production warranted. The turbine was eventually removed. This pilot demonstrated that site location is critical to maximum performance from wind energy technologies.

Figure 3.14: Residential wind turbine in Fairview, eventually removed.

Wind Turbine Example	
Equipment:	SKYSTREAM 3.7 by Southwest Windpower
Rated Capacity:	1.8 kW
Estimated Maximum Monthly Energy Production:	300 kWh/month at 10.7 mph
Turbine Cost:	approx. $5,500 (tower, generator, and blades)
Installation Cost:	approx. $3,000
Height:	35'

4.0 Water

4.1 Introduction

Similar to energy, water is vital to a community's prosperity and longevity. To its credit, Lewisville has the lowest per capita use of water of the large cities in north Texas, including Dallas, Fort Worth, Plano and Denton. Founded in the early 19th century, at the site of a local water well, the City of Lewisville has a strong history in water conservation and preservation.

The City of Lewisville is fortunate to have a tremendous natural resource in Lewisville Lake, and has put forth numerous initiatives to protect its water assets. As the City continues to develop throughout the 21st century, challenges to protect this crucial resource will continue to require Lewisville's focus.

4.2 Assessment Approach

Data Analysis

The following evaluation components were identified in the assessment's review of municipal water usage:

- **Environmental Impact** – Quantity of Greenhouse Gas Emissions (MT CO_2e) resulting from water consumption in buildings and for landscaping purposes.
- **Programs/Policies** – Assessment of associated programs and policies that affect water purchase, consumption, and efficiency.
- **Water Consumption Rate** – Evaluation of the rate of consumption by various City operations.
- **Water Costs** – Identification of costs incurred for energy consumption.
- **Water Rate Structure** – Evaluation of rate structures for water purchases from providers, and rate structures utilized by the City for water distribution.
- **Water Sources** – Research on water providers and sources.

Significant amounts of water are used in irrigation, therefore this is covered in some detail. The first section of this chapter offers a discussion on observations made regarding irrigation water consumption. (see sidebar, p. 29) Several variables were considered. ***Low Plant Density*** *benchmark* describes plantings that are immature and sparsely planted. ***Medium Plant Density*** *benchmark* describes plantings that are full coverage, but predominantly consist of one vegetation type. ***High Plant Density*** *benchmark (not used)* describes plantings that are a mixture of plant types with full coverage such as trees, flowers, and shrubs.

There are no ***regional*** or ***local*** water use or water use intensity benchmarks available for either indoor water use or irrigation water use. The benchmarks used in this report are defined for specific comparisons. Irrigation water use benchmarks were gathered from similar facilities in locations with

similar characteristics, as much as possible. Some of the benchmark facilities are more directly appropriate than others, but all are relevant.

Indoor (or building) water use benchmarks were derived from national and regional aggregated data sets from similar facility types. While the derived benchmarks are less regionally specific than the irrigation water benchmarks, indoor water use varies much less from region to region in the US.

Water used for irrigation purposes was compared using the U.S. Department of Energy (DOE) Energy Efficiency & Renewable Energy's Guidelines for Estimating Unmetered Landscaping Water Use.[9] As no local data for average water use per square foot of irrigated landscape was available, an average was derived from three municipalities in Texas: Amarillo, Houston, and San Antonio.

The DOE report categorizes landscapes as having low, moderate, and high water requirements (see Definitions). Lewisville's irrigation was compared to low and moderate water requirements. Further, each water requirement category had three sub-categories - low, average, and high density of plant landscape. Lewisville's irrigation was compared to average density of landscape planting for both low and moderate water level requirements. In other words, most landscape consisted of lawns with periphery plants such as trees, flowers, and bushes, as that was determined to be the most similar to Lewisville conditions, based on observations.

Irrigation Water Use Plant Density Benchmarks

"Plants that require low amounts of water are native or well adapted plants to a particular area (which is a good strategy to limit supplemental irrigation requirements). If your landscape does not include species that are native or drought tolerant in your area, then they likely are moderate to high water consuming plants."

Landscape water use benchmarks are based on the U.S. Department of Energy's "Guidelines for Estimating Unmetered Landscaping Water Use" report dated July 2010. The report outlines procedures to estimate water use from irrigated landscapes. The report's findings are based on the amount of water transpired and evaporated from plants and landscapes for different locations across the US.

In order to determine the irrigation factor, three landscape characteristics must be designated: 1) water requirements of the plant species (low, moderate, high), 2) density of planting (low, average, high), and 3) type of microclimate of the landscape (protected, open, or intense exposure).

The two benchmarks of water requirements for irrigation were estimated to be "low and moderate" for plant species in Lewisville's landscapes. The density of planting for Lewisville's landscapes were determined as "average" for Lewisville. The microclimate of the Lewisville's landscapes were determined to be "open".

While the report didn't specifically state irrigation factors for Lewisville, three cities surrounding were calculated and include Houston, San Antonio, and Amarillo, Texas. The average of these three towns determined Lewisville's anticipated irrigation factors.

- *Guidelines for Estimating Landscape Water Use*, Federal Energy Management Program

4.3 Observations

Total Water Use

Figure 4.1 and Table 4.2 include both indoor and irrigation water use and cost for FY 2014. As shown, ***Parks*** were the largest municipal consumers of water, accounting for 55% of municipal consumption, all of which is assumed to be for irrigation. ***Buildings*** accounted for 26% of all water used by the City, half of which was used indoors and the other half used for irrigation. The ***Treatment Plants*** category includes water used by both water treatment and wastewater treatment facilities combined.

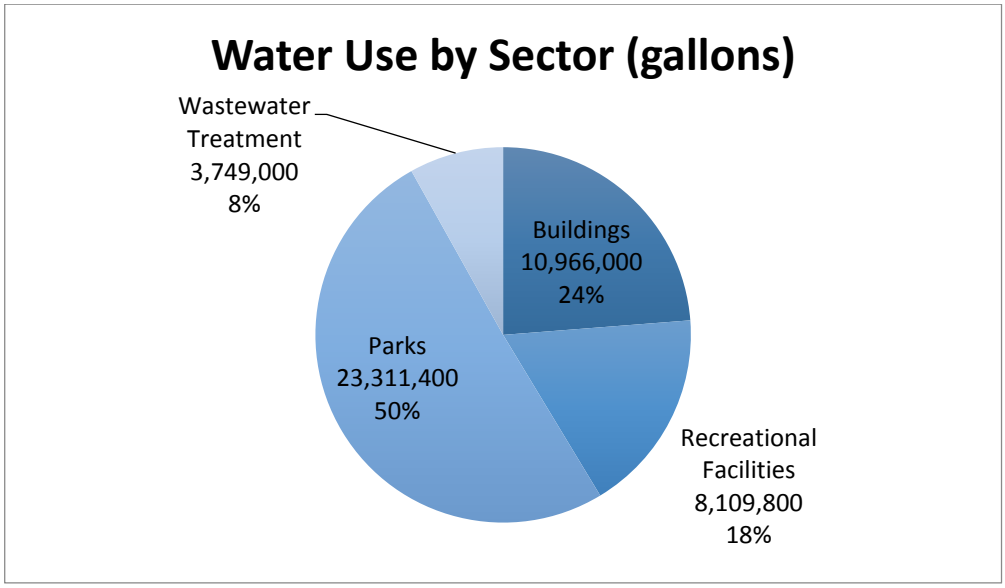


Figure 4.1: Water Use by Sector for Municipal Properties

Recreational facilities often have extensive irrigation water use for athletic fields or lawns, and aquatic centers use significant amounts of water in their pools. A breakdown of water use in these facilities is shown in Figure 4.3. Water use indicated as "indoor" is based on readings from water meters designated "8" in the municipal water use records. Water use designated as "irrigation" is based on reading from water meters designated "8s" in the municipal water use records.

	Total Water (Gallons)	Cost
Buildings	10,966,000	$50,866
Recreation Facilities	8,109,800	$33,956
Parks	23,311,400	$79,871
Water Production, Distribution		
Waste Water Treatment	3,749,000	$16,579
Public Lighting		
Total:	***46,136,200***	***$181,272***

Table 4.2: Water Cost by Sector

Description	Annual Indoor Water (Gallons) From "8" meters	Annual Cost	Annual Irrigation (Gallons) from "8s" meters	Annual Cost
Railroad Park	1,729,400	$8,244	562,000	$2,154
Senior Center/Memorial Park Recreation Center	401,200	$3,319	2,363,600	$7,985
Old Town Aquatic Center	329,000	$2,460	915,000	$3,267
Sun Valley Aquatic Center	1,692,600	$6,105	679,000	$2,576
Total:	**4,152,200**	**$20,129**	**3,957,600**	**$13,828**

Table 4.3: Water Use: Recreation Facilities

Irrigation

Irrigation of parks and landscapes accounts for the majority of treated water used by the City of Lewisville. The City has a water conservation plan with Stage I water conservation procedures in place as standard policy. More stringent Stages 2 & 3 would be implemented during times of reduced rainfall, or drought conditions.

Irrigation Water Benchmarks[10]

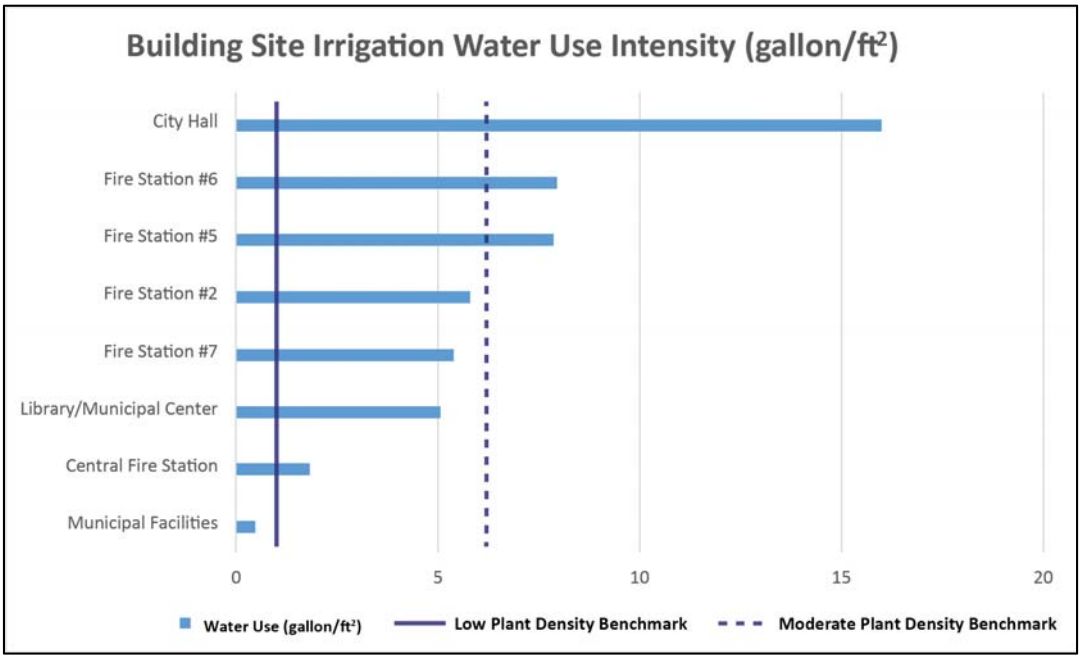


Figure 4.4: Building Site Irrigation Water Use intensity ("Municipal Facilities" are other buildings.)

Figure 4.4 shows water use compared to benchmarks of two different plant densities. Moderate plant density includes landscaping installations with average water requirements. Low plant density shows water requirements for less landscaping or more drought-tolerant plants, as noted above.
The graph shows that City Hall used the most water for irrigation, followed by Fire Stations #6 and #5. All of these used more water than the moderate plant density benchmark. Most buildings also used more water than the low plant density benchmark, indicating that there is possible improvement in the amount of water used for irrigation at all buildings, possibly by switching to native and drought-tolerant plantings. In some cases, it may be possible to install rainwater capture systems, particularly fire stations.
City Hall has a water fountain located near its front entrance. This fountain is served by recirculating water, but it will inevitably lose some water to evaporation on hot days.

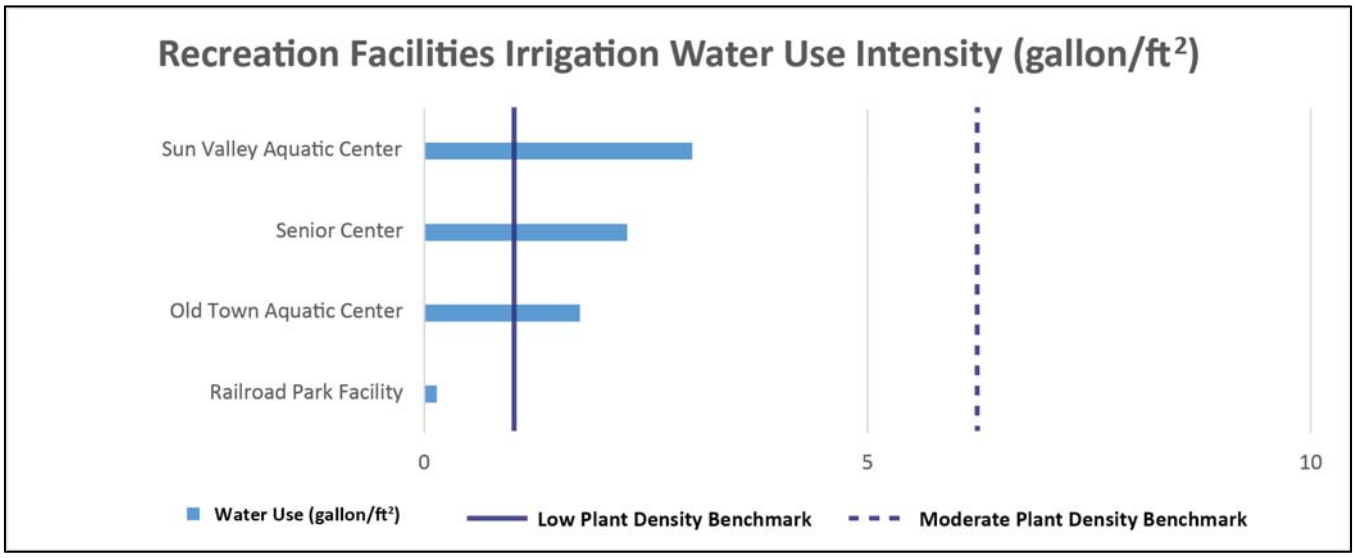


Figure 4.5: Recreation Facilities Irrigation Water Use Intensity

Figure 4.5 shows that all Recreational Facility sites performed at well below the moderate plant density benchmark, and were close to the low benchmark for irrigation. Water tracked in these benchmarks came from the Lewisville municipal water system. Water that came from other sources, such as irrigation water pulled from a lake or reservoir, was not included in this analysis.

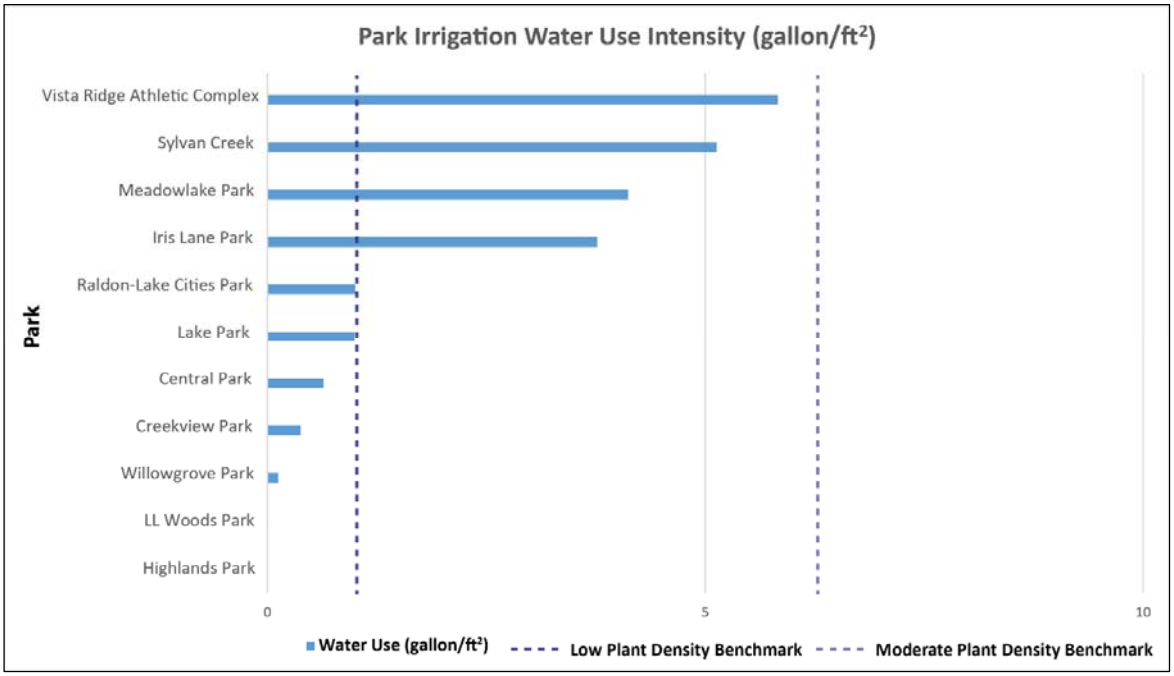


Figure 4.6: Park Irrigation Water Use Intensity

All parks shown in this assessment performed below the moderate density benchmark, with most being at or below the low density benchmark. Vista Ridge, Sylvan Creek, Meadowlake Park, and Iris Lane used much more than the low water use benchmark. Parks that have large areas of irrigated turf will be closer to the moderate plant density levels. Areas with more drought-tolerant planting types can achieve the lower benchmark. Areas designed to act as rain gardens and concealed detention ponds may offer ways to maximize rain capture for landscape use. Features of this type would also reduce the amount of site runoff. Further study should be conducted to determine the viability of installing rainwater capture systems to actually store water for irrigation.

Indoor Water Use

Total Indoor Water Use for Buildings (gal)	5,856,900
Total Indoor Water Use for Rec. Facilities (gal)	4,152,200
Total Indoor Water Use (gal)	10,009,100
Indoor Water Use Percent Savings	20%
Indoor Water Use Savings (gal)	2,001,820
Total Annual Indoor Water Cost	$51,489
Annual Indoor Water Savings	$10,298

Table 4.7: Water Statistics

Indoor water use conservation affects a smaller portion of municipal water use, but there are still significant opportunities for use reduction. The Environmental Protection Agency's (EPA) WaterSense

Program[11] labels toilets, faucets, showerheads, and urinals that save at least 20% of water over conventional fixtures. These fixtures are typically included in new buildings, especially LEED Certified buildings, but are not typically found in older ones. If the water use in City buildings is about 11 million gal (see Table 4.8) then, as shown in Table 4.7, 20% of water savings could lead to about $16,965 in annual savings.

While there is typically no cost premium for efficient fixtures, the City of Lewisville would still need to invest in new fixtures to achieve savings. Developing a fixture replacement policy specifying the purchase of efficient fixtures over time is recommended, and is planned for inclusion in the green purchasing policy, currently being developed. As well, human use of facilities and fixtures is the primary driver of water consumption.

	Total Water* (gallons)	**Cost**
Buildings	10,966,000	$50,866
Parks with Buildings	4,152,200	$33,956
Parks	23,311,400	$79,871
Treatment Plants	3,749,000	$16,579
Water Production, Distribution		
Total:	***42,178,600***	***$181,273***

*Totals do not account for water lost from the system.

Table 4.8: Total Water Use (FY 2014)

Indoor Water Use Benchmarks

Building water use can be measured and compared as Water Use Intensity (WUI), measured in gallons/ft^2/year. Unlike building energy, there is no single entity that benchmarks water use. Water use benchmarks were derived from the average water use intensity of various national sources, as indoor use is statistically consistent across the country. These sources include Energy Star's Portfolio Manager Water Use Tracking,[12] Pittsburgh 2030 District Water Baseline,[13] Green Building Information Gateway (GBIG),[14] Snohomish [Washington State] County Facilities Water Conservation Benchmark,[15] and New York City's Energy and Water Data Disclosure[16] open data system.

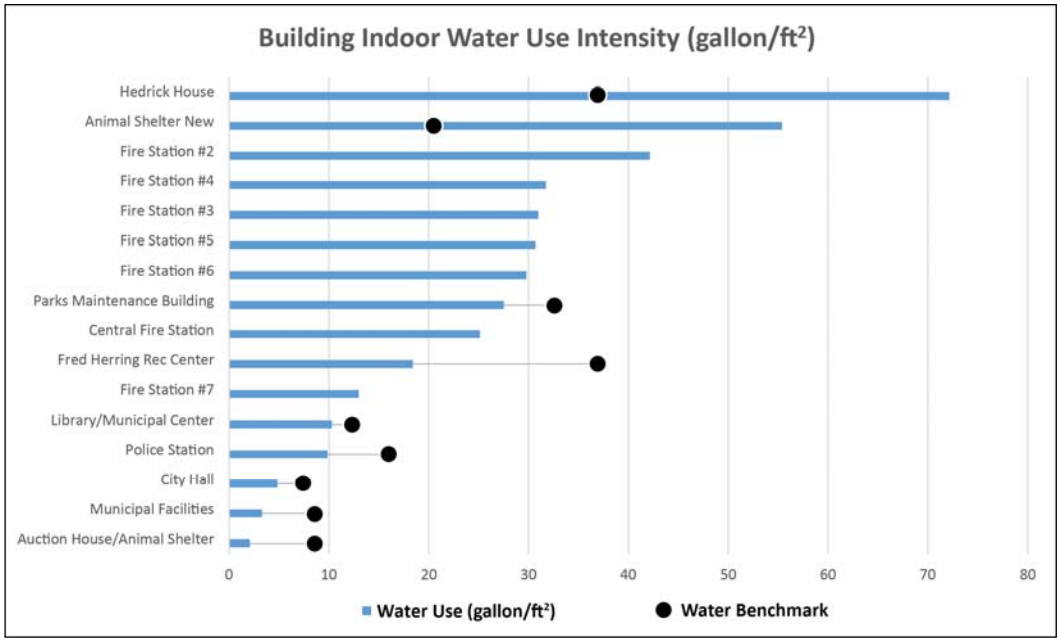


Figure 4.9: Building Indoor Water Use Intensity

Water park Water Use Intensity (WUI) was derived from *My San Antonio's* "Water Parks Conserving" article (2011).[17] The article listed several local water parks that derived a benchmark from a spatial analysis of total square feet of each facility. Figure 4.9 shows that many Lewisville buildings performed below the relevant benchmarks for indoor water use. The Hedrick House was the largest consumer of indoor water per square foot. The house is well landscaped, but has no 8s meter, so it is very likely all irrigation water is attributed to "indoor" use. The Hedrick House should be a focus of further research.

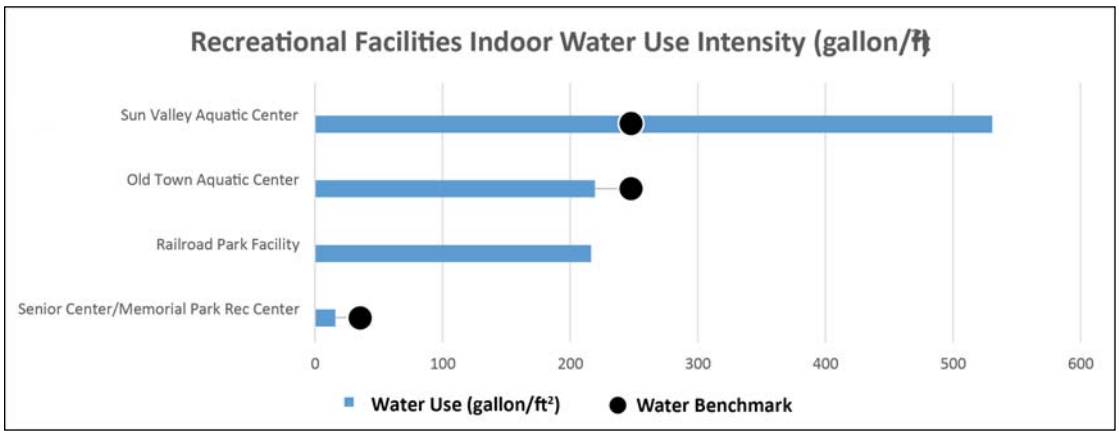


Figure 4.10: Recreational Facilities Indoor Water Use Intensity

The Sun Valley Aquatic Center uses a large amount of water per square foot, especially compared to the Old Town Aquatic Center, which performs below the benchmark.[18]

5.0 Buildings

5.1 Introduction

The Resource & Efficiency Assessment (REA) evaluated the City's built environment. Data from a total of 208 structures was included in the assessment sample that the City owns and manages, consisting of multiple types of structures from municipal buildings to park pavilions. Total square footage included in the sample was 619,891 ft.^{2}. Of the 208 buildings, City representatives identified 28 for in-depth analysis. These buildings are listed in Table 5.1. Findings for these buildings are further discussed below. The REA also assessed the programs, practices, and policies of the City of Lewisville that relate to building use and efficiency.

Animal Services	Fleet Services Building	Public Works Service Center
Central Fire Station	Fred Herring Recreation Center	Records Storage Building
City Hall	Hedrick House	Residential Convenience Center
Fire Station #2	Library	Senior Center
Fire Station #3	MCL GT/Art Center	Sun Valley Aquatic Park
Fire Station #4	Memorial Park Recreation Center	Railroad Park
Fire Station #5	Municipal Annex	Visitor's Bureau
Fire Station #6	Old Town Aquatic Center	Waste Water Treatment Plant
Fire Station #7	Parks Maintenance Building	Water Treatment Plant
	Police Station	

Table 5.1: 28 Primary Buildings Assessed

5.2 Assessment Approach

Data Analysis

The following evaluation components were identified in the assessment's review of buildings:

- **Environmental Impact –** Quantity of Greenhouse Gas Emissions (MT CO2e) from the City's built environment.
- **Resource Consumption Rate** – The rates of energy and water consumption by buildings.
- **Resource Costs** – Energy and water costs incurred by buildings.
- **Building Efficiency –** Comparative analysis of the energy and water consumption rates and costs required to operate a building, as well as a national comparison of similar building types.
- **Building Attributes –** Factors considered influential in building efficiency, such as the year the structure was built, functions/activities occurring in the building, hours of operation, building management systems, HVAC, occupancy rate, and solid waste management and recycling.
- **Programs/Policies** – Assessment of associated programs and policies that affect the built environment's use and efficiency.

5.3 Observations

Following site assessments of numerous City buildings, and the review of associated data, a few observations were made. The following two sections offer general and specific observations from site visits. General observations were made that relate to many of the buildings collectively and are noted in the first section. Some observations however, were specific to a building. These are listed in the second section. Additional specific issues related to particular buildings are also addressed in the Recommendations Chapter.

Building Efficiency: General Observations

- Many buildings utilize occupancy sensors to control lighting.
- Older HVAC units are being replaced with more efficient units (e.g. Fred Herring Rec Center).
- In many buildings, older lamps are being replaced with LED fixtures, reducing energy consumption and environmental impact.
- The City utilizes multiple Energy Management Systems (EMS).
- Not all buildings are on an EMS system. In many cases, a building's HVAC is locally controlled.
- EMS systems currently utilized only capture electrical energy - gas and water are not included.
- There is not a consistently enforced climate control policy with uniform thermostat set-points. An Administrative Directive to address this is being developed.
- The City does not have a central reporting system where energy and water data can be found. At present, data is collected and managed by the Accounting ***and*** Facilities departments.

Building Efficiency: Specific Observations

General features of the building observed were noted. A building-specific examination of each building's systems may reveal other specific issues.

Animal Services

- Uses a software program to manage the lighting scheme in the building.
- There are numerous outdoor aesthetic lighting fixtures.
- Utilizes native landscape materials.

City Hall

- Front entry has revolving door, but the doors to either side, without vestibules, are most often used.

Fire Stations

- Fire stations have high-energy costs and bays experience high temperatures during summer months.
- Most of the seven fire station buildings have flat roofs of dark, built-up roofing.

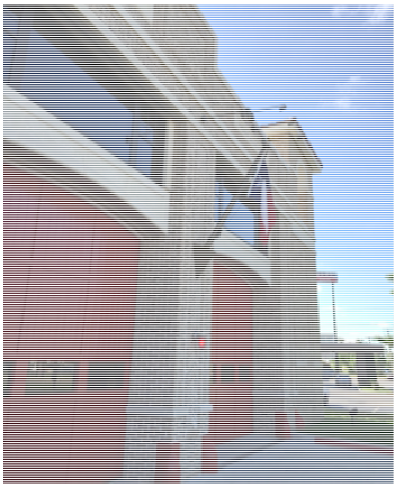


Figure 5.2, Fire Station #7

Fred Herring Recreation Center

- Basketball courts have been retrofitted with LED fixtures.
- Roof was replaced with Flex Roof
- HVAC improvements earned a rebate from TNMP

Library

- Reading areas are using florescent lamps.
- The Library shares electric meter with Municipal Annex.

Municipal Annex

- Shares electric meter with Library.

Energy and Potential Cost-Savings

There are many strategies that could be applied where appropriate, to reduce energy use for heating and cooling, and therefore the associated carbon emissions, in municipal buildings. Some of these strategies are:

- Radiant barriers in roofs where they can be added
- Re-roofing black membrane or built-up roofs with white membrane roofing
- If not appropriate to reroof, painting with reflective paint
- Increase all insulation values to at least R-30 in roofs, R-19 in walls
- Replace any single-glazed windows with insulated double glazing
- Perform air-tightness testing where feasible to determine areas of air leakage
- Visually inspect all window and door openings for weather-tight seals
- Add shading devices (awnings, overhangs or trees) at south-facing windows

Based on averages from other facilities, if the City of Lewisville took advantage of these energy savings strategies, the City could see approximately 26% in energy savings.

	FY 2014 Electricity Consumption	FY 2014 Natural Gas Consumption	FY 2014 Total Energy Consumption	Potential Consumption	Potential Savings*
Buildings	33,464	7,284	40,748	26,486	35%
Recreational Facilities	6,999	14	7,013	4,559	35%
Parks	1,102	-	1,102	1,102	0%
Water Production and Distribution	25,299	587	25,886	21,002	19%
Wastewater Treatment	32,639	-	32,639	26,481	19%
Public Lighting	9,614	-	9,614	4,807	50%
Total:	***109,117***	***7,886***	***117,003***	***84,437***	***28%***

Table 5.3: Current Consumption and Estimated Electricity and Natural Gas Savings by Sector (mmBtu) Based on Suggested Energy Conservation Programs

Buildings and recreational facilities: Average energy savings per square foot from retrofit case studies from the Rocky Mountain Institute: http://www.rmi.org/Content/Files/RMI_Retrofit_Guide_BuildingTheCase_1.1.pdf and http://www.josre.org/wp-content/uploads/2013/01/The_Economics_of-Green_Retrofits-JOSRE_v4-11.pdf

Water production and distribution and wastewater treatment: Average energy savings from case studies from the EPA: http://www3.epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf

Public lighting: Department of Energy, Municipal Solid-State Street Lighting Consortium reports: http://energy.gov/sites/prod/files/2015/09/f26/2015_gateway-msslc_portland_0.pdf and http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2013_gateway-msslc_kc.pdf

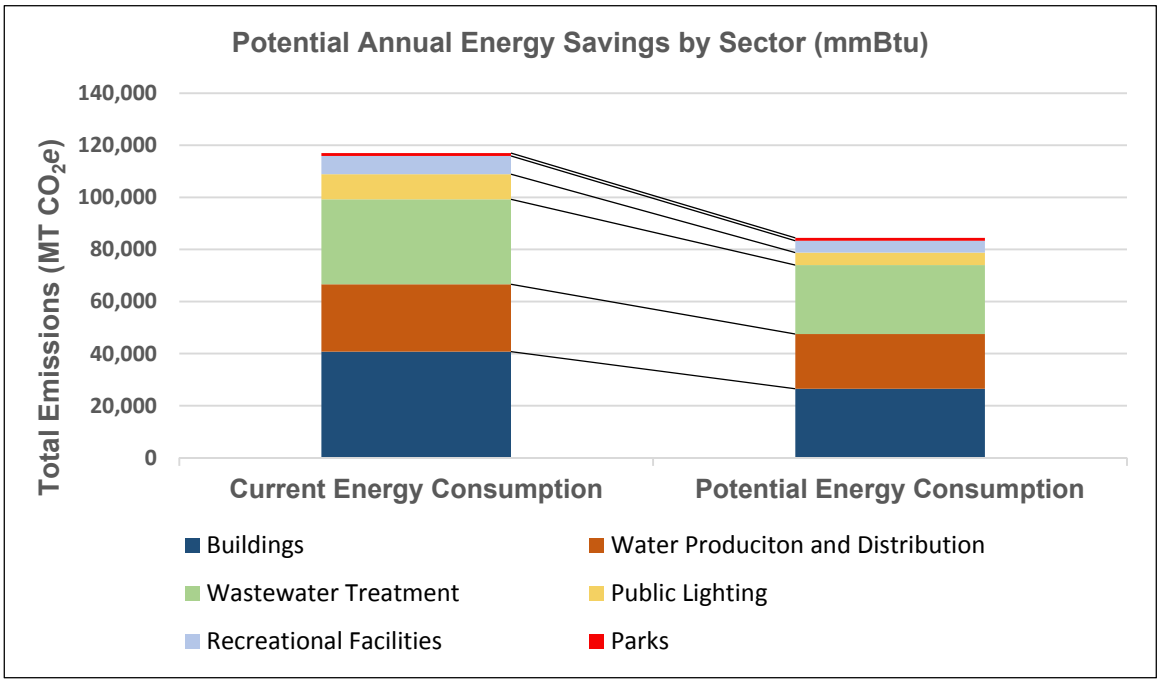


Figure 5.4: Projected Annual Energy Savings by Sector (MMBtu)

Strategies such as these will vary building by building and can be included in routine maintenance programs. These strategies may already be in place or may be planned by Lewisville staff.

High-Energy Use Facilities

There are several facilities that stand out for their high-energy use. These facilities include the Library and Municipal Annex, City Hall, and the MCL Grand Theater. Together, these facilities account for over 65% of total energy use in municipal buildings, not including parks and the water treatment and distribution system. By looking more closely at these facilities, the City of Lewisville has the opportunity address specific issues at these buildings to provide greater efficiency and reduce energy use and carbon emissions.

According to a report from the Department of Public Services,[19] between 2003 and 2012, the City has engaged in a number of energy reduction retrofits, saving $199,000 in energy costs and receiving $22,560 in rebates. Many of these were undertaken to meet state energy conservation goal, but the City has met and surpassed those state goals since 2003. Overall, the City realized a 19.4% reduction in energy consumption in City facilities resulting from the retrofits.

Buildings that have undertaken energy reduction retrofits include:

- Animal Services
- City Hall
- Fred Herring Recreation Center
- Fire Stations
- Hedrick House
- Library
- MCL Grand Theater
- Memorial Park Recreation Center
- Municipal Annex
- Police & Fire Training Facility
- Police Station
- Records Storage Building
- Senior Center
- Traffic Lighting
  - Utilities & Public Works
  - Waste Water Treatment Plant
  - Water Treatment Plant

Plug Loads

One of the primary factors in interior energy use is the plug load. This refers to anything that draws current, but is not part of the building structure, basically, anything that can be plugged into an outlet. While overall building lighting is accounted for separately, desk lamps and incidental lighting are considered plug loads. All equipment such as computers, printers, phones and their associated chargers are all included. All appliances such as microwaves and coffee makers are included as well.

The biggest challenge in reducing plug loads is human behavior. As these items are not fixed to the building, they can come and go at the occupant's discretion. One example is under-desk space heaters in low temperature-air-conditioned spaces. This promotes situations where energy is used to cool the space, then more energy is used to heat the local desk space, creating a greater overall heat load which causes even more air conditioning.

One cause of increasing plug loads is the increase in the number of devices. Each desk has a phone to be charged, and a computer, with perhaps two monitors. Many people appreciate the convenience of a personal printer, and will also charge multiple hand-held devices. Many of these electrical items continue to draw power even when they are turned off. Because these items are associated with individuals, not attached and controlled by the building systems, this kind of electrical loading is very difficult to control or reduce.

A large amount of energy can be saved from reducing plug loads in buildings, with no capital cost. This would need to be achieved through behavioral modification through education. This is the most cost-effective strategy – implementing a campaign to unplug appliances, turn off desk lamps, ensure devices utilize "sleep mode", use fewer extra devices (e.g. under-desk heaters and fans, desktop printers), share devices, and shutting down devices when not in use. This is in addition to building control efforts such as general lighting controls and setting schedules on thermostats.

Building Energy Benchmarks

Municipal facilities were categorized by applicable building typologies in order to compare energy use with national and regional benchmarks. Three sources of benchmark references were used. These three benchmarks (CBECS, Climate Zone, and high performance) are defined below in order to provide a clear assessment of how Lewisville's buildings' energy use compares to other similar buildings nationally and regionally.

- The Commercial Buildings Energy Consumption Survey[20] (CBECS) database was used to define benchmarks for Lewisville's building energy use. Building energy use comparisons were based on the 2003 CBECS data.
- Where applicable, building energy use was also compared to buildings in Climate Zone 5, Lewisville's climate zone.[21] This gives a more appropriate comparison for energy use, but this data was not available for all building types.
- Lewisville's buildings were also compared to high performance buildings[22] of similar typologies, where data was available. This comparison gives an idea of how much improvement is actually obtainable with best practices being utilized.

EUI and EEI

Energy Use Intensity (EUI) is a commonly used benchmark for energy use (kBtu/ft^2/year) in buildings, which includes energy use of all types (electricity and gas). Chart 5.6 shows Lewisville buildings, which use both gas and electricity as compared to national and regional averages.

By measuring the total energy use of a building as a ratio with its area, buildings of different sizes can be compared. Typical benchmarks categorize buildings by use or type. While these categorizations are sometimes imperfect, they give a starting point for analyzing total energy use.

EUI uses both electricity and gas usage. Electricity Use Intensity (EEI) can be used when gas is either not used in the building or the information is not available.

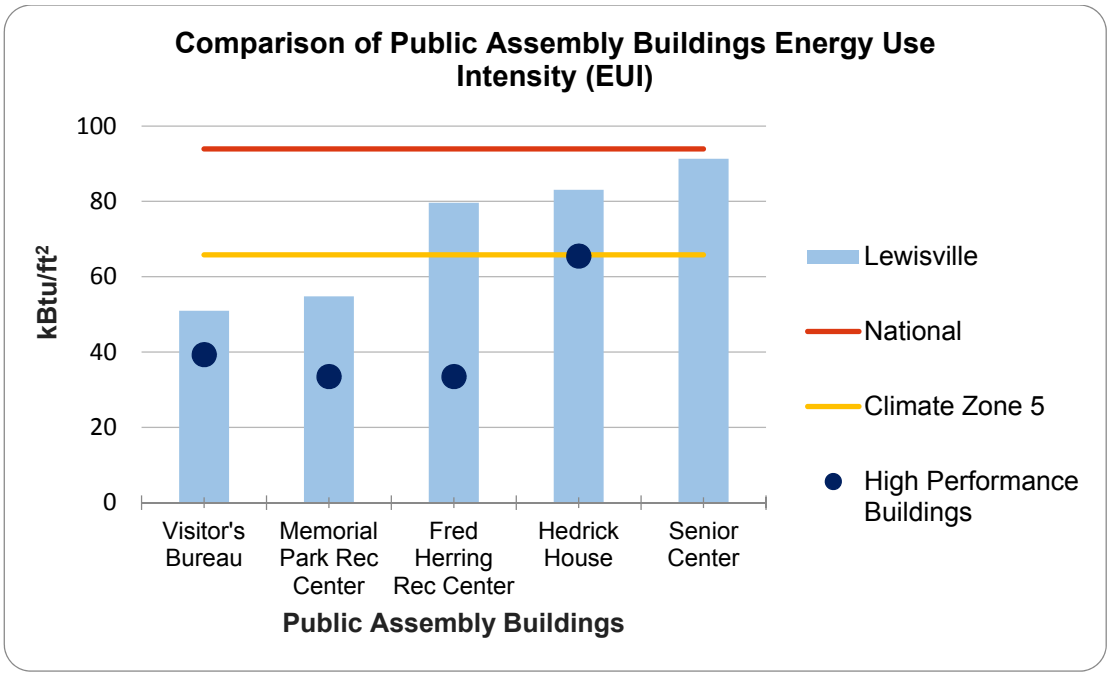


Figure 5.5: Comparison of Public Assembly Buildings Energy Use Intensity (EUI)[23]

The Senior Center has the highest EUI among the public assembly buildings, and the Hedrick House and Fred Herring Recreational Center are above the climate zone benchmark. The high performance benchmarks show what level of energy performance has been achieved in other similar buildings that have been designed to maximize performance. The EUI shows a ratio of total energy to space, and **a lower value reflects a more efficient building.**

For some municipal buildings, natural gas data was not available or the building did not utilize natural gas. To include comparisons for these buildings a similar Electricity Energy Intensity (EEI) measure was used, in order to compare electrical consumption (kWh/ft^2/year) among buildings without gas use data. While the two are similar, when natural gas data is available, it provides a more accurate assessment of energy use, especially in winter months, as space heating and hot water heating often use natural gas.

If natural gas is used in the structure and that data is available, the EUI gives a more complete picture of total energy use. As above, the EEI shows a ratio of electric energy use to building area, and a lower value reflects a more efficient building.

The comparison in Figure 5.6 can be used to prioritize energy use reduction efforts for specific buildings in Lewisville.

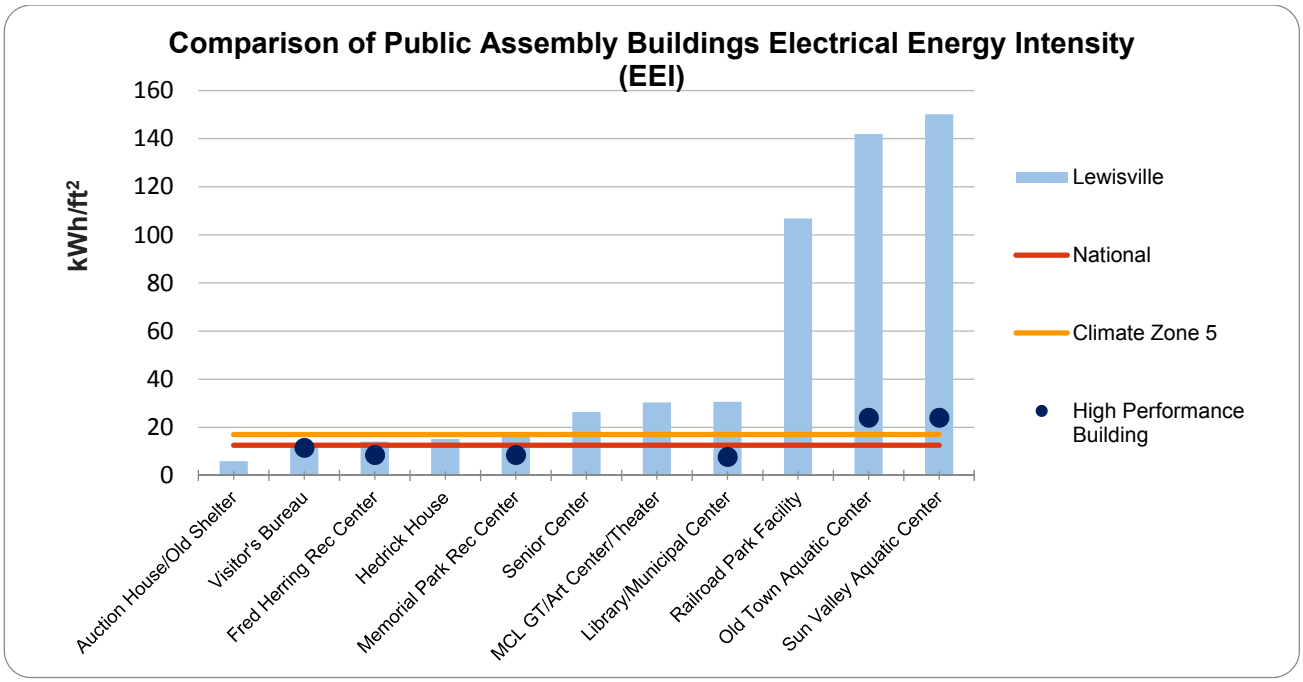


Figure 5.6: Comparison of Public Assembly Buildings Electrical Energy Intensity (EEI)[24]

Important to note is that Public Assembly may not accurately depict the Railroad Park Facility, Old Town Aquatic Center, or the Sun Valley Aquatic Center, as they are unique buildings. There is no CBECS typology that is appropriate for these buildings. However, it is clear how much energy the park and aquatic center consume annually. While the CBECS benchmarks may not be ideal, the high performance benchmarks are more relevant, and show what level of energy efficiency can be achieved. This is the only CBECs category for them.

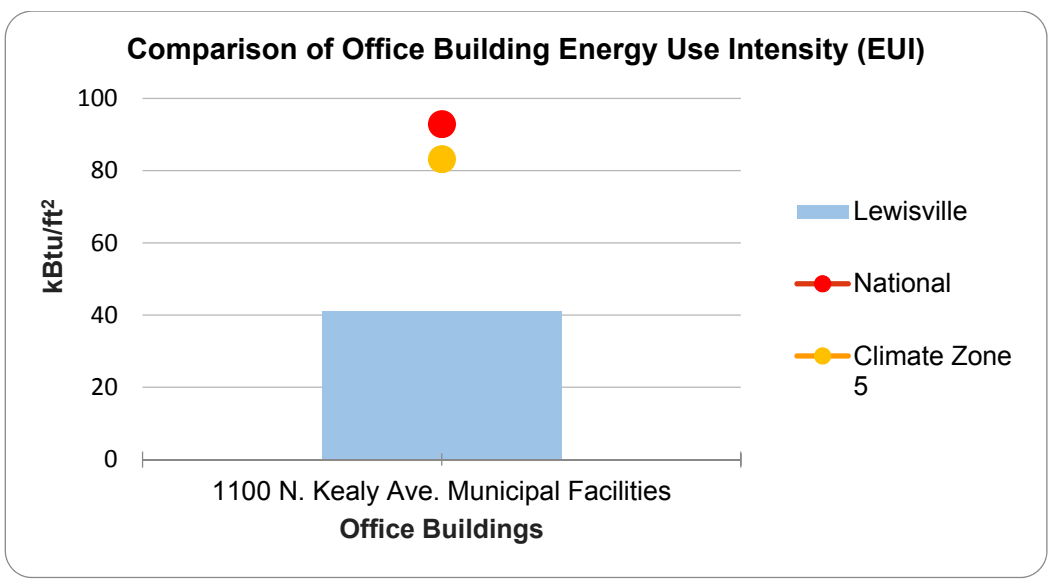


Figure 5.7: Comparison of Office Building Energy Use Intensity (EUI)

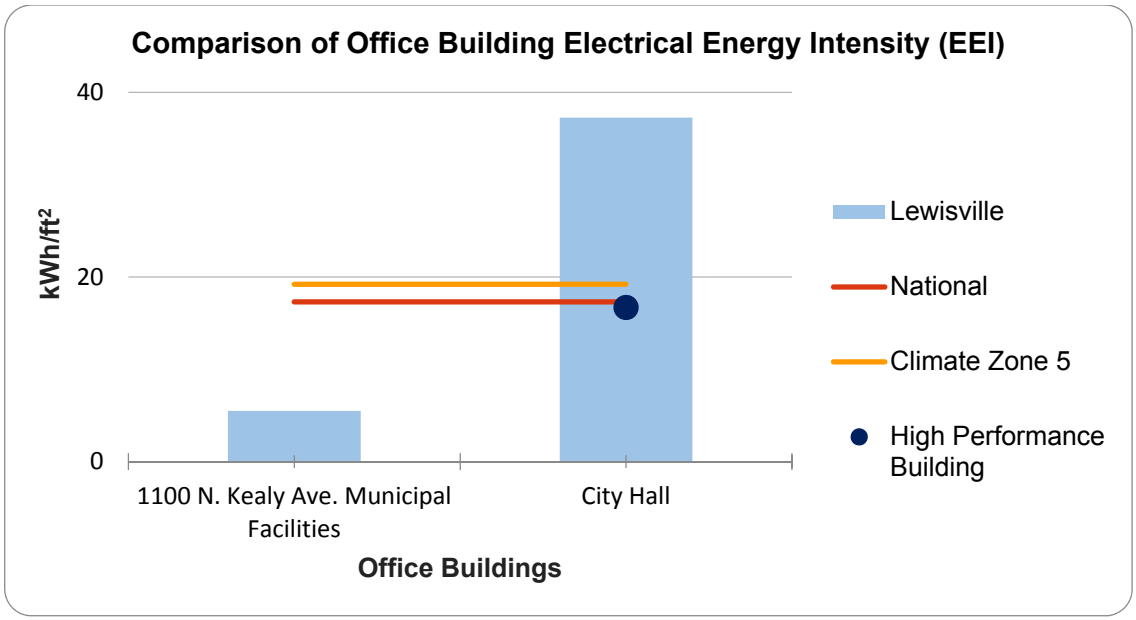


Figure 5.8: Comparison of Office Building Electrical Energy Intensity (EEI)[25]

The Kealy Operations Center used well below the national and regional averages for office buildings. However, while the Kealy Operations Center was below the benchmarks for energy use, reflecting its comparatively limited use, as most offices are used by field personnel. City Hall, with much greater occupancy and more intensive use was well above the benchmarks and should be a target for further study.

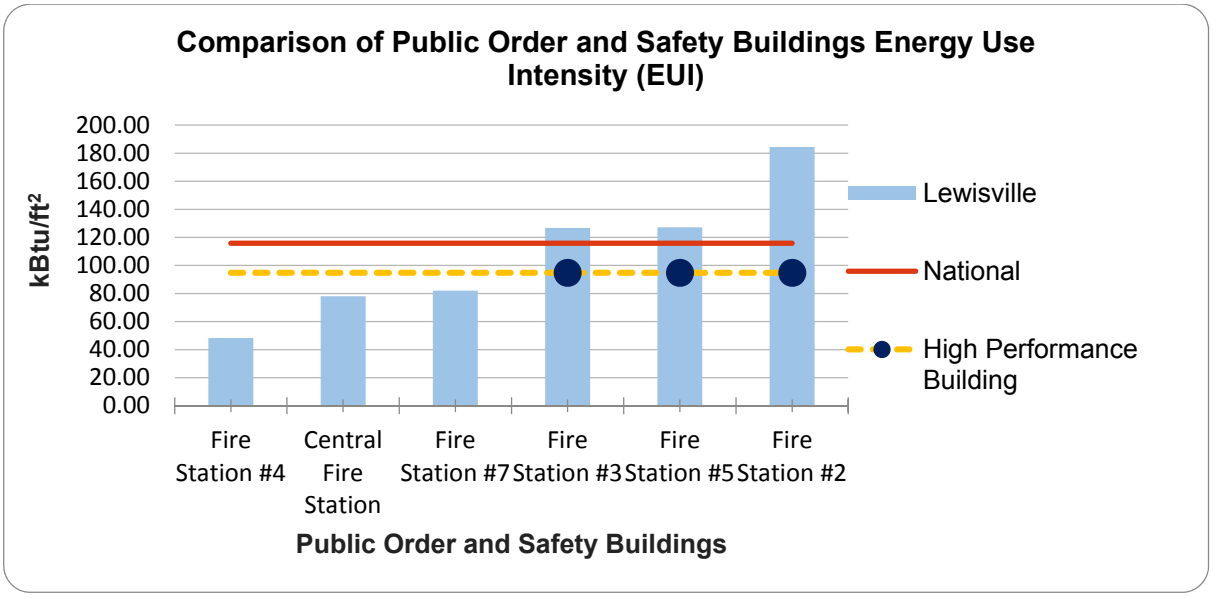


Figure 5.9: Comparison of Public Order and Safety Energy Use Intensity (EUI)

Three of the six fire stations performed below the relevant benchmarks, and three performed above the benchmarks. Looking at only use of electricity in Figure 5.10, Fire Station #2 stands out for high-energy

use, but that can be expected as it is the only station with a dive tank for water-rescue training. Even so, Fire Station #2 would be a good target for further study.

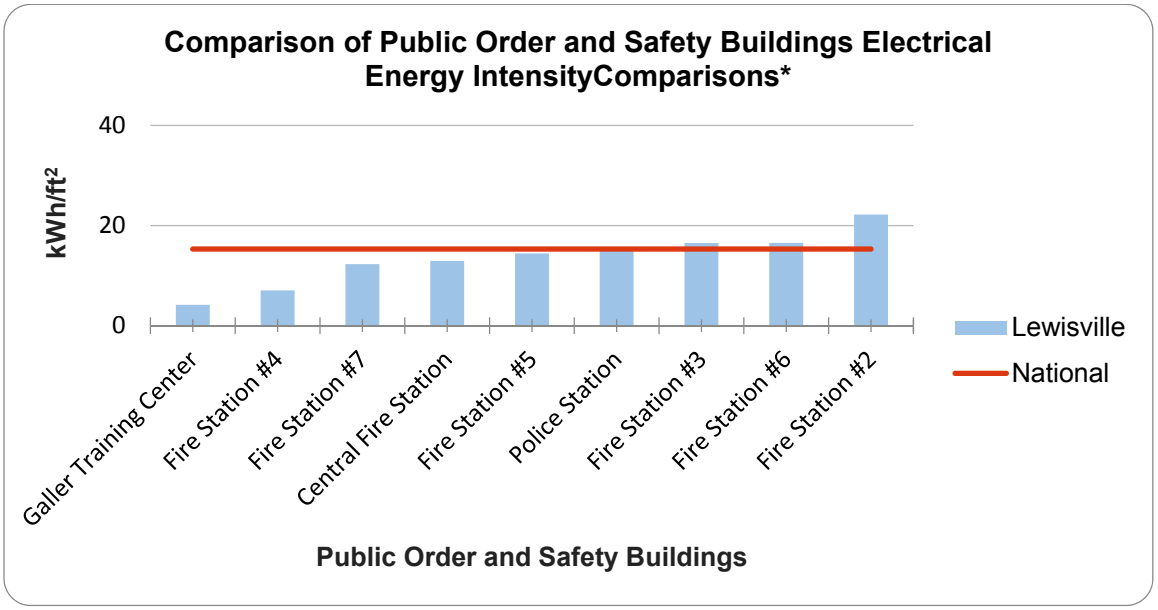


Figure 5.10: Comparison of Public Safety Buildings Electrical Energy Intensity (EEI)[26]

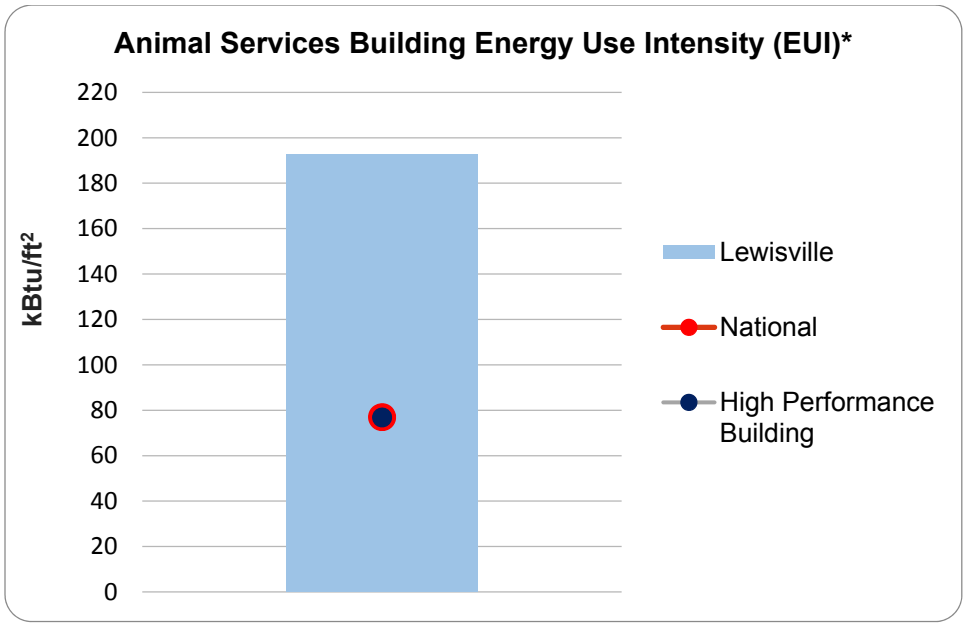


Figure 5.11: Animal Services Building Energy Use Intensity (EUI)

*Data derived from Energy Star's Portfolio Manager analysis.
Climate Zone 5 and High-Performance Building data not available.

The New Animal Services building performed at more than double the national average for energy use intensity. Further research should be conducted to determine the cause for such high-energy use.

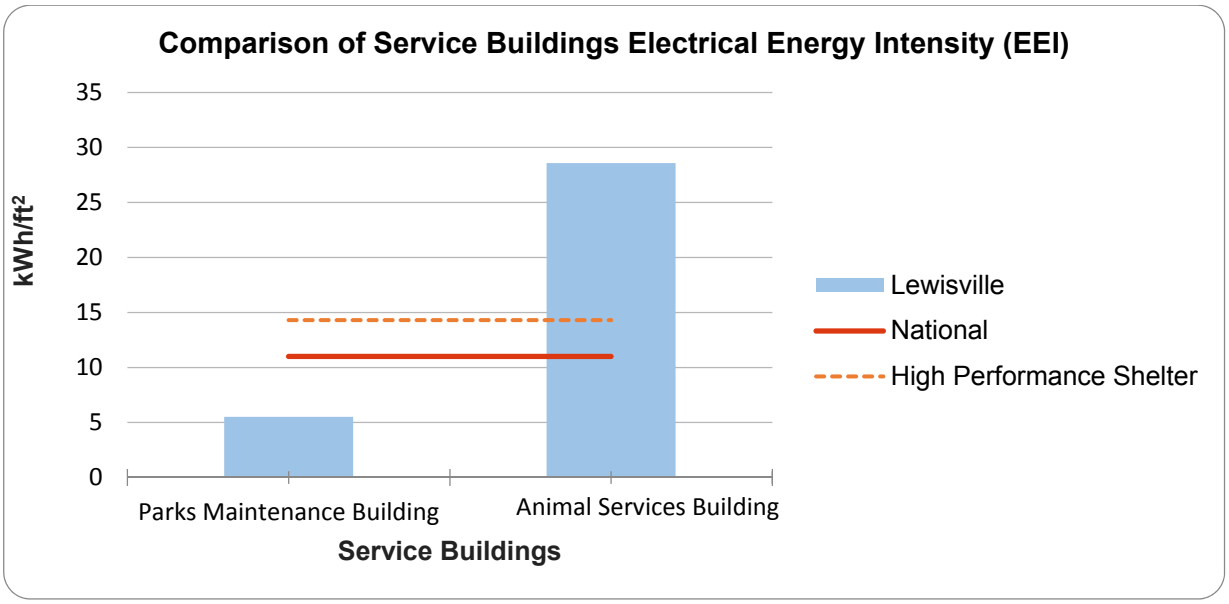


Figure 5.12: Comparison of Service Buildings Electrical Energy Intensity (EEI)[27]
*Climate Zone 5 data not available.

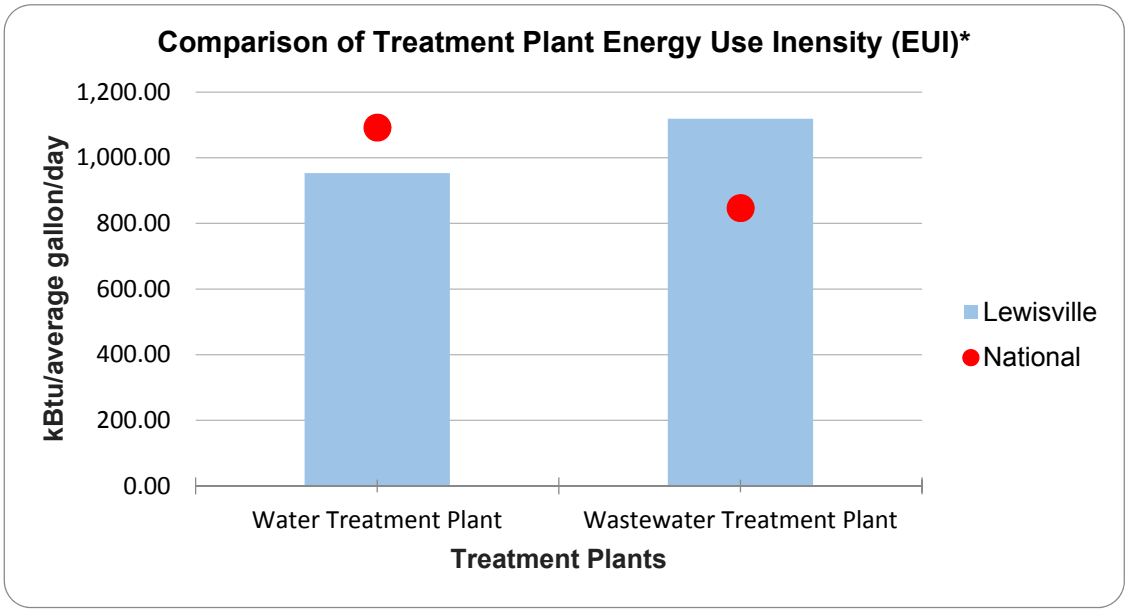


Figure 5.13: Comparison of Treatment Plant Energy Use Intensity (EUI)*
*Data derived from Energy Star's Portfolio Manager analysis. Climate Zone 5 and High-Performance Building data not available.

Comparison of energy use for water treatment facilities is difficult, as they are energy intensive facilities, and each one functions differently and has different local issues. However, the comparison shown in Figure 5.13 is a compilation of national water treatment facility EUIs. Analysis of other comparable

individual facilities showed similar results. An examination of the Capital Improvement Plan and a discussion with key staff members will help set priorities.

Energy Savings Example[28]

Many city buildings have been retrofitted for energy efficiency. Figure 5.14 shows a typical reduction in building energy for each category of retrofit, compiled from national averages for similar buildings.

System	Estimated Energy Reduction (kBtu/ft^2/yr)	Estimated Capital Cost ($/ft^2)
Plug Load	9.5	$0.00
Lighting	7.0	$4.00
Ventilation	4.5	$3.50
Cooling	12.5	$42.50
Total:	***33.5***	***$50***

Figure 5.14: Average Energy v. Capital Cost for Retrofit Types

If these same average results were applied to Lewisville's buildings, the proportional reductions would be as shown in Figure 5.14. The retrofits included in the projects producing these results included human behavior changes to reduce plug load (using fewer appliances, sharing equipment), lighting upgrades, HVAC changes, and building envelope improvements (sealing around windows, increasing insulation). Figures 5.15 and 5.16 show the estimated energy and cost savings that could be achieved from these types of retrofit projects for the total sum of city buildings. (Values include total building square footage of Buildings and Recreation Facilities.)

Table 5.15: Estimated Energy Savings from Retrofits of Lewisville Facilities

System	Energy Savings (kBtu/ft2/yr)	Energy Reduction
Plug Load	5,113,470	10.7%
Lighting	3,767,820	7.9%
Ventilation	2,422,170	5.1%
Cooling	6,728,250	14.1%
Total:	***18,031,710***	***37.7%***

Energy Use	Total Estimated Capital Costs	Potential Cost Savings/Year
Plug Load	$0	$160,224
Lighting	$2,153,040	$118,060
Ventilation	$1,883,910	$75,896
Cooling	$22,876,050	$210,821
Total:	***$26,913,000***	***$565,001***

Table 5.16: Lewisville Estimated Electricity Cost-Savings from Implementing Select Efficiency Measures in Buildings

Total kBtu	47,811,000
Annual Electricity Cost	$1,496,549
Total Building Area ft^2	538,260

Table 5.17: Lewisville Data Used for Comparisons

6.0 City Fleet

6.1 Introduction

The Resource & Efficiency Assessment (REA) evaluated the City Fleet, to include emergency vehicles and other equipment. It also assessed the programs, practices, and policies of the City of Lewisville that relate to the City Fleet. This chapter of the REA discusses the assessment, its findings, and recommendations for Lewisville's City Fleet.

6.2 Assessment Approach

Data Analysis

The following evaluation components were identified in the review of the fleet and were investigated for this study. A total of 430 City Fleet vehicles (311) and equipment (119) were assessed, including all emergency vehicles.

- **Environmental Impact** – Quantity of Greenhouse Gas Emissions (MT CO_2e) resulting from vehicle and equipment use.
- **Fuel Consumption Rate** – The rate of fuel consumption by vehicles and equipment.
- **Fuel Costs** – Costs incurred for vehicle and equipment use.
- **Vehicle Use –** The life total and annual miles used by a vehicle. (Some vehicles are not tracked by miles, but rather tracked by the hours they are operated. Additionally, off-road vehicles are generally designated as "equipment" and use is determined by hours. The study accounted for the variations.)
- **Vehicle Efficiency –** Comparative analysis of the fuel consumption rate and costs required to operate the vehicle or equipment per mile or per hour. Cost per mile (cpm) is determined by assessing annual fuel costs and annual miles driven.
- **Vehicle Function** – Assessment of the vehicle or equipment's primary function, various activities it supports, the types of equipment it carried or pulled, its general occupancy, and frequency of use.
- **Vehicle Maintenance/Replacement** – Overall investment costs, replacement schedules, and annual operating costs were analyzed to determine overall viability of individual investment in vehicles.
- **Programs/Policies** – Assessment of associated programs and policies that affect fleet efficiency and enhancement.

6.3 Observations

Environmental Impact

- The City Fleet (including equipment) produced 2,307 MT CO_2e during FY 2014. The Police and Fire Departments accounted for 52% of all City Fleet emissions.
- The Fleet tests emissions during vehicle inspections for all vehicles as required. Diesel vehicles and motorcycles are not tested for emissions, as these are exempted per state policy.

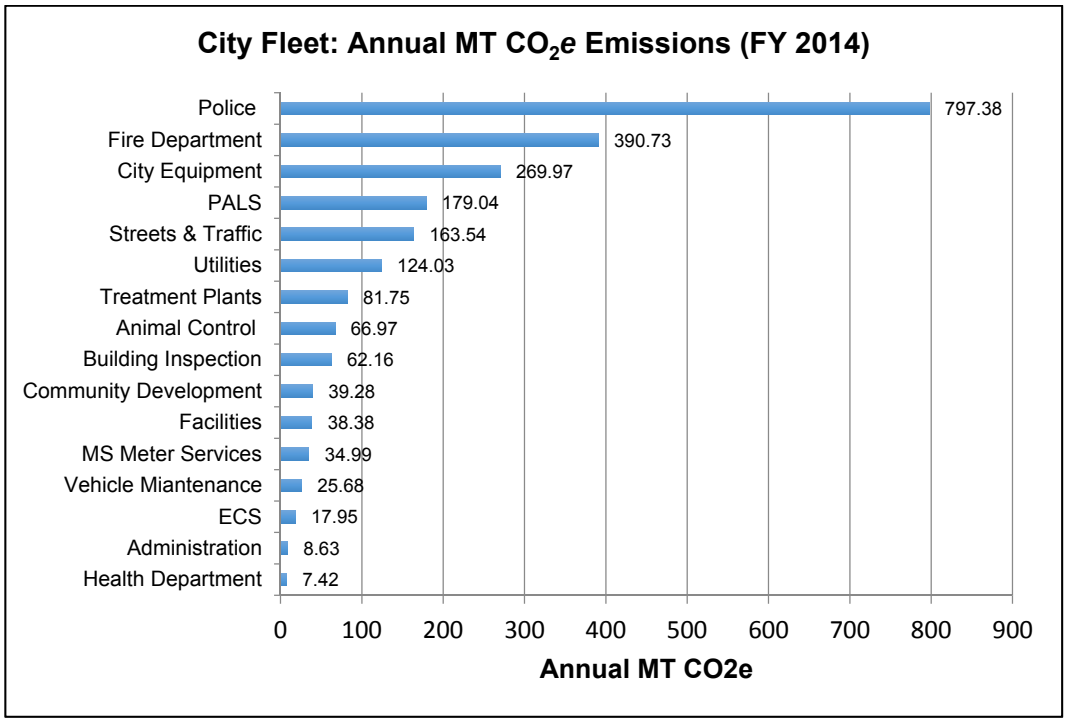


Figure 6.1: City Fleet: Annual MT CO_2e Emissions (FY 2014)

Fuel Consumption Rate (Figure 6.2)

- The City Fleet used a total of nearly 245,000 gallons of gasoline and diesel fuel.
- The City Fleet used 149 gallons of Liquid Propane Gas (LPG) in FY 2014 with two forklifts.
- The Police (37%) and Fire Departments (16%) have the highest fuel consumption rates, followed by PALS (8%), Streets & Traffic (7%), and Utilities (6%).

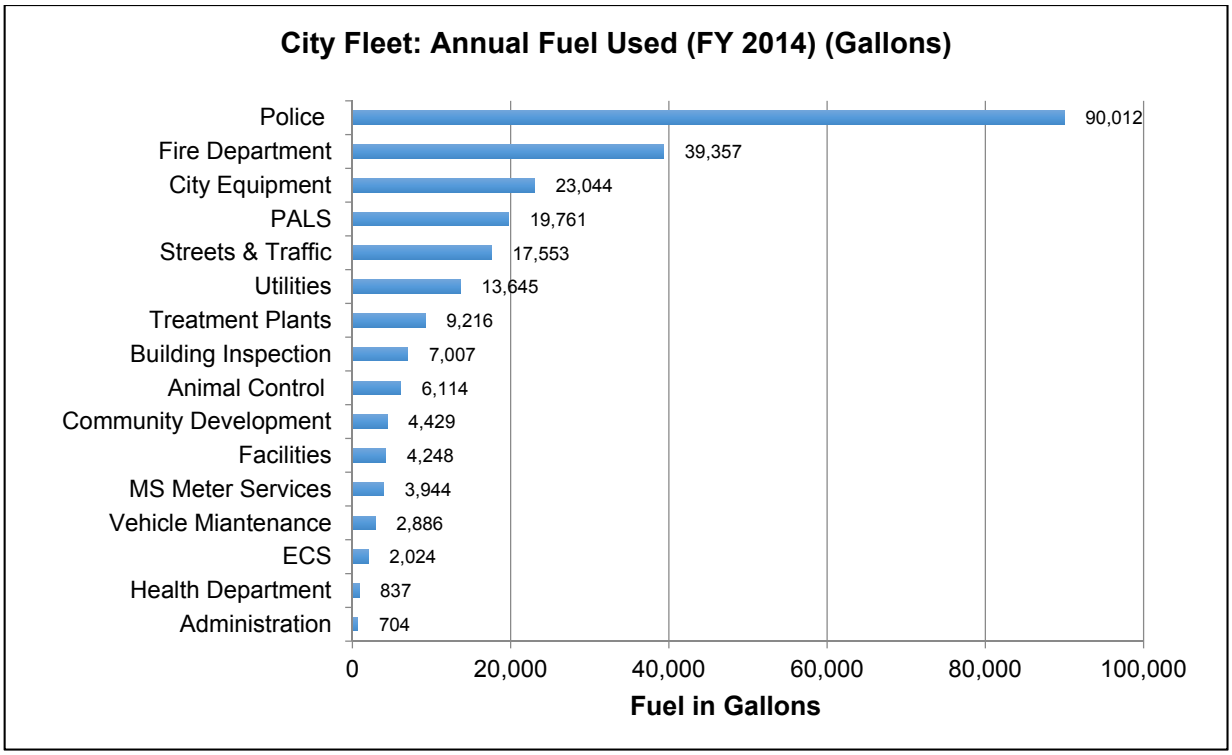


Figure 6.2: City Fleet: Annual Fuel Used (FY 2014) (Gallons)

Fuel Costs (Table 6.3)

- Fuel Costs across different City units correlated with the amount of fuel used.
- Total City Fleet expenditures for fuel were over $739,000.
- Vehicle and equipment tracked by miles purchased over $575,000 in fuel, while those tracked by hours purchased nearly $164,000 in fuel.
- Vehicles accounted for $661,701, or 90% of the total fuel purchased.
- The Police and Fire Departments accounted for $389,151, or 53% of the total fuel purchased.

Annual Miles Driven	Annual Hours Used	Annual Fuel Consumed (Gallons)	Annual Fuel Cost	Average Miles per Gallon	Average Hours per Gallon	Annual Emissions (MT CO2e)	Average Cost per Mile	Average Cost per Hour
2,133,793	46,268	245,580	$739,237	10.95	0.91	2,307	$0.26	$4.32

Table 6.3: Total Vehicle & Equipment Use and Efficiency (FY 2014)

Vehicle Use

- The City Fleet accounted for 2,133,793 million miles driven.
- The City Fleet accounted for 2,307 MT CO_2e emissions.
- Vehicles tracked by hours, accounted for 46,268 hours of operation.
- The Police Department accrued nearly half of all miles driven by the City with 1,028,161.
- There are 8 pool/shared vehicles.

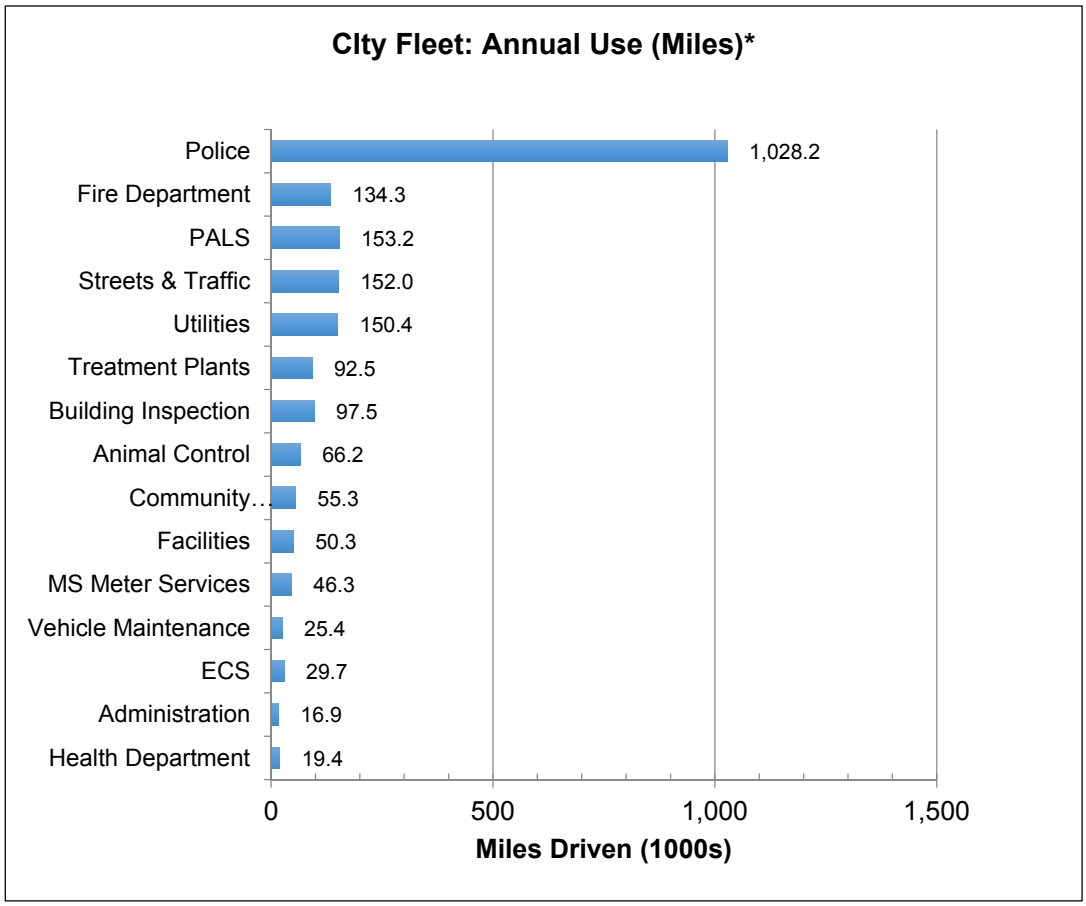


Figure 6.4: City Fleet: Annual Use (Miles)*

**Note: Fire Department total does not include vehicle usage tracked by hours. See Appendix for complete listing of vehicles tracked by miles and hours.*

Vehicle Efficiency Notes

- The City's average mile per gallon (mpg) rate is 10.95.
- The City's average cost per mile (cpm) rate is $0.26.
- The City's average hour per gallon rate is 0.91.
- Although the Police and Fire Departments account for most of the miles driven and fuel consumed, they are the fourth and fifth most efficient departments, with cpm rates of $0.21 and $0.22, respectively.
- The Health Department has the best cpm rate at $0.14. This is likely due to its inventory

including a Toyota Prius.

- PALS has the highest cpm with $0.37.
- Due to use of heavy vehicles and equipment Streets & Traffic ($0.35), Vehicle Maintenance ($0.34), Utilities ($0.33), and Treatment Plants ($0.31) have lower cpm rates.
- The City's cost per hour (cph) rate for vehicles is $4.47.
- The City's cost per hour (cph) rate for equipment is $4.17.
- City vehicles operated for over 148,200 hours, with a fuel cost of over $97,400.
- Equipment operated for over 212,700 hours, with a fuel cost of over $66,400.

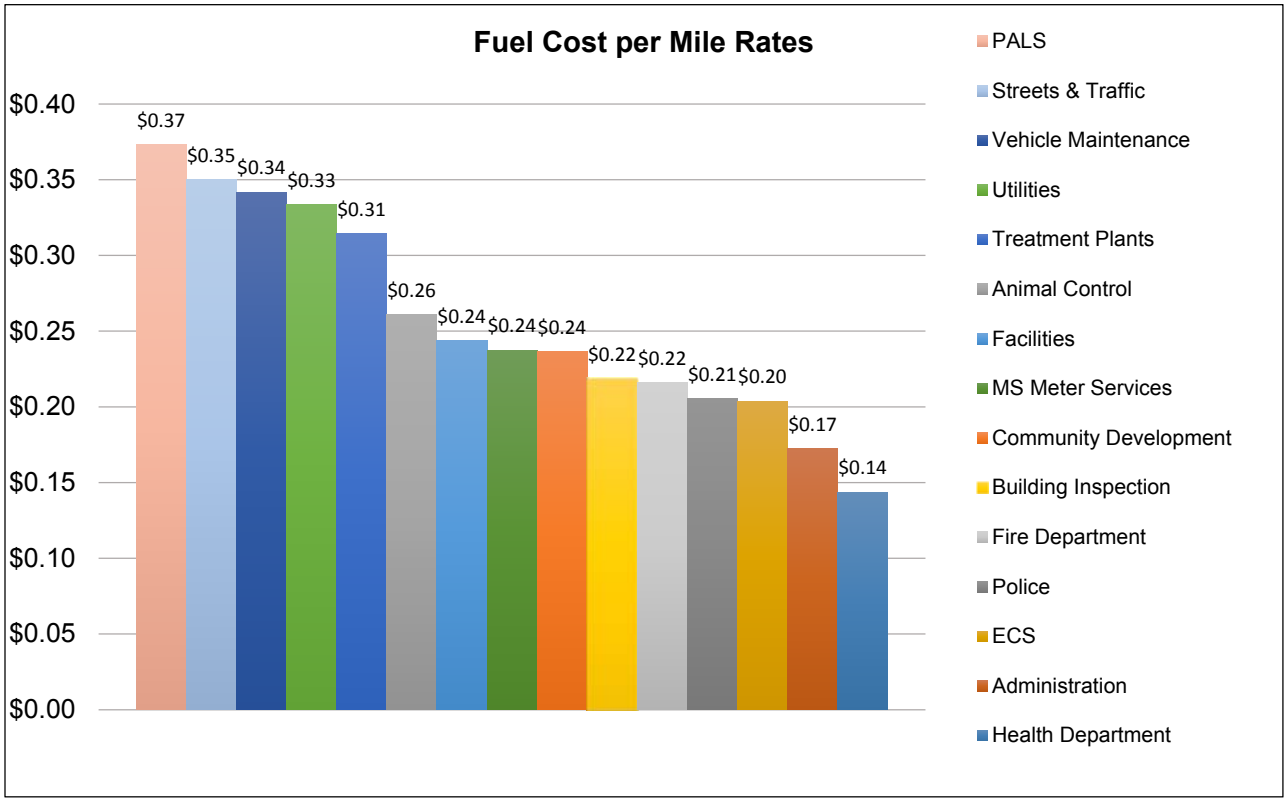


Figure 6.5: City Fleet: Cost per Mile Rates

Vehicle Function

- Vehicles are assigned per function. Where a vehicle serves multiple functions, if even occasionally, it may not be the most efficient vehicle for all functions served.

Vehicle Maintenance/Replacement

- The City has a regularly reviewed and implemented vehicle replacement policy, based on use, mileage, and personnel needs.
- The City purchased 31 vehicles in the previous year, including an additional Prius.
- 128 fleet vehicles (nearly half of the entire fleet) are scheduled for replacement in the next 18 months, many with extremely low mileage.

- 90 vehicles (29% of the total fleet) were scheduled for replacement in FY 2014-2015, with 44 (nearly 50%) of those vehicles having less than 50,000 miles and 12 (13%) with less than 25,000 miles. The total replacement cost of these 90 vehicles is over $1.2 million, which equates to over $165,000 in annual lease payments.
- 38 vehicles are scheduled for replacement in 2016, with 32 vehicles having 50,000 or less miles at present. The total replacement cost of these 38 vehicles is over $860,000, which equates to over $158,000 in annual lease payments.

Programs/Policies

- The City utilizes a Fleet Services Bulletin to communicate on policies, education and training programs, and procedures for safety, efficiency, environmental compliance, and regulatory compliance messaging to its employees.
- The City has a “No Idling” policy. Idling time is limited to 5 minutes.
- The City has a High Ozone Day policy that applies to vehicle fueling, driving, burning, painting, asphalt overlay, and small engine operation.
- Fleet Services replacement policy considers the use level of higher-emitting vehicles as part of each vehicle replacement request.
- Fleet Services recycles vehicle fluids and tires, and/or properly disposes of hazardous materials.

Data Collection

- The City collects data on its fleet vehicles/equipment by type, department, fuel type, and fuel consumption rate.
- The City tracks preventative maintenance and vehicle repairs, which provides the capacity to conduct aggregate cost/benefit analyses.
- The City has recently purchased a vehicle GPS tracking system to enhance data collection processes related to vehicle use.

7.0 Parks, Green Space, and Landscaping

7.1 Introduction

Parks, green space, and landscaping are powerful elements of a community's presentation to visitors. These attributes enhance a community's identity and culture. Managing them well will lead to an active and healthy community with thriving neighborhoods and engaged residents. Indeed, "The quality of a city's environment is the most significant factor in attracting new members."[29]

The City of Lewisville's natural assets are a great benefit to its residents, providing an outdoor recreational network visited by many from around north Texas. Visitors from around the region are able to enjoy an array of sporting activities. The Lewisville Lake Environmental Area (LLELA) is an important and unique natural resource preserve making it an unequaled asset in the region. The City of Lewisville's green space network has the foundation to develop into the region's premier center for outdoor activities, festivals and athletic competitions.

The City has accomplished much in recent years and has a strong planning foundation in several documents such as the 2011 Lewisville Parks, Recreation, & Open Space Vision Plan (2011), Lewisville Trails Master Plan (2011) and Lewisville 2025 (2014). All three documents reflect the importance of, and the need to prioritize investments in, parks, green spaces, and landscaping.

The Parks Vision Plan[30] puts forth several noteworthy points:

- There is *"…increased demand for passive recreation. Across the north Texas region, the provision of trails is the top priority for citizens"*[31]
- The City should:
  - *"Provide connectivity between parks via trails, greenbelts, and open spaces."*
  - *"Develop short and long range plans for the development, expansion, modernization, and upgrading of Lewisville's parks system."*
  - *"Acquire and preserve land along creeks."*
  - Celebrate diversity by helping *"…build a strong identity for the community through parks, public spaces, streetscapes, and greenways."*
  - Preserve open space by capitalizing *"…on the value provided by Lewisville Lake Environmental Learning Area (LLELA), both in terms of recreation and image."*
  - *"Provide Parks and Leisure Services (PALS) staff with the manpower and funding resources to maintain facilities in a superior manner."*
  - *"Promote the use of native plant materials, low-maintenance design techniques, and organic practices to reduce maintenance and irrigation costs."*

Maximizing the Value of Parks and Green Space

Parks and green space must be managed effectively, as resources to support these community assets are increasingly strained. Enhancing parks and green space per the recommendations set out in the Parks Vision Plan, Trails Master Plan, as well as the recommendations offered in this document will promote cost-savings, reduce the City's environmental impact, establish the City as a leader in sustainable practices, and enhance the community culture.

Promote Cost-Savings

Innovative funding models that bolster program impact will likely:

- Increase program efficiency through focused, strategic practices
- Decrease resource consumption
- Expand collaborations

Environmental Impact Reduction

Reduced carbon emissions will result from:

- Enhanced green space and tree canopy
- Greater coverage area of native plants
- Viable and cost-effective organic fertilizer program
- Decreased water consumption
- Improved water quality through Smartscaping

Leadership Position in Sustainable Practices

The City of Lewisville has the essentials to develop and showcase a celebrated green space network to be envied by many. Unlike its neighbors, Lewisville has not yet consumed a disproportionate amount of its green space for development. Combining efforts to create a Green Centerpiece and Extend the Green throughout the City, with its natural resources in Lewisville Lake and Lewisville Lake Environmental Learning Area (LLELA) will position the City in a notable position of stewardship in the region and the nation.

Enhanced Culture

People seek the outdoors. They want to interact with it at all points of their life and they want to share it with others. People crave places outside of their homes where they can add to their lives and create memories. Parks, green space, and landscaping are a municipality's primary means to create these opportunities for residents. Lewisville has the foundation to provide a renowned green space network, and with it strengthen its community identity and culture in unprecedented ways.

The Resource & Efficiency Assessment evaluated the City of Lewisville's parks, green space, and landscaping programs, practices, and policies. This chapter discusses the assessment, its findings, and recommendations for parks, green space, and landscaping.

7.2 Assessment Approach

The assessment of Parks and Green Space was not intended to replicate findings or recommendations of *The 2011 Lewisville Parks, Recreation, and Open Space Vision Plan (2011)*, *The Lewisville Trails Master Plan (2011),* or *Lewisville 2025 (2014)*. Rather, this assessment evaluated how effectively the City utilizes its resources to attain its objectives and goals laid out in the above-mentioned plans. Conditions of parks and green spaces were evaluated, to document current status. Also, the systems and processes to maintain and enhance the condition of parks and green spaces were considered. The assessment included seeking evidence of improvements based upon the 2011 plan.

Data Analysis

The following evaluation components were identified as pertinent to a review of parks, landscaping and green spaces and were investigated for this assessment.

Parks and Green Spaces

- **Function** – What is the primary function of the site? Is the site utilized for multiple purposes? To what extent does the green space/landscaping support the site's function?
- **Location** – To what extent does the site's green space/landscaping enhance the site's location?
- **Acreage/Square Footage** – What is the total area of the site's green space/landscaping in square footage?
- **Plant Inventory** – What types of plants are located at the site? To what extent does the plant inventory maximize function efficiency while enhancing the site?
- **Tree Inventory** – What types of trees are located at the site? To what extent does the tree inventory maximize function efficiency while enhancing the site?
- **Lighting** – To what extent is lighting utilized at the site?

Medians and Buildings

- **Location** – To what extent does the location of green space/landscaping maximize efficiency while enhancing structure aesthetics?
- **Square Footage** - What is the total area of the green space/landscaping in square footage?
- **Lighting** – To what extent is lighting utilized at the site?

Maintenance

- **Irrigation Systems –** What types of irrigation systems are utilized? Where are irrigation systems located? What site functions does a system support? What is the irrigation schedule? What is the water consumption rate for the site?
- **Fertilizer** – What types of fertilizers are used? What is the fertilizer schedule? What quantities of fertilizer are dispersed? What are the annual costs for fertilizer?
- **Labor** – What are the costs, maintenance schedule, and any other factors associated with maintenance labor?
- **Programs/Policies** – Assessment of associated programs and policies that affect parks, green space, and landscaping efficiency and enhancement.

Parks	
Austin Ellis Park	L.L. Woods Park
Central Park	Memorial Park
College Street Park/Pool	Oakbend Park
Daffodil Park	Orchard Valley Park
Hedrick House	Raidon Lake Cities Park
Highland Lakes Park	Rev. Alvin Turner Sr. Park
Highlands Park	Railroad Park
Iris Lane Park	Valley Vista Park
LLELA (Lewisville Lake Environmental Learning Area)	Valley Ridge Athletic Complex
Lake Park	Willow Grove Park
Green Belts	
Creekview	Meadowlake Park
Fox Creek	Old Orchard
Hidden Creek Trail	Sylvan Creek
Valley Ridge	

Table 7.1: Lewisville Sites Visited

7.3 Observations

Observations and potential areas of improvement were noted in landscaping and maintenance, tree canopy, data collection, programs and policies, funding, and storm water management. These are further discussed below.

Parks, Green Space, and Landscaping

Lewisville 2025 states that one of the City's most tremendous assets is its collection of natural resources. Of the City's 23,296 acres of land, 3,468 acres are designated as parks and green space, accounting for nearly 15% of the City's total geographical area. This quantity of park and green space is comparable to other communities in the region.

The City has many types of parks. Facilities include small neighborhood parks to high-use athletic parks to the Lewisville Lake Environmental Learning Area (LLELA), a research and education preserve. Additionally, the City has over 14 miles of trails for residents. Athletic parks enjoy approximately 375 games per year, with youth and adult sporting activities such as soccer, baseball/softball, football, and

lacrosse. In 2013, over 3,400 people visited Lewisville athletic parks, having an economic impact of over $2.9 million. In 2014, visitors exceeded 5,500, with an estimated economic impact of over $6.4 million.

The *2011 Lewisville Parks Vision Plan* found that the City had an acceptable ratio of green space acreage per resident and an acceptable amount of facilities in 2011. However, considering the projections for population increase, the Plan found that the City had a green space deficit.

> *"Currently, Lewisville has approximately 48% of the acreage for neighborhood parks required at build-out based upon the 2011 Target Level of Service for neighborhood parks. Considering that Lewisville's current population is at approximately 86% of its anticipated build-out, this deficit is significant. In addition to a deficit with regard to acreage, there is also a moderate park service area deficit."*

Landscaping & Maintenance

Several observations were made regarding landscaping and maintenance.

- In FY 2014, the City employed two arborists
- Parks and green spaces had varying types and quantities of landscaping.
- Grasses were cut short at parks and green spaces.
- There was limited use of native, adapted, and drought-tolerant landscaping.
- There was no comprehensive inventory or mapping of plant species at City sites.
- There is currently no system to employ landscape design expertise.

Landscaping & Storm Water Management

Parks, green space, and landscaping are vital tools in the management of storm water runoff. With nearly 4,000 acres of green space and over 14 miles of trails, the City of Lewisville has numerous opportunities to use its natural environment to improve water quality, improve water-capture local surface bodies of water, and decrease erosion rates and flooding risks around the area. Two notable accomplishments by the City of Lewisville are the drafting of the Storm Water Management Plan (2007) and the passing of the Storm Water Ordinance (2010).

Trees

Tree City USA

The Tree City USA program is a nationwide movement that provides the framework necessary for communities to manage and expand their public trees. The City of Lewisville has been successfully registered as a Tree City since 1994. A Community

must meet Four Standards for Tree City USA Recognition:

A Tree Board or Department. The City of Lewisville's Park Board acts as the Tree Board. It is responsible for the care of all trees on city- or town-owned property. By delegating tree care decisions to a professional forester, arborist, or city department, city leaders determine who will perform necessary tree work. The public will also know who is accountable for decisions that impact community trees. Often, both professional staff and an advisory tree board are established, which is a good goal for most communities.

A Tree Care Ordinance. A basic public tree care ordinance forms the foundation of a city's tree care program. It provides an opportunity to set good policy and back it with the force of law when necessary. A key section of a qualifying ordinance is one that establishes the tree board and gives the board the responsibility for public tree care, as reflected in Standard 1. It should also assign the task of implementing a plan of work for annual tree care activities.

A Community Forestry Program With an Annual Budget of at Least $2 Per Capita.
City trees provide many benefits, but they also require an investment to remain healthy and sustainable. By providing support at or above the $2 per capita minimum, Lewisville demonstrates its commitment to grow and tend these valuable public assets. Budgets and expenditures require planning and accountability, which are fundamental to the long-term health of the tree canopy and the Tree City USA program. To meet this standard each year, the community must document at least $2 per capita toward the planting and maintenance of city trees.

An Arbor Day Observance and Proclamation. An effective program for community trees would not be complete without an annual Arbor Day ceremony. Citizens join together to celebrate the benefits of community trees and the work accomplished to plant and maintain them. By passing and reciting an official Arbor Day proclamation, public officials demonstrate their support for the community tree program and complete the requirements for becoming a Tree City USA. Lewisville has two annual Arbor Day celebrations.

Although the City of Lewisville has received Tree City USA certification, it should continue to put the energy and funding commitment toward maintaining its status. Additional observations to consider are:

- There is no comprehensive inventory or mapping of tree species at City sites.
- Choices for tree plantings are hardwoods, known to do well in this region. These trees have long life spans (50 - 70 years), are not generally affected by storm (wind) damage, are drought tolerant, and withstand excessive wet or dry periods.

- As Figures 7.2 to 7.5 demonstrate, there are sites that have little to no tree canopy and where additional trees would bring benefit. These sites include:
  - Fire Stations
  - Green Belts
  - Neighborhood and Community Parks
  - Lake Park
  - Railroad Park
  - Recreation Centers

Figure 7.2: Fred Herring Recreation Center

Figure 7.3: Fred Herring Recreation Center

Figure 7.4: Memorial Park Recreation Center

Figure 7.5: Fire Station #5

Water

- Storm water runoff was managed using standard procedures. Railroad Park was designed to direct the flow of runoff into the lakes which are used for irrigation, with the excess going into the Trinity River. Any synthetic fertilizers used at the site flow into the lakes, therefore contamination of the Trinity River occurs only in flood events.
- Railroad Park is irrigated with water from the reservoirs in the immediate area.
- There were no water capture systems (cisterns or rain barrels) installed near buildings with irrigation needs.
- There were sites with ornamental landscaping that may be candidates for less water-intensive planting materials.
- The City employed a Motorola Central Irrigation System with 120 irrigation controllers, 1,575 irrigation valves, and 12,600 irrigation heads.
- Median landscaping was inconsistent and resource intensive.
- The City's watering schedule correlated with the City's ordinance, following the Commercial

Guidelines.

- To reduce evaporation rate, the City watering is conducted at night between the hours of 10:00 pm to 7:00 am. By variance, the City runs half of its irrigation zones on one night, and the other half on a different night. No single zone is run more than twice per week.
- There are no rainwater capture systems in use beyond reservoirs.

Fertilizer

- In FY 2014, only synthetic fertilizers were used. Officials state that the City has not identified an organic fertilizer program that meets its needs and which is fiscally viable.
- Fertilizer use varied with site and functionality. Fertilizer was used at Railroad Park, Lake Park, Vista Ridge Park, and City Hall, and the MCL Grand Theater & Art Center.
- At Railroad Park's athletic fields, 150 - 200 pounds of American Plant Food UAS 33-0-0 granular fertilizer per acre was applied. Applications consisted of 40-60 pounds of nitrogen per acre. Applications began in February, and occurred every 4-6 weeks thereafter. Common areas received 100 pounds per acre supplements with liquid fertilizer. All of Railroad Park received 20 ounces of 32-0-0 HydraHume per 100 acres.
- Lake Park, which is approximately 25 acres, received 49 ounces of Green Activator 12-0-3 liquid fertilizer per acre. Treatments occurred every 4-6 weeks starting in the spring.
- Vista Ridge Park, which is approximately 16 acres, received 150 pounds of American Plant Food UAS 33-0-0 granular fertilizer per acre. Each application consisted of 49.5 pounds of nitrogen per acre. Treatments occurred every 4 – 6 weeks.
- City Hall and the MCL Grand Theater and Art Center received American Plant Food UAS 24-2-4 or 34-0-4. Each application consisted of 1.5 pounds of nitrogen per 1000 square feet, with four applications occurring in March, May, June, and September.

Energy

- Energy consumption at most parks was low due to the number of lighting fixtures installed at neighborhood and community parks.
- Parks where athletic activities and functions occur, such as Railroad Pak, Lake Park, and Vista Ridge Park, had lighting for night events.
- In most cases, park lighting consisted of highly efficient bulbs. In those cases where less efficient bulbs were installed, the City was replacing them with more efficient technology, due in part to a rebate program with the power provider. There seemed to be few maintenance issues. For more information on energy use at city parks, see the Energy section of this assessment.

Renewable Energy

- There are two small-scale solar panels used to support electric street signage at Railroad Park.
- There is one solar-powered light fixture at Tennie and Mill.
- There are two solar-powered trash compacters located near concession stands.
- The City did not have significant quantities of renewable energy in its parks and green space network. For more information on renewable energy at city parks, see the Energy chapter of this

assessment.

Programs/Policies

- The City has a landscaping code for developers, residents and city properties "...for the preservation of existing and protected trees, replanting of trees lost due to development and to provide guidelines for minimum landscaping on site."[32]
- The City has a landscaping ordinance for development, requiring landscape strip, trees and Bermuda turf.
- A new ordinance to allow and encourage Smartscaping (native plant materials) is being constructed, but has not yet been enacted.
- A seasonal mulching program is offered during the Christmas holiday season.
- The City of Lewisville is a Tree City USA. This is a national program that provides the framework for community forestry management for cities and towns across America.
- The City hosts the Spring Clean-up and Trinity Trash Bash events annually in partnership with Keep Lewisville Beautiful, which promotes cleanup activities throughout the City, green belts, waterways and roadways.
- The City offers educational information on Water-Wise Landscaping, as well as free landscaping courses to the public. Course offerings are in conjunction with Keep Lewisville Beautiful and Texas AgriLife Extension and are held at city facilities.

Future PALS Planning[33]

The Parks Vision Plan (2011) includes a survey conducted to determine Demand-Based, Standard-Based, and Resource-Based needs of City parks and green spaces. This survey revealed the following:

- Demand-based needs showed residents' strong desire for expanded and enhanced green space.
- Residents had great interest in passive recreational facilities, including parks and green spaces on the east side of Interstate 35.
- 95% of respondents were highly supportive of green space preservation.
- Standard-based needs showed the future growth projections for Lewisville would require increasing park acreage holdings to maintain a ratio of sufficient green space.
- Lewisville Lake, LLELA, Creeks & Greenbelts, and the Trinity River and its Floodplain were some of the City's "most valuable physical and natural resources."[34]

The above points are important when evaluating PALS' future planning, as PALS is a major contributor to the City's general efforts to provide services and amenities to residents, and a major contributor in helping the City reach objectives outlined in the Parks Vision Plan and Lewisville 2025.

8.0 Solid Waste and Recycling

8.1 Introduction

Effective and efficient solid waste management and recycling programs are critical to operational success. By engaging staff and suppliers in an effective recycling program, Lewisville can enhance its position as a leader in sustainable practices, and enhance the municipal culture. A visible recycling program that encourages participation by all employees is an inclusive way to engage everyone in Lewisville's goals of overall smart resource use.

In general, a robust recycling program will provide cost savings or payback to a city. Although Lewisville's current agreement with Waste Management will not provide saving if the waste to recycling balance changes, over time reduced waste and recycling totals can lead to savings. If waste quantity is reduced, there will be a reduction of servicing required. The City would also see a reduction of indirect costs associated with wasteful behavior.

Strong recycling leads to a reduction of environmental impact due to less waste in the landfill, and less contamination from the landfill waste.

Recycling can also lead to an enhanced City culture. Besides promoting less wasteful behaviors, recycling activities are easily observed and invite participation. They can be the first step taken toward building support for waste reduction and for other sustainability-related activities. If an individual is willing to take the step to recycle, he or she is likely to support more advanced initiatives that the City may wish to promote.

8.2 Assessment Approach

Information collected from the City came from site visits of City buildings and parks, interviews, responses to solicited questions, the City's web site, and descriptive data provided by Waste Management, Inc.

Data Analysis

The following evaluation components were identified as important to waste management:

- **Environmental Impact** – Quantity of Greenhouse Gas Emissions (MT CO_2e) equivalent to quantity of solid waste produced.
- **Landfill Waste Production** – Infrastructure assessment and tonnage of solid waste collected.
- **Landfill Waste Cost** – Costs required to support program.
- **Landfill Waste Collection Process** – Assessment of program processes.
- **Recycling Production** - Infrastructure assessment and tonnage of recycling collected.
- **Recycling Cost** - Costs required to support program.
- **Recycling Collection Process** - Assessment of program processes.
- **Programs/Policies** – Assessment of associated programs and policies that affect solid waste & recycling management.

8.3 Observations

Solid Waste Management

The City has a traditional solid waste management program. The City's primary partner for solid waste management is Waste Management, Inc. Indoor collection services are provided by custodial contract. Services are provided regularly to support the multi-faceted nature of waste production at City sites. Information collected for this assessment did not demonstrate any internal criticisms or much needed improvement regarding the management of solid waste after it is collected (see recycling for collection issues).

Observations

Due to the outsourcing of solid waste management, the assessment found little information that would lead to improvements for the City. While data exists on number and frequency of trash and recycling pick-ups, there is no information on the actual quantity picked up, or the specific origin of the material. Some recycling locations are also open for public use. There are few data on the quantity of solid waste produced by the City, in aggregate or at individual buildings. There are also no data on the type of waste being produced. Data that do exist are collected entirely by Waste Management. Consequently, evaluating whether the services are appropriate for the quantity of waste produced or whether initiatives intended to curb waste production are effective is challenging.

Besides the recycling of metal containers, glass containers, paper, packaging, and plastics that Waste Management, Inc. provides, the City recycles many other materials and reusable items. These include:

- Electronic waste
- Ammunition boxes and cartridges
- Tires, Motor oil, and automotive fluids
- Concrete (crushed and used as flex base)
- Scrap metal, including fire hydrants and water meters
- Lead acid batteries
- Cooking oil
- Toner cartridges

Significant quantities of these materials are collected, diverted from landfills, and redirected to be used again, whenever possible.

Recycling Management

The City has recycling activities/infrastructure in certain buildings and at certain sites. Waste Management utilizes a single-stream process to collect metal containers, glass containers, paper, aseptic packaging, and plastics. The City allows residents to dispose of recyclables at some City facilities' recycling receptacles. The City has five drop-off locations for recycling. The City also has an informative web site that discusses recycling information for residents and commercial entities. There

was a desire expressed by employees for a more robust internal recycling program, coupled with a concern that efforts to recycle are wasted as it appears that the janitorial staff is not keeping waste and recycling separated. The system of recycling is completed by a separation after pick-up, but it can seem that all material is being handled in the same way.

According to Waste Management's Annual Report to the City of Lewisville (2014), the citywide diversion rate of recyclables was 2% for commercial and industrial customers for 2014. This category includes municipal buildings. When the residential diversion rates of 13% is included, the overall diversion rate increases to 5%, indicating that there may be room for improvement in all commercial recycling including City facilities within the current program.[35] Waste Management provided the City with monthly and annual service reports. Many of the stated quantities collected at various sites were identical amounts, as loads, not measured quantities, are reported, whether the load is full or not. (See Table 8.1).

Waste Generation by Site

Total waste generated at municipal properties was estimated using the Waste Management Annual Report to the City of Lewisville (2014)[36] and the Waste Management Monthly Report to the City of Lewisville (August 2015)[37]. (Cost data associated with internal receptacle servicing, i.e. custodial service, were not available). The type of waste generated was not determined.

The assessment found that Waste Management provides trash collection service at no cost to all City facilities and recycling collection services at no cost"[38] to City buildings, so there is little economic leverage for increasing recycling. Several other notable points are outlined below.

- The City's annual solid waste quantity was approximately 342.6 short tons.[39]
- The City's annual recycling quantity was approximately 17.8 short tons.
- The City's overall diversion rate for all facilities was 6.6%.
- The City's total emissions amount from solid waste was approximately 106 MT CO_2e.
- Lake Park was the highest producing site for solid waste.
- Fire Station #4 produced the least quantity of solid waste.
- The Municipal Annex site recycled the highest quantity and had the highest recycling rate. However, the site consisted of combination-recycling receptacles, that is, drop-off recycling for residents and recyclables from City buildings. This study was not able to distinguish City materials from dropped-off materials.
- Numerous sites did not recycle.
- There was no strategy to ensure adequate quantity, type, and placement of recycling receptacles.
- There was no official recycling policy, and no outreach/education program that promoted recycling for employees. A recycling directive is being developed currently.
- Varying types of internal/external receptacles were placed at buildings and facilities.
- There were two outdoor solar-powered Big Bellies trash-only receptacles located at Railroad Park in addition to the standard trash barrels used at all parks. ..

Location	Annual Solid Waste (Short Tons)	MT CO_2e per short ton	Annual Recycling (Short Tons)	Recycling Rate
Animal Shelter New	17.2	5.3	0.0	0%
Auction House/Animal Shelter				
Central Fire Station	17.2	5.3	0.0	0%
City Hall	34.5	10.7	4.6	12%
Fire Station #2	6.5	2.0	0.0	0%
Fire Station #3	6.5	2.0	0.0	0%
Fire Station #4	4.3	1.3	0.0	0%
Fire Station #5				
Fire Station #6	6.5	2.0	0.0	0%
Fire Station #7				
Fred Herring Rec Center	19.4	6.0	0.0	0%
Hedrick House				
Jerry R. Galler Public Safety Training Center				
Lake Park	155.2	48.1	0.0	0%
Library/Municipal Annex				
MCL GT/Art Center/Theater				
Municipal Facilities	11.8	3.7	8.6	42%
Old Town Aquatic Center	12.9	4.0	0.0	0%
Parks Maintenance Building				
Police Station				
Railroad Park	17.2	5.3	0.0	0%
Residential Convenience Center				
Sun Valley Aquatic Center	17.2	5.3	0.0	0%
Visitor's Bureau				
Wastewater Treatment Plant	9.7	3.0	2.3	19%
Water Treatment Plant	6.5	2.0	2.3	26%
	Total:	***342.6***	***106.0***	***17.8***	***6.6%***

Table 8.1: FY 2014 Solid Waste and Recycling of Materials Collected by Waste Management (paper, cardboard, plastic)

9.0 Recommendations

This chapter outlines preliminary ideas for improvement for each area assessed. Lewisville City staff should review these ideas and use them to spur further thought and discussion.

The first section lists important metrics to capture for accountability of future progress. Section 9.2 is a summary of the primary recommendations. The following sections offer further details for the specific recommendations in each category. The City's buildings, fleet, parks and green space, and solid waste and recycling efforts are addressed. The sections present recommendation tables that articulate the specific recommendation, the likely benefits, and in some cases, "best practice" examples of the recommendation implemented by other organizations.

9.1 Metrics Recommendations

To track progress and measure improvements, it's important to measure exactly where improvement is sought. The following areas are the basic metrics recommended to be gathered for monthly and annual reporting. A dashboard which provides easy visual access to the primary metrics to all stakeholders is an effective way to gain consensus on progress. Once metrics are established, programs that involve the leaders and stakeholders of the involved participants can be created to generate methods for genuine, measurable improvement.

Recommended Metrics

Emissions
From the following sources:
- Electricity use
- Gas and oil use
- Vehicle and equipment fuel use
- From wastewater treatment

Energy Use
From the following sources:
- Buildings
- Outdoor lighting
- Streetlights (estimated)
- Water plants and pumps
- Vehicles and equipment (fuel use)

Water Use
From the following sources:
- Buildings - Indoor
- Buildings - Outdoor
- Parks
- Pipe/system losses

Land Use/ Parks
Permeable surfaces (data exists)
Percentage of city in use as parkland
Park usage by residents
Tree City
- Tree coverage
- Tree species
- Most thriving species

Targeted tree placements on City sites
Amount and types of fertilizer

Waste (Municipal)
From the following sources:
- Municipally generated solid waste
- Municipally generated recycling
- Other waste streams from the City
  - Electronic waste
  - Ammunition boxes and cartridges
  - Tires, Motor oil, and automotive fluids
  - Concrete (crushed and used as flex base)
  - Scrap metal, including fire hydrants and water meters
  - Lead acid batteries
  - Cooking oil
  - Toner cartridges

9.2 General Resource Efficiency Recommendations

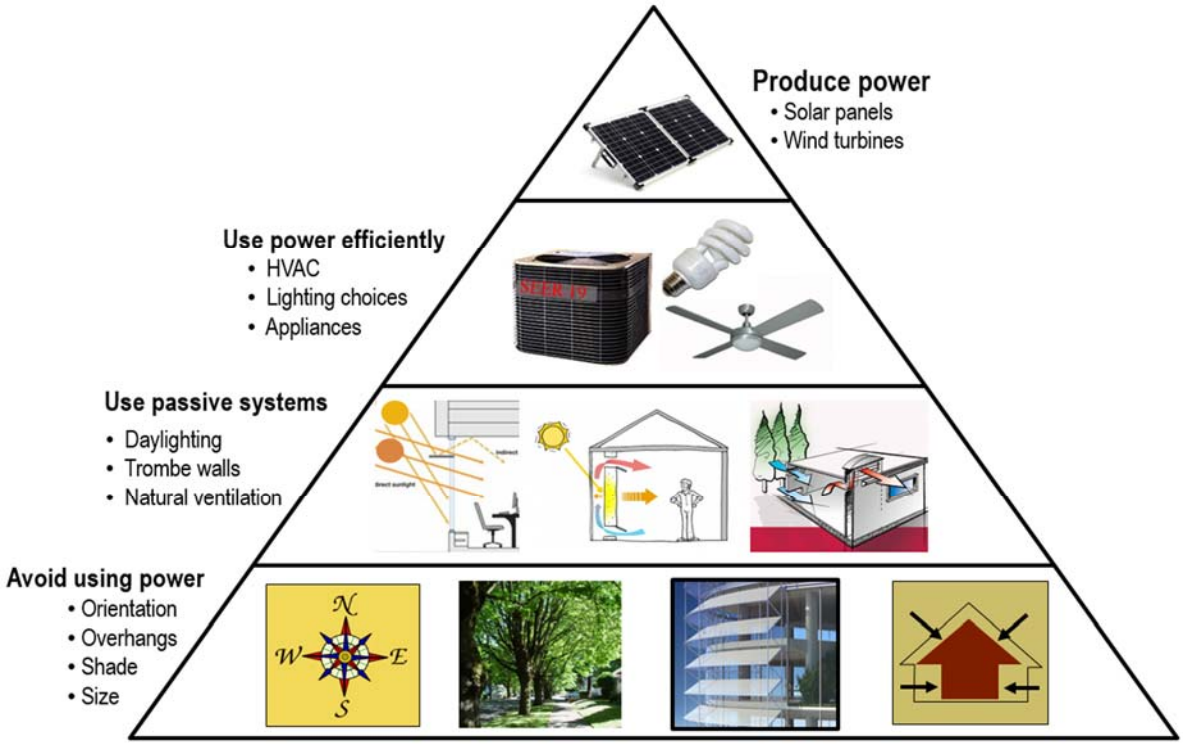
These recommendations offer considerations for improved efficiency and environmental quality, as well as emissions reductions, through adjustments in practice, purchasing, and education.

The City of Lewisville has an opportunity, as it moves toward 2025, to establish itself as a source of leadership in north Texas, while enhancing the city as a place for businesses and residents to achieve happy, healthy prosperity. To solidify this opportunity, the City should further its advocacy and leadership initiatives.

Resource Use Reductions: Recommendations

The most effective way to improve resource use costs is to reduce consumption. It has been shown that time and money spent on increasing efficiency has the greatest payback of any other effort. Addressing reduced use first is the best way to be environmentally responsible while being fiscally wise.

The Energy Use Pyramid diagrams this concept, moving up from the bottom. This diagram shows methods for reducing energy consumption in buildings:

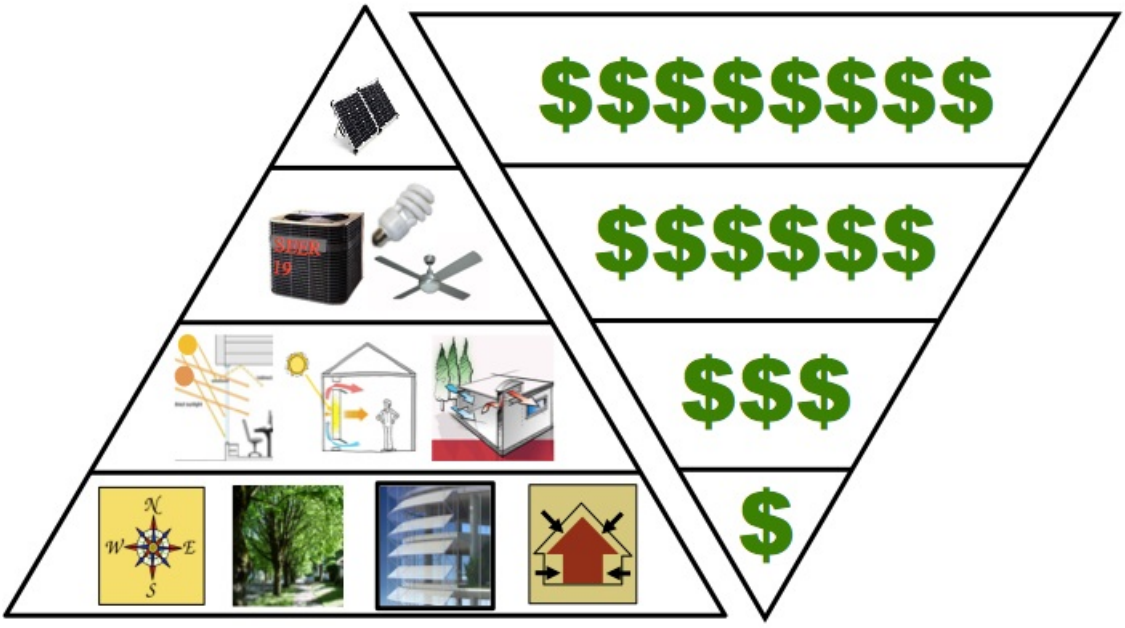


The bottom level includes basic items like reducing building sizes, adding trees and shading devices and controlling orientation. These decisions have little or no cost impact. Besides energy use in buildings, other important issues for a city are to minimize infrastructure, reduce or consolidate required driving, use less water, and maximize recycling.

At the next level, continued reduction of energy use in buildings can be achieved by using passive systems. These systems perform important functions (lighting, heating and cooling, ventilation) but without using electric power. Only in the third level are powered systems considered, and these can be carefully selected to be the most efficient that is economically feasible.

Once the total power need has been reduced as much as possible, it may be possible to provide a percentage of the power required through on-site renewable systems. Obviously, the smaller the total energy requirement, the greater the percentage of renewable power that can be provided.

This is emphasized when the cost pyramid is considered, as the magnitude of costs for these efforts is oppositely proportional.



Based on this principle of **efficiency first**, the following actions are recommended. Greater specifics can be found within each category, below.

- **Track resource use:** To enable the City to maintain a focus on resource use, create a method of tracking, based on the benchmarks established in this assessment. Such a system will motivate personnel and measure effectiveness of efficiency measures. As buildings and water treatment and circulation are the two greatest users of electricity, these are the most effective areas to target.

- **Create a building assessment program for all City buildings**: Through inspections and information gained from building management, document specific areas of potential improvements, building by building. This assessment program should be a phased, multi-year plan to allow alterations to be made as logistically and financially appropriate.
- **Design for efficiency first:** Create a program to ensure that all new buildings and major renovations are begun with a focus on energy efficiency before initial design decisions have been made. While it needs to influence the selection of design professionals, or training offered to City staff, this approach will add nothing to capital costs, and can potentially reduce construction costs, as building designs focus on efficient footprints, and will most certainly significantly reduce operating costs for the life of the structures.
- **Strategic review of water treatment equipment replacement:** Because the treatment and movement of water uses so much power, a review of the equipment maintenance and replacement schedule may show that an acceleration of equipment upgrades could lead to increased savings on energy costs that would repay the equipment costs. The reduced energy usage would continue to offer savings over time.
- **Review opportunities to reduce water usage on City properties:** As per capita water use in Lewisville, which includes City properties, is already low, focus should be on areas where improvement may be possible, such as continuing expansion of Smart Meters for irrigation.
- **Accelerated efficiency focus on fleet management and replacement:** Fleet management is important to reducing fuel usage, leading to improved air quality. By purchasing more efficient replacement vehicles, including more alternatively fueled vehicles, overall fuel consumption will decrease. Reviewing practices of vehicle use (pool vehicles, alternative hours, strategic route management) can also be a consideration for use reduction.
- **Develop a culture of careful resource management:** Increasing awareness through policies, administrative directives and education can lead to reduced use of resources in everything from reusable cups and double-sided printing to reduced plug-loads for electrical use. A visible way to emphasize resource efficiency is recycling. A visible and robust recycling program can encourage other methods of resource efficiency.
- **Consider alternative energy generation:** When all aspects of efficiency and energy reduction have been addressed, it would be appropriate to determine what percentage of total energy use could be provided by renewable sources. A careful review of options for placement and technologies will determine the most efficient and fiscally responsible way to provide renewable energy for the maximum percentage of need.
- **Energy Procurement.** The City has agreements with energy providers that offer little option or reason to change. Fortunately, most electric power is provided by GEXA, which has a high percentage of renewable energy use. As purchased electricity is responsible for more than half of the City's emissions, purchasing from a supplier with a greater reliance on renewable energy is an important issue.

Resource Use: Projected Savings

Based on general levels of reductions in resource use achieved in other cities, Lewisville could expect to reduce energy, water, and other resource usage similarly by implementing practices, policies, and programs laid out in this chapter. Table 9.1 shows the City of Lewisville's potential to reduce energy consumption, and therefore the associated carbon and carbon equivalent emissions, by implementing the strategies recommended in this assessment.

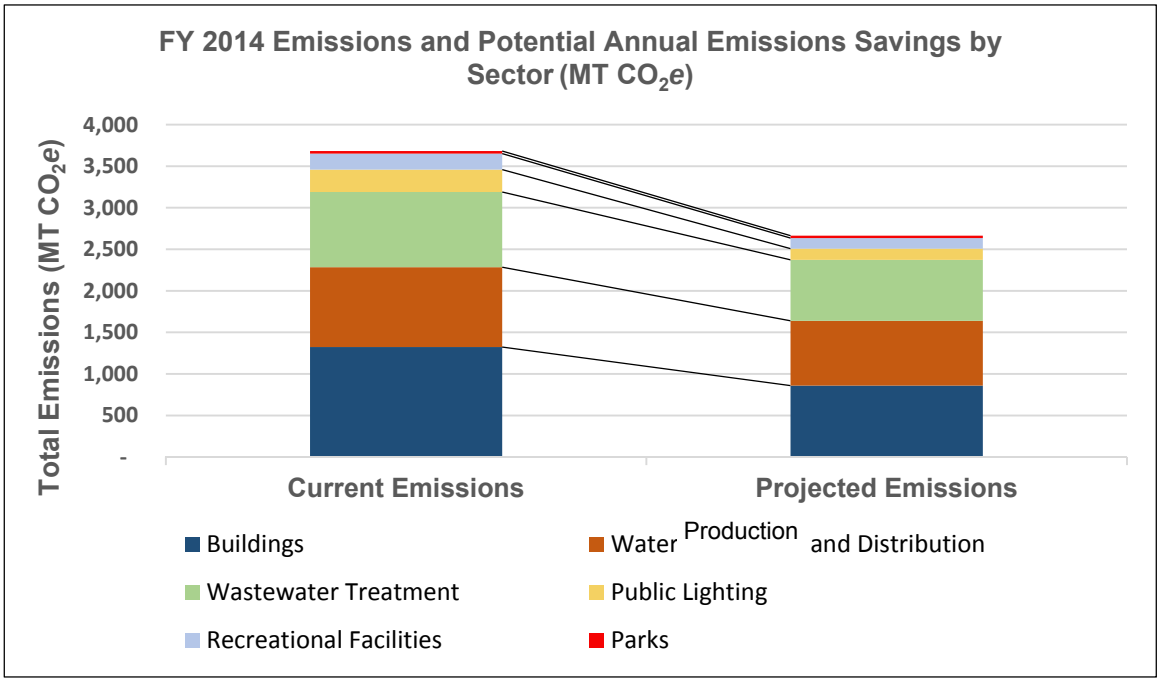


Figure 9.3: Potential Annual Emissions Savings by Sector (MT CO_2e)

	FY 2014 Emissions	Potential Emissions	Potential Savings*
Buildings	1,324	860	35%
Recreational Facilities	196	126	35%
Parks	30	30	0%
Water Production and Distribution	961	780	19%
Wastewater Treatment	904	733	19%
Public Lighting	269	135	50%
Total:	***3,682***	***2,665***	***28%***

Table 9.4: 2014 Emissions and Estimated Electricity and Natural Gas Emissions Savings

Buildings and recreational facilities: *Average energy savings per square foot from retrofit case studies from the Rocky Mountain Institute: http://www.rmi.org/Content/Files/RMI_Retrofit_Guide_BuildingTheCase_1.1.pdf and http://www.josre.org/wp-content/uploads/2013/01/The_Economics_of-Green_Retrofits-JOSRE_v4-11.pdf*

Water production and distribution and wastewater treatment: *Average energy savings from case studies from the EPA: http://www3.epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf*

Public lighting: *Department of Energy, Municipal Solid-State Street Lighting Consortium reports: http://energy.gov/sites/prod/files/2015/09/f26/2015_gateway-msslc_portland_0.pdf and http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2013_gateway-msslc_kc.pdf*

9.3 Energy Recommendations

These are the specific recommendations for energy savings. As the City's built environment consumes considerable energy, specific recommendations regarding this issue are presented in the Buildings section of this chapter.

Establish Metrics for Accountability

This assessment measured the energy consumption of most of the City's assets, i.e. City buildings, major programs, and prominent activities. As a result, the City now has a baseline for which to guide future decision-making, gauge progress, and evaluate ideas. In order to maximize the benefits of such a baseline, the City should establish a central reporting system for all energy data that is accessible by designated leaders in the municipality and accessible through a user-friendly interface. Regular review of energy consumption should also be conducted.

Increase Awareness

Implement energy conservation awareness initiatives and trainings for City employees. This awareness program should be conducted in collaboration with the leaders of each department, to emphasize not just efficiency, but the budget benefits. By establishing city-wide policies for thermostat set-points, water use, plug-in policies and equipment use, staff can made to feel part of the overall program, rather than singled out.

Advocacy for Energy Options

The City can use the initiatives that implement Lewisville 2025 as the foundation for more active leadership on issues at the regional, state and national level. An example would be advocacy to change the way TNMP provides lighting services, to allow the use of more efficient fixtures to be advantageous to the City. The use of more efficient street lighting should be a benefit to the City.

Energy Savings in Buildings

As the City's buildings are one of its two major energy users, extensive attention must be paid to their energy use. Please see the following section, 9.5 Buildings Recommendations, for details.

Water Distribution/Conservation

Water treatment and distribution combine to consume the greatest amount of electricity purchased by the City. The sale of potable water to residents and businesses generates significant revenues for the City, but conservation measures can produce cost savings. For example, the Lewisville Water Conservation and Emergency Water Management Plan (2014) shows a 10% reduction in water use in Lewisville between 2009 and 2014. Because moving water is one of the City's biggest energy uses, this equated to over $175,000 in saved energy costs per year. However, the correlation with revenue is not direct, as other issues were involved.

As the City moves forward with conservation efforts within its facilities and programs, as well as amongst the broader residential and commercial base, it must fully understand the extent to which conservation measures, revenues, and fee structure are interrelated. Accordingly, the City should consider a review of rate structures to encourage conservation, while maintaining revenue. This review will be appropriate at the time of the Castle Hills annexation.

Maximize Efficiency of Water Treatment Process

The City should continue regular review of its water treatment process, its equipment, and its maintenance/upgrade schedule to ensure maximum efficiencies across seasons are attained. A projection of reduced energy costs due to accelerated equipment upgrades should be constructed and reviewed for strategy adjustment considerations.

Renewable Energy Strategy

Renewable energy technology installations in the City of Lewisville could bring significant economic, social, and environmental benefits. As well, city governments, residents, and business have grown significantly more amenable to renewable energy projects. Throughout the nation, there are many examples of technologies, strategies, and funding models that could be applicable to City needs. To establish the most viable approach to this complex issue, and to maximize the benefits from renewable energy installations, the City should consider renewable energy options that could meet the needs of the City. A review of these options would lead to a holistic renewable energy strategy to address:

- Consideration of solar, solar thermal, wind, geo-thermal, and other technologies.
- Each technology should be considered for feasibility, cost effectiveness and maintenance.
- Available funding mechanisms, and site candidates.
- Complementary strategies for municipality, residential, and business application.

- Comprehensive identification of all benefits including reduction in energy costs and environmental impact, increased education/awareness of renewable energy, and reinforcement of the City's environmental stewardship.

9.4 Water Recommendations

Water usage includes the larger water issues facing the City of Lewisville: water conservation, preservation, and quality. Specifically, this section discusses smart irrigation as a primary driver for reduced water consumption by the City. As the City's built environment, landscaping, and green space are the primary consumers of water, recommendations associated with these areas can be found in the respective sections of this chapter.

Because water is a major revenue source, the City should fully investigate the effects of conservation measures on revenue streams ***and*** expenditures. The investigation should lead to the development of the most viable model for reduced usage and rate structures. Before implementing a program that would affect rate-payers, the City should maximize its own efficient systems, both to serve as an example, and to discover challenges. A review of rate structures would be appropriate at the time of the Castle Hills annexation.

Water Conservation

While Lewisville is already ahead of other regional cities in water use reduction, further conservation could help to reduce the funds spent on water use. This can be addressed with these measures:

- Establish a water use policy to address water consumption at City facilities, conservation, oversight, and education/awareness.
- Install water-conserving technologies in all City buildings where they are not installed, such as controls on water fixtures for auto-flush and auto-shut off, and circulating pumps where hot water is needed.
- Collect grey water from lavatories to use for irrigation purposes.
- Extend/include the installation of smart meters and sub-metering.
- Implement water conservation education initiative for City employees.
- Replace aging water lines to reduce water loss and other inefficiencies.
- Engage the Castle Hills development to identify and implement water conservation measures.
- Tie data analyses to weather events and seasonal changes.

EPA WATERSENSE LABEL

The EPA WaterSense Program label is for products that are independently tested to meet water efficiency and performance criteria. Labeling criteria have been established for plumbing fixtures (toilets, faucets, showerheads, and urinals), new homes, and training programs for irrigation professionals. In general, products that receive the WaterSense label are 20% more water-efficient than conventional products. In addition to conserving water, these products can reduce the amount of energy required to deliver and treat water.

Source: U.S. EPA, 2007a.

- Establish a central reporting system for all water data that is accessible by designated leaders in the municipality and accessible through a user-friendly interface. Regular review of water consumption should also be conducted.

Water Quality and Site Preservation

As Lewisville continues to develop, the resulting increased imperviousness translates into loss of natural areas, more sources for pollution in runoff, and heightened flooding risks. To help mitigate these impacts, Lewisville joined the NCTCOG and more than 60 other governments to create sound storm water management guidance for the region through the *integrated* Stormwater Management (*i*SWM) project. The *i*SWM Design Manuals for Site Development and Construction help cities achieve goals of water quality protection, streambank protection, and flood control. They also help cities meet their construction and post-construction obligations under state storm water permits, leading to reduced costs, lower emissions, and a healthier community. To promote these goals, the City should:

- Proactively implement iSWM principles in all City projects.
- Continue to install Smartscape landscaping around City buildings and grounds, to include medians and public thoroughfares.
- Implement a storm water management education initiative for City employees.
- Use the existing data base of impermeable surfaces to inform permitting and development policies.

Smart Irrigation

It is important for water conservation that Lewisville continues to install smart irrigation systems, starting with the most water-intensive landscapes. In large-scale irrigation installations elsewhere, a systematic approach toward implementing a citywide park and landscape irrigation plan with upgraded irrigation equipment has been shown to reduce water use for irrigation by as much as 25%. For Lewisville, this would potentially save the City approximately 8 million gallons per year, with a value of about $40,000 per year. “Smart” irrigation systems can help reduce irrigation in municipal landscapes by calculating the ideal irrigation schedule each day based on the rain, temperature, and humidity. Different types of systems have advantages, but to get the most effective use of water an “evapotranspiration controller” is the best choice. Evapotranspiration irrigation controls are relatively inexpensive, though other changes to the irrigation systems may be needed to work efficiently with these controllers, increasing the cost of installation. Even so, the project payback in water fees saved is typically less than two years.

Leak Detection

The City’s ongoing leak detection and repair program produces additional savings and should be emphasized. The 10% reduction in total water over the last three years comes from different

conservation efforts, some of which is attributed to leak reduction. The City should expand its water leak detection system throughout the entire water distribution network, where needed.

9.5 Buildings Recommendations

This section focuses on City buildings evaluated for this report. Specific buildings may benefit from a more thorough analysis, especially the ones identified as particularly high in energy use, but some general recommendations apply to all. Below are general recommendations and recommendations by building type. Two tables below provide recommendations for internal and external improvements to specific buildings.

General Recommendations

- In general, buildings in north Texas use energy for cooling and for lighting. These areas are therefore the primary targets for energy use reduction.
- Check hours of occupancy against hours of operation. Utilize thermostat adjustments and lighting timers to reduce energy use when not needed.
- As older lamps are replaced with LED fixtures, scheduling group re-lamping for buildings will reduce costs.
- Not all City buildings are on the Energy Management System, which undermines central management of HVAC systems, significantly increasing inefficiencies. A schedule should be instituted to place all buildings onto a master EMS.
- The current EMS addresses only electricity. Tie all utilities including gas and water into a comprehensive EMS system.
- Any buildings that are older or less diligently maintained should be inspected for air infiltration.
- Record and track component efficiencies for HVAC, water heaters, pumps, etc.
- Hot water consumption should be fully investigated to determine site-specific need and quantity.
- Guidelines should be developed for all new construction and renovations that address energy efficiency, water conservation, environmental impact, and occupant comfort.
- Develop and enforce a climate control policy using established set points that reflect the seasons and Lewisville's commitment for greater efficiency.
- The City should determine a central data repository to collect and organize all data and information associated with the multiple program components of the City's built environment. A central repository with holistic collection and analysis parameters will be significant to the provision of information to City leaders.
- Radiant barriers in roofs where they can be added
- Re-roofing black membrane or built-up roofs with white membrane roofing
- If not appropriate to reroof, painting with reflective paint
- Increase all insulation values to at least R-30 in roofs, R-19 in walls
- Replace any single-glazed windows with insulated double glazing
- Perform air-tightness testing where feasible to determine areas of air leakage
- Visually inspect all window and door openings for weather-tight seals
- Add shading devices (awnings, overhangs or trees) at south-facing windows

Recommendations by Building Type

Recreation Centers

- As the Memorial Park Recreation Center and Senior Center are scheduled for replacement in the planned multi-generation recreation center, there are no specific recommendations for these existing buildings.
- It is strongly recommended that the new multi-generational recreation center be conceived with efficiency and high-performance as the basis of its design.

Fire Stations

- Fire Department HVAC systems have no regulated set points. Determine effective set points and implement throughout the system, teamed with an educational roll-out.
- Review each building for use of economizer on HVAC, as well as heat exchanger.
- Some stations have ceiling-mounted bay heating. An industrial scale fan to circulate the heat would make this more effective, ***and*** would help cooling in the summer.
- Areas that may be unoccupied for a time should have motion sensors to turn off lights.
- Energy conservation initiatives should be explored. For strategies that have worked for other fire departments, Lewisville may refer to the Chief's Energy Challenge*: "Fire departments around the country have already implemented low- or no-cost strategies that have reduced energy consumption, as well as energy bills."* [40]
- Fire station roofs are prime targets for improvement as many are dark colored. City buildings should paint built-up roofs with light colored or reflective paint.
- If solar panels are to be installed by the City (see Renewable Energy section) most flat station roofs would be candidates for placement.
- Provide shading whenever possible on south- and west-facing windows with overhangs or trees.
- Consider water capture system to supplement Fire Station #2'sdiver training tank.

City Hall

- Because side doors at the main entrance are commonly used by the public to enter City Hall, vestibules should be considered. Alternatively, these could be locked for use as entrances (exit only), with signage to use the main revolving door.
- Install rainwater capture system to support water fountain. Educational signage to explain the recycled use of water could be added.
- Provide shading whenever possible on south- and west-facing windows with overhangs or trees.
- Implement a program for a common thermostat set point.

Library/Municipal Annex

- Replace fluorescent lamps in reading areas with 2 x 2 LED panels.
- Install an electric meter for the Library, separate from Municipal Annex.
- Implement a program for a common thermostat set point.

MCL Grand

- As one of the largest, more recent, and most complex City buildings, as well as one of its greatest energy users, it is recommended that a specific detailed review of this structure be done to identify all areas of potential improvement.

Police Stations

- Review each building for use of economizer on HVAC, as well as heat exchanger.

Public Services Kealy Center

- Determine if concrete cracks and differential settling have opened areas for air leaks. Repair cracked pan

Public Restrooms, generally

- Install auto-shutoff faucets, where they are not already installed
- Provide educational signage to encourage smart water use.
- Provide signage to encourage taking only paper towels actually needed.

9.5 Buildings Recommendations, cont'd.

Internal Recommendations

Location	Upgrade All-LED Fixtures	Install Energy Efficient Washers and Dryers	Install Motion Sensors	Install Recyling Receptacles	Turn off Vending Machine Lighting	Manage Adequate Indoor Temperature	Install Industrial Ceiling Fans	Install Air Evacuation Fans/Vents (Solar Powered)	Install Roof Ridge Vents	Lower Bay Heaters	Insulate Bay Ceilings
Animal Services		X		X							
Central Fire Station	X	X	X	X		X	X			X	X
City Hall	X		X	X	X	X					
Fire Station #2	X	X	X	X		X	X	X	X	X	X
Fire Station #3	X	X	X	X		X	X	X	X	X	X
Fire Station #4	X	X	X	X		X	X	X	X	X	X
Fire Station #5	X	X	X	X		X	X	X	X	X	X
Fire Station #6	X	X	X	X		X	X	X	X	X	X
Fire Station #7	X	X	X	X	X	X	X	X		X	X
Fred Herring Recreation Center	X		X	X	X						
Hedrick House	X			X		X			X		
Library	X		X	X		X					
Memorial Park Recreation Center	X		X	X	X	X					
Municipal Annex	X			X	X	X					
Old Town Aquatic Center	X			X							
PALS Maintenance Building	X			X							
Police Station	X			X		X					
Public Works Buildings	X			X			X				
Recycling Center	X			X			X	X	X		
Toyota Railroad Park	X			X			X				
Visitor's Bureau	X		X	X							
Waste Water Treatment Plant	X			X							
Water Treatment Plant	X			X							
MCL Grand Theater	X		X	X		X					

9.5 Buildings Recommendations, cont'd.

External Recommendations

Location	Upgrade All LED Fixtures	Weatherize Exterior - Around Windows and Doors	Plant Trees to Shade Building	Plant Trees in Parking Lot to Reduce Heat Island Effect	Increase Grass Height	Potential for Solar Power on Building	Potential for Solar Powered Lighting - Independent of Building	Potential for Wind Power	Potential for Water Collection System	Extend Rainwater Downspouts Away From Building	Install Reflective Roofing	Install Double-Entry Doors	Establish Community Garden	Install Native Landscaping	Install High Efficiency Windows	Upgrade HVAC System
Animal Services		X	X	X	X	X	X		X							
Central Fire Station	X	X	X	X	X					X		X		X	X	
City Hall	X	X	X	X	X	X	X		X	X	X	X		X		
Fire Station #2	X	X	X		X	X		X	X		X				X	
Fire Station #3	X				X	X			X						X	
Fire Station #4	X	X	X		X	X		X	X				X		X	
Fire Station #5	X	X	X		X	X		X	X						X	
Fire Station #6	X				X	X			X						X	
Fire Station #7	X				X	X			X						X	
Fred Herring Recreation Center	X			X	X	X	X	X	X				X			
Hedrick House	X	X	X		X									X	X	X
Library	X		X	X	X	X	X		X							
Memorial Park Recreation Center	X		X	X	X	X	X	X	X	X	X		X	X		
Municipal Annex	X		X	X	X	X	X		X							
Old Town Aquatic Center	X		X	X	X	X	X						X			
PALS Maintenance Building	X	X	X	X	X	X	X		X						X	X
Police Station	X				X	X	X		X							X
Public Works Buildings	X	X	X	X	X	X	X		X						X	X
Recycling Center	X	X	X	X	X	X	X		X	X		X			X	X
Toyota Railroad Park	X		X	X	X	X	X	X	X				X			
Visitor's Bureau	X															
Waste Water Treatment Plant	X		X		X	X	X	X					X		X	
Water Treatment Plant	X		X		X	X	X	X					X		X	
MCL Grand Theater	X				X	X	X		X	X						

9.6 City Fleet and Equipment Recommendations

The tables present specific recommendations, with examples of best practices from other cities for reference.

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
1. Reduce Environmental Impact			
1a. Increase vendor awareness of no idling policy.	*Reduce environmental impact and position the City in a leadership position*	City of Wichita, Kansas: Implemented an expanded no-idling policy that includes vendors.	http://www.wichita.gov/Government/News/Supplemental%20Documents/AR%2091%20Idle%20Reduction%20Policy.pdf
1b. Further educate and monitor the following activities on High Ozone Days: vehicle fueling, driving, burning, painting, asphalt overlay, or running small engines.	*Reduce environmental impact and promote cost-savings*		
1c. Establish an emissions inspections schedule for high-use and high emissions producing vehicles.	*Reduce environmental impact*	North Central Council of Governments: SHED testing for HDDVs is a viable inspection and maintenance technology for heavy emitting vehicle. A city government can easily employ this method and test it on fleet vehicles at their own pace/schedule.	http://www.nctcog.org/trans/air/hevp/SHED.asp
1d. Establish policy to use environmentally friendly products in fleet services.	*Reduce environmental impact*	City of Santa Monica, California	http://www.smgov.net/Departments/Public Works/ContentMaintMgt.aspx?id=4941
1e. Establish water recovery/water reuse policy in fleet services.			
1f. Provide annual training on anti-idling and eco-driving practices to all vehicle users.	*Reduce environmental impact and realize cost-savings*	City of Chicago, Illinois: Implemented Eco-Drive Chicago, a green driving training program. During the first year of the program, the City spent a total of $191,733, and was able to save $1,252,303 in fuel costs.	https://www.fels.upenn.edu/sites/www.fels.upenn.edu/files/harris_school_eco-drive_chicago_upenn_fels_final.pdf
1g. Establish CNG filling station in Lewisville.	*Reduce environmental impact and realize cost-savings*	City of Kansas City, Missouri	http://kcmo.gov/news/2014/city-opens-fifth-fast-fill-cng-station-first-open-to-the-public/
1h. Establish grant-seeking strategy to support alternative-fuel vehicle purchases.			
1i. Replace regular diesel fuel use with B20 Biodiesel fuel.	*Reduce environmental impact*	City of Austin, Texas: "The City of Austin earned a $5 million grant to purchase alternative-fuel and/or hybrid vehicles for its fleet from the Texas Commission on Environmental Quality." 379 vehicles now run on biodiesel.	https://www.austintexas.gov/sites/default/files/files/Sustainability/CAR/CityofAustin_ClimateActionReport.pdf
1j. Install solar panels on police car roofs to reduce idling time.	*Reduce costs and environmental impact*	State of Ohio: Ohio State Police equipped fleet of 1,150 patrol cars with solar panels.	http://statepatrol.ohio.gov/media/2009/09-045.pdf
1k. Install solar panels on ambulance roofs to reduce idling time.	*Reduce costs and environmental impact*	City of Austin, Texas: "New solar panels on ambulances—13 have them so far—charge batteries so ambulances idle less at hospitals, meaning each uses 560 fewer gallons of gas per year."	https://www.austintexas.gov/sites/default/files/files/Sustainability/CAR/CityofAustin_ClimateActionReport.pdf
2. Improve Management of Vehicles Miles Traveled			
2a. Develop a travel logging policy, using GPS tracking system to identify inefficiencies and avoid unnecessary travel.	*Reduce fuel consumption, fuel costs, and environmental impact*	City of Conroe, Texas: Used FASTER Fleet Management Software to measure fuel consumption rates.	http://www.ccgsystems.com/index.php
2b. Establish a fleet vehicle use policy that promotes carpooling, mass transit, route optimization, and/or telecommuting. Policy must be adaptable to various units' contexts.	*Encourage cost-savings and environmental impact reduction*	City of Portland, Oregon: Worked with car-share companies and transit agencies to ensure affordable access to EV technology.	http://www.cars21.com/news/view/355
2c. Increase use of bicycle patrols to replace vehicle patrols.	*Reduce environmental impact and realize cost-savings.*	City of Los Angeles, California	http://environmentla.com/programs/bikepatrolsnew.htm
2d. Increase number of pool/shared vehicles.	*Reduce investment and maintenance costs*	City of Loveland, Colorado: Approximately 40 aging sedans, pickups, and vans from the City fleet were replaced by 15 shared vehicles leased from Enterprise Fleet Management and equipped with the same automated rental technology used in Enterprise Rent-A-Car's popular car-sharing program, WeCar.	http://www.government-fleet.com/news/story/2012/07/loveland-reduces-fleet-through-car-sharing-technology.aspx

9.6 City Fleet Recommendations, cont'd.

Recommendation

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
3. Improve Vehicle Efficiency (mpg)			
3a. Replace vehicles with vehicles that have lower cost per mile (cpm) rate.	*A reduction in cpm rate from $0.27 to $0.19 would equate to an annual cost savings of over **$147,000**, and **600 MT CO_2e**.*		
3b. Increase use of alternative fuel/hybrid vehicles.	*Reduce environmental impact and incur cost-savings*	Arlington County, Virginia: Well over half of Arlington's fleet of 1,148 vehicles now relies on fuels that are cleaner, improve air quality, and reduce reliance on foreign sources of petroleum products.	http://freshaireva.us/2011/11/transportation/
		City of New York, New York: Implemented a Clean Fleet Transition Plan. The City purchased 6,880 hybrid vehicles, mostly sedans such as the Prius or the Ford Fusion Hybrid.In the NYC fleet, hybrid sedans are achieving anywhere between 65% and 130% fuel economy over gasoline powered sedans. In addition, they cost less to maintain, and have a higher resale value through public auction.	http://www.nyc.gov/html/dcas/downloads/pdf/fleet/nyc_fleet_hybrid_report_june_2014.pdf
3c. Utilize GPS vehicle tracking system to monitor vehicle idling rates.	*Reduce costs and environmental impact, increase efficiency, accountability, and safety.*		http://www.brickhousesecurity.com/category/gps+tracking/gps+vehicle+tracking+governments+municipalities.do
			http://www.fleetmatics.com/atlantic-beach
3d. Strengthen idling policy awareness campaign.	*Reduce environmental impact, incur cost-savings, and promote less wasteful behaviors.*		unsm.ca/doc_download/1534-idle-free-toolkit-for-municipalalites.html
3e. Assign appropriate vehicle to mission function (The right vehicle for the right job).			
3f. Purchase and install Idle Management System.	*An idle management system can reduce costs in fuel, preventive maintenance, and normal maintenance due to engine wear. Installing on half of City vehicles, and reducing idling by one hour per day, would realize over **$95,000** in annual fuel savings, and a reduction of **389.5 MT CO_2e**. If the Fire Department attained GRIP's average idling reduction rate of 30%, the City would save over **$27,000**, and reduce its emissions by **111.83 MT CO_2e**. Fire Station bays would experience reduced bay temperatures during summer months.*	City of Columbus, Ohio: See Grip Technology web site for more information on application and city comparison.	http://www.gripidlemanagement.com/us-en/home.html
4. Improve Vehicle Replacement Strategy			
4a. Establish a more balanced, economically viable vehicle replacement schedule to avoid replacing a significant number of fleet vehicles in any given year.	*Balanced replacement strategies will mitigate substantial transactions that are unnecessary.*	City of San Jose, California	https://www.sanjoseca.gov/DocumentCenter/View/5043
4b. Fleet Services should ensure its stakeholder committee provides input on the enhanced vehicle replacement strategy.	*Realize cost-savings.*	The Cities of Santa Rosa, California, Castle Rock, Colorado, Sacramento, California	http://issuu.com/bobit_governmentfleet/docs/government_fleet_magazine_may2011_flipbk
4c. The City should avoid replacing vehicles that do not bring an adequate return on investment.	*A number of vehicles do not warrant replacement for various reasons (See Appendix). By not replacing these vehicles, the City would incur over **$1.7 million** in savings.*	City of Sacramento, California	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCMQFjABahUKEwigsb2Y9bjIAhVDkQ0KHYBSBoA&url=http%3A%2F%2Fportal.cityofsacramento.org%2F~%2Fmedia%2FCorporate%2FFiles%2FAuditor%2FAudit-Reports%2FAuditofCityLight-DutyVehicleUse.pdf&usg=AFQjCNE12CeIi7ej5PX-6bE02m2lpKu2xw
4d. The City should identify vehicles that can be retained for an additional one to two years to realize cost-savings and accomplish its mission.	*Prolonged replacement of designated vehicles for one year would incur over **$289,000** in cost savings. For those vehicles that do not need to be replaced for at least two additional years, the City would realize over **$246,000** in savings.*	City of Arlington, Texas	http://www.arlington-tx.gov/cityauditor/wp-content/uploads/sites/20/2014/05/Fleet_Utilization_and_Replacement_Audit.pdf

9.6 City Fleet Recommendations, cont'd.

Recommendation

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
5. Data Collection, Analysis, and Dissemination			
5a. The City should establish a central data repository to collect and organize all data concerning the City's Fleet.	*A central repository with analysis and accessibility parameters will promote added efficiency measures.*		
5b. Fleet Services should utilize a computerized fleet management system.	*Incur cost-savings each year through better managing history of vehicles and equipment maintenance/repair costs, sublet repairs, labor charges, and fuel usage. Reports can be distributed to city departments on a monthly basis to encourage increased efficiencies.*	City of Denton, Texas: Realizes $275,000 in soft costs, $176,000 in part costs and increase productivity per year.	http://issuu.com/bobit_governmentfleet/docs/government_fleet_magazine_may2011_flipbk
6. Reduce Maintenance Costs			
6a. The City should outsource the maintenance of heavy equipment class vehicles.	*Reduce maintenance and infrastructure improvement costs*	City of San Diego, California: "In May 2005, the City of Dallas issued a request for bids for privatized fleet maintenance and repair services for a five-year term. Dallas officials determined that taxpayers could receive the greatest benefit through contracting out only the maintenance and repair of heavy equipment class sanitation vehicles. While the 293 vehicles in this class represented just 6.4 percent of the total city fleet in 2005, they accounted for 23% of total fleet maintenance expenses."	http://reason.org/files/pb84_san_diego_fleet_maintenance.pdf

9.7 Parks, Green Space and Landscaping Recommendations

Recommendation

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
Build Internal Capacity			
1. Re-examine 2011 Parks Vision Plan Priorities			
1a. Consider expansion of park areas, as indicated in the 2011 Plan, to continue to keep sufficient park area available for the growing population **1b.** Align PALS planning with the intention to ensure City focus on Lewisville 2025's Big Moves - Green Centerpiece and Extending the Green.	*Strengthen PALS' capacity to attain Lewisville 2025 goals.*		
2. Planning for Future Usage Levels			
2a. The professional capabilities of planning and landscape architectural design should be utilized as required for addressing future park planning	*Strengthen PALS' capacity to improve park and landscape assets and support Lewisville 2025 goals.*		
3. Establish Partnership with Appropriate Organizations			
3a. The City should explore partnerships with the Trust for Public Land and the Audubon Society to strengthen its capacity to reach objectives.	*Strengthen PALS' capacity to improve park assets and support Lewisville 2025 goals.*		https://www.tpl.org/ http://tx.audubon.org
4. Improve Data Collection and Use			
4a. Create database of plant materials data, including a tree inventory.	*• Provide information about what plants thrive in the area.* *• Create knowledge about maintenance issues.* *• Gather knowledge for PALS staff and to share with residents.*		
4b. The City should establish a central data repository to collect and organize all data concerning the City's parks, green space, and landscaping.	*A central repository with analysis and accessibility parameters will promote added efficiency measures and guidance for decision-making.*		
Maximize the Value of City Parks, Green Space, and Landscaping			
1. Reduce Environmental Impact			
1a. Quantify parks, green space, and trails value as an emissions offset.		City of Chicago, Illinois	http://www.cmap.illinois.gov/about/2040/supporting-materials/process-archive/strategy-papers/parks-and-open-lands/environmental-benefits
1b. Determine what percentage of the City's total geographical area will be maintained in the future as parks and green space.	*• Establish ongoing environmental impact reduction efforts.* *• Promote cost-savings.* *• Conserve resources.* *• Ensure healthy outdoor lifestyles for future generations.*		
1c. Schedule drought tolerant plant replacements.			
1d. Target high water-use outdoor areas for analysis.			
1e. Decrease imperviousness throughout City and in new projects, based on GIS database of impervious surfaces.		City of Beaverton, Oregon	http://www.beavertoncivicplan.com/nature/
1f. Revise storm water ordinance to go beyond traditional storm water management. Utilize iSWM principles.	*• Prevents loss of natural areas.* *• Reduces sources for pollution in runoff.* *• Provides additional flood storage.* *• Restores health to urban creeks.*		http://iswm.nctcog.org/index.asp
1g. Install permeable pavement at City facilities.		City of Philadelphia, Pennsylvania	http://www.werf.org/liveablecommunities/studies_phil_pa.htm
1h. Install rain & community gardens throughout city.	*• Preserve environment. and enhance City image and community culture.* *• Filter storm water runoff to improve water quality.* *• Promote collaborations with other organizations in the City.*	New York Restoration Project (NYRP), New York, New York	https://www.nyrp.org/
1i. Install green roofs on City facilities.	*Reduce environmental impact and promote cost-savings.*	City of Chicago, Illinois: Installed green roof on Chicago City Hall.	http://www.greenroofs.com/projects/pview.php?id=21
1j. Re-evaluate any new concrete storm water infrastructure projects.	*Re-design of concrete structures, to include landscape materials, will provide water flow benefits and potentially reduce costs.*		

9.7 Parks, Green Space and Landscaping Recommendations, cont'd.

Recommendation

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
2. Landscaping Enhancement/Expansion			
2a. Install landscaping that will achieve the goals of the Parks and Vision Plan.	*Reduce environmental impact and place the City in a leadership position.*		
2b. Enhance parks landscaping.	*Improve safety, aesthetics, residents' enjoyment, and water quality from storm water runoff.*		
2c. Replicate "model landscape" site (located at Kealy Center) at other potential Smartscape garden sites.	*• Demonstrate design methods for water-efficiency planting.* *• Show aesthetic properties of Smartscaping.* *• Encourage Smartscape for residents.*		
2d. Schedule drought-tolerant plant replacements.		City of Austin, Texas	http://austinnativelandscaping.com/xeriscape-texas-native-plants-for-drought-toleran-landscaping-in-austin-texas/
2e. Target high water-use landscaped areas for analysis.	*Reduce water consumption, environmental impact, and incur cost-savings.*		
2f. Install smart irrigation systems.			See example in Appendix
2g. Increase Smartscape awareness/educational activities.	*Reduce environmental impact, improve storm water runoff quality, and enhance aesthetics.*	City of Coppell, Texas	• http://www.coppelltx.gov/government/departments/parks-recreation/community-programs • http://www.nctcog.org/envir/seeclean/storm water/program-areas/public_education/documents/Marcheventideas
2h. Install Smartscaping features like bioswales.	*• Enhance the aesthetics of parks.* *• Act as a filtration system to capture contaminants.* *• Reduce soil erosion.*	City of Katy, Texas	http://tbg-inc.com/project/cinco-ranch-southwest-katy-tx/
2i. Utilize bio-retention as a low-impact development technique to enhance parking lot and median landscaping.	*Improve aesthetics and reduce environmental impact.*	• Upstate South Carolina • City of Seattle, Washington • City of Durham, North Carolina • City of Virginia Beach, Virginia	http://upstateforever.org/pdfs/other/CAW_LIDFact_Bioretention.pdf
3. Mowing Framework			
3a. Where viable, grasses should be cut at greater heights and should promote grasscycling.	*Although athletic fields require a shorter grass base to support activities, there is a significant amount of green space that does not.*		
3b. Develop a mowing policy that specifies appropriate grass height at all City site locations, and accounts for seasonal adjustments in mowing height.	*• Incur cost-savings in reduced mowing.* *• Enhance green space aesthetics.* *• Reduce insect damage, water and energy consumption, and the required quantity of fertilizers.* *• Higher grass will serve as a filtration system to improve the water quality of storm water runoff.*		
4. Reduce Synthetic Fertilizer Use			
4a. Establish a mulching, composting, and organic fertilizer program in collaboration with LLELA.	*• Reduce environmental impact and develop a viable program for the City.* *• Promote benefits from researching the City's challenges and new relationships with youth and other organizations.*	• City of Garland, Texas • City of Ft. Worth, Texas	•https://www.garlandenvironmentalwaste.com/gov/eg/ews/goods/mulch.asp • http://fortworthtexas.gov/compostoutpost/
4b. Review fertilizer use at Railroad Park to mitigate possible contamination of the Trinity River.	*Reduce environmental impact and improve storm water runoff quality.*		

9.7 Parks, Green Space and Landscaping Recommendations

Recommendation

Implementation Steps	Benefit / ROI	Best Practices	Best Practices URL Link
Enhance Community Culture Through Collaboration			
1. Optimize LLELA (City's most significant green asset)			
1a. Partner with City staff who work at LLELA to develop citywide education programs.	*LLELA's City staff can offer services at City parks to demonstrate ecosystems at work in the region.*	City of Plano, Texas	https://livegreeninplano.obsres.com/Info.aspx?EventID=3
1b. Develop educational collaborative with LLELA, Lewisville ISD (LISD), and the Lewisville ISD Outdoor Learning Area (LISDOLA).	*Increase awareness and enhance culture through educational programs for the youth and other residents. Programs could focus on the City's parks and green spaces, and integrate site visits to reinforce instruction.*	City of Plano, Texas	https://livegreeninplano.obsres.com/Info.aspx?EventID=3
1c. Enhance access to LLELA.	*Promote education and awareness of the City's delicate ecosystem, and protecting the balance that makes it unique.*		
1d. Construct a Visitors' Center ideally in an area that has already been cleared and previously developed such as City's former tree farm location.	*• Provide facilities and meeting space for education and awareness programming.* *• Tree farm has many mature trees too large to be transplanted, but could be used as a grove to mark the Visitors' Center*		
1e. Provide guided access to the available areas while controlling flow to prevent damage.	*Reduce environmental impact and place the City in a leadership position.*		
Preserve Resources			
1. Create Water Capture/Collection Systems			
1a. Establish water capture systems at Railroad Park.	*• Water capture/collection system at Railroad Park will decrease the demand on the Trinity River and enhance the aesthetics of the park.*	City of Austin, Texas	http://www.harvesth2o.com/zilker.shtml#.Vh6CqKKgpjs
1b. Construct collection ponds, cisterns, or other mechanisms to capture rain-water, as well as collection tanks linked to park structures and other irrigation needs.	*• Reduce environmental impact.* *• Preserve natural resources.* *• Enhance the City's image.*	Kroon Hall, Yale University	http://www.nitscheng.com/?t=1&DO=67&DI=4695&CAT=2918&format=xml&stylesheet=NE_Projects_Popup&p=5418
1c. Install above or below ground collection tanks to collect rainwater off City buildings to use for irrigation and unique needs.	*Service unique water needs such as the City Hall fountain.*		
2. Reduce Energy Consumption			
2a. Develop a comprehensible renewable energy plan to integrate renewable energy technologies into City parks and	*• Technologies can produce electricity that can be used on site.*	City of Santa Fe, New Mexico: "Since 2007, through a variety of resolutions and policies, the City has made a commitment to reduce its carbon footprint. A plan was	http://www.santafenm.gov/energy_efficiency_and_renewable_energy
2b. Attain full LED installation at all parks and green space.	*• Renewable energy can be used in direct and passive education programs.* *Reduce energy costs and environmental impact.*		
Strengthen Tree Canopy			
1. Create Tree Inventory			
1a. Conduct a comprehensive tree inventory with a listing and geographical mapping (using GIS layering technology) of the City's tree species.	• Help determine the overall tree canopy area and its value. • Help establish a donor program for tree plantings, apply for grants, and determine carbon sequestration.	City of Cambridge, Massachussets	https://www.cambridgema.gov/theworks/ourservices/urbanforestry/treeinventory
2. Tree Planting Program			
2a. Establish a regular tree planting program targeting sites that have limited tree canopy	*• Provide shade for structures and visitors, reduce heat islands, reduce soil erosion and reduce demand on irrigation*	Savannah Tree Foundation, Savannah, Georgia	http://www.savannahtree.com/
3. Maintain the designation of Lewisville as a Tree City USA			
3a. Plant trees and publicize the activities of the Tree Board.	*• Maintain Lewisville's Tree City USA designation.*		
3b. Share the City's public tree care ordinance.	*• Reduce environmental impact.* *• Establish City as a sustainability leader.*		
3c. Maintain $2 per capita fund for urban forestry.	*• Promote citywide tree plantings.*		
3d. Celebrate Arbor Day.			

9.8 Solid Waste & Recycling Recommendations

Future assessments of the City's waste stream should evaluate the procurement process to maximize purchasing power. They should also seek a reduction in the quantity of landfill waste to reduce the City's environmental impact. To do this effectively will require a city-wide assessment of waste management for both municipal and resident facilities.

• The City should (re)design its solid waste and recycling management programs to focus on six vital areas: Infrastructure, Logistics, Education & Outreach, Policy, Funding, and Metrics. Such a program will meet the needs of the City and support its efforts to implement Lewisville 2025.

• Design and implementation of the program should consist of three phases.

Implementation Steps	***Description***
PHASE I: Conduct Waste Stream Assessment	***• Conduct a holistic assessment of existing programs, practices, and policies.*** ***• Assess entire waste stream.*** ***• Evaluate indoor and outdoor attributes of the current solid waste and recycling programs.*** ***• City buildings, parks, and green spaces should be evaluated.***
1. Infrastructure:	*• Conduct an Indoor/Outdoor Receptacle Inventory.* *• Analyze the recycling infrastructure, focusing on:* ***Quantity, Type,*** *and* ***Placement.***
1a. Quantity:	*• Identify and map current locations of indoor and outdoor recycling receptacles in buildings and areas, as well as where overall demand exists.* *• Calculate the quantity of waste produced by the City to determine distinct amounts for landfill waste and recycling.*
1b. Type:	*• Identify the varying types of receptacles currently utilized.* *• Investigate the varying needs of the City for recycling in offices, parks, and special events.* *• Determine the type(s) of landfill waste discarded by the City.* *• Determine the type(s) of recyclables discarded by the City.*
1c. Placement:	*• Identify current indoor and outdoor receptacle placement and their proximity to landfill waste receptacles.*
2. Logistics:	*• Assess servicing mechanisms for indoor, outdoor, and special event recycling.* *• Identify factors inhibiting effective and efficient recycling at City-owned facilities.*
3. Education/Outreach:	*• Identify and evaluate the effectiveness and efficiency of any trainings, marketing or PSA efforts, and contests that currently exist.*
4. Policies:	*• Identify and assess any and all policies associated with solid waste management and recycling.*
5. Funding:	*• Identify and assess all funding and funding mechanisms supporting the solid waste and recycling programs.*
6. Metrics:	*• Identify and assess any and all metrics used by the City to evaluate its solid waste and recycling programs.* *• Data collected during the inventory will help establish a more formalized measurement system for future inventory and analysis.*
PHASE II: Program (Re)Design:	***• Utilizing the findings of Phase I, the City should design a viable recycling program that addresses the following:***
1. Infrastructure:	*• An infrastructure should be designed to service all indoor, outdoor, and special event needs.* *• Design should incorporate the required capacity to collect all recyclable types that the City wishes to collect, such as paper, plastic, aluminum, cardboard, ink cartridges, batteries, and fluorescent light bulbs.* *• A schedule to install the expanded infrastructure should be determined.*
2. Logistics:	*• Design a logistics process to ensure programs are cohesive, consistent, supportable, and economically viable.* *• Design should address servicing capabilities – daily/weekly procedures and practices to collect recyclables and deliver receptacles to users.* *• Design should ensure uniformity across receptacle type, quantity, and placement for indoor, outdoor, and special events needs.*
3. Education/Outreach:	*Design education and outreach programs for short- and long-term utility.* *• Programs should consist of employee trainings, marketing/PSA initiatives, and contests.* *• Programs should attempt to maximize employee support and engagement.*
4. Policies:	*• Offer recommendations for policy creation or revision, to include green procurement policies and practices.* *• Recommendations should address infrastructure management, special event recycling, and servicing and outreach responsibilities.* *• The core objective should be to decrease the City's environmental impact through reduced waste production and reduced waste that is environmentally harmful.*
5. Funding:	*• Research potential funding avenues.*
6. Metrics:	*• Establish metrics for future use by City representatives to ascertain goals and assess program effectiveness and efficiency.*
PHASE III: Program Implementation	***• Upon completion of Phase II, the City should implement the finalized design concepts.***
1. Infrastructure:	• Purchase and install the expanded infrastructure.
2. Logistics:	• Establish the services (internal and external) required to support the expanded infrastructure.
3. Education/Outreach:	• Provide training sessions to building/site representatives or other specified leadership on the new recycling program and its components.
4. Policies:	• Revise, develop, and implement necessary policies.
5. Metrics:	• Provide training sessions to City representatives on the use of the metric tool, and to determine an adequate reassessment schedule to be conducted by the City.
6. Data Collection:	• Establish a central data repository to collect and organize all data concerning the City's solid waste and recycling. • Analysis and accessibility parameters should be addressed to ensure data reports promote additional efficiency measures and guidance for decision-making.

10.0 Concluding Remarks; Supporting Lewisville 2025

Importance of Supporting Lewisville 2025

It is important to link this assessment's findings and recommendations to the City's vision plan – Lewisville 2025. Undeniably, the City of Lewisville has taken the lead in north Texas with the implementation of its vision plan, seeking to "Create a community that is sustainable – desirable and thriving."[41]

This assessment provides an understanding of the efficiency of resource use and the environmental impact of City operations. It also demonstrates City accomplishments, identifies areas of waste and/or inefficiencies, establishes baseline data and information on activity impact and to use as a future metric, and it offers recommendations for consideration to support Lewisville 2025.

The findings show a city with a broadly implemented commitment to efficient resource use. It also shows that while there are areas of high achievement, there are also areas for potential improvement. By linking Lewisville 2025 to the recommendations set out in this assessment, the City of Lewisville is uniquely positioned in north Texas to realize its vision.

Lewisville 2025

Lewisville 2025 consists of nine Big Moves. Collectively, the Big Moves drive Lewisville toward a more sustainable and resilient future. The Big Moves are:

1. Green Centerpiece
2. Extending the Green
3. Old Town
4. Thriving Neighborhoods
5. New Neighborhood Choices
6. Employment Centers
7. Identity Focal Points
8. Marketing and Communications
9. Sustainability

During the development of Lewisville 2025, City officials and residents addressed several questions to best determine their city's future.

- *"What features would give Lewisville a distinctive identity and appeal so more new Denton County residents will choose to live in Lewisville?"*[42]
- *"What are the best strategies to enable the homes and neighborhoods in Lewisville today will still be thriving and valuable in 2025?"*[43]

- *"What types of housing, community features and services will continue to strengthen Lewisville's appeal to households with or without children?"*[44]
- *"What characteristics should Lewisville have by 2025, and what design ideas or features will help make this community cherished by its residents?"*[45]
- *"How could Lewisville Lake and its related natural areas become a large and distinctive Green Centerpiece that would make this a community of choice for future residents?"*

Lewisville 2025's Big Move, Marketing and Communications, states that, *"The City's image and identity is often in question about 'Who are we?' and 'How do others see us?'"*[46] It goes on to say that:

> *Sustainability can change the perception of this community's character. This Big Move places emphasis on green to help differentiate Lewisville from other communities. This new sustainable focus is very desirable to the younger residents Lewisville seeks to attract. Sustainability also relates to many aspects of City operations and community design, so this Big Move provides a framework for all areas of City business and reduces the City's demands on limited resources. Ultimately, it preserves Lewisville's competitiveness for those aspects of sustainability that the market now expects to see.*[47]

Supporting Lewisville 2025 with the recommendations presented in this assessment will provide the City with additional capacity to reach its goals.

- Position Lewisville as a Leader
- Preserve Natural Resources
- Reduce Environmental Impact
- Enhance the Community Culture
- Enhance the City's Image
- Attract Residents and Businesses

Utilizing the information presented in this assessment to support the Lewisville 2025 makes Lewisville more sustainable – to realize its powerful vision.

Supporting Lewisville 2025

The following section speaks to the relationship between each area assessed and the goals laid out in Lewisville 2025. The first three parts address the expansive areas of Emissions, Energy, and Water. Although this assessment focused specifically on municipal operations, it is likely that every Big Move outlined in the City's vision plan can be linked to improvement efforts presented in previous chapters.

The rest of the section deals with the relationships between City buildings, fleet, parks, green space, and landscaping, and solid waste and recycling. Although these areas are narrower in scope, their relationship to, and support of, Lewisville 2025, is equally important.

Emissions

Lewisville 2025 clearly demonstrates that the City's environmental impact is important to current and prospective residents and businesses. To strengthen the City's capacity to reduce its environmental impact, this assessment investigated numerous City operations, programs, and activities to determine City emissions and recommended that the City conduct a broader greenhouse gas (GHG) emissions inventory. As the municipality is likely one of the largest carbon emitters in the community, gauging its aggregate environmental impact will establish a solid baseline from which to design future initiatives and to position it as the community's environmental steward.

The City's emissions values presented in this report also allude to the extent to which resources are used and waste may occur. Using this assessment as a guide, along with a full GHG inventory, the City can maximize the efficiency and effectiveness of its operations, programs, and activities. The end result will be the preservation of natural resources, an enhanced image, cost-savings, and a reduced environmental impact.

By cutting emissions in ways called for in Lewisville 2025, such as more efficient energy and water use, onsite energy generation and water collection, and investing in infrastructure efficiency, the City will demonstrate a proactive and distinctive approach to enhancing its culture and the culture of the broader community. Such an approach relates directly to Big Move #9: Sustainability, and sets an example "for other new public and private development" in both the residential and commercial sectors of the City.[48]

Energy

The City's greatest contributor to its emissions is its energy consumption. That consumption comes from the water distribution system and building use. Accordingly, reducing energy consumption could do as much, if not more, to realize cost-savings and reduce emissions than other efforts.

Lewisville 2025 calls for a strong approach to reduce consumption through increased efficiencies and onsite, renewable energy generation. This assessment identified multiple areas where energy consumption can be reduced and offered recommendations to reduce that consumption through increased efficiencies.

One major recommendation offered in this assessment was for the City to develop a renewable energy strategy. Onsite generation would likely have profound effects on the entire community's culture, image, environmental impact, and leadership status. Combined with a comprehensive energy plan or policy centered on efficiencies, a renewable energy strategy would contribute significantly to the City's overall branding and messaging to prospective residents and businesses. Aligning education initiatives, community partners, neighborhood revitalization, and parks and green space enhancements with the City's energy initiatives would likely increase awareness and conservation behaviors in every aspect of community life and development.

Water

The City's historical legacy is built upon water as the community's most vital natural resource. Lewisville 2025 seeks to preserve this resource and to enhance the benefits of its local water amenities, primarily Lewisville Lake.

This assessment identified areas where the municipality can conserve water, offering recommendations to reduce consumption by buildings and through irrigation activities.

As the City's population will only increase, so too will the demand for water by both the municipality and its residents. In addition, the treatment of water and waste water uses substantial amounts of energy, as well as produces large quantities of greenhouse gas emissions. Establishing a strong water conservation and preservation foundation within the municipality's programs, policies, and practices that is linked to Lewisville 2025 goals will not only position the municipality as the community's prime steward, but will also set a precedent for consumption behaviors throughout the broader community.

Buildings

The City's biggest consumer of energy and emitter of greenhouse gases, outside of the water treatment and distribution system, is its inventory of municipal buildings. It is likely that the municipality will continue to grow in size and services. For instance, Lewisville 2025's Big Move #3 particularly calls for "continued investment in Old Town." Growth in areas such as Old town will likely lead to expanded municipal presence alongside private development. Conditions such as these present very unique opportunities. Lewisville 2025 also states that by 2025, Lewisville's…"capital assets should be the foundation for a distinctive, desirable, and efficiently-managed sustainable community."[49] Notably, the vision plan articulates the significance of the City's buildings as a physical influence on the community and its development process, as well as its importance in functioning as efficiently as possible. In other words, City buildings are a prominent face of the municipality and representation of its operations.

This assessment identified areas in which City buildings can be made more efficient through infrastructure improvements or occupant behavior change. Implementing the recommendations set out in this assessment will enhance the buildings' aesthetics, functionality, and the behaviors interacting with and within the buildings. High-profile City buildings such as the recreations centers, library, City Hall, and MCL GT/Art Center experience substantial resident use and exposure. Linking Lewisville 2025 goals with the recommendations in this assessment can provide the City with a physical infrastructure to educate residents, realize cost-savings, enhance the City's image, grow constituent support, and promote broader behavior change.

City Fleet

The City's fleet is a major contributor to its emissions. However, it is one of the most viable areas for cost-effective improvements and robust innovation.

Maximizing the City Fleet's sustainability level will have a major impact on increasing efficiencies. This will result in cost-savings and reduced environmental impact. As the Fleet is one of the City's greatest contributors to greenhouse gas emissions, improving its performance will clearly demonstrate the City's intentions to meet Lewisville 2025 objectives to improve operations.

It's important to consider how increased efficiency of the Fleet will enhance the City's image. Unlike energy and water conservation measures, the fleet is highly visible throughout the city. From the City's Police and Fire departments, to its Streets and Parks crews, an enhanced fleet will be viewed by many and will have an everlasting effect on the perception of those who now live in and visit Lewisville, strengthening the culture for generations to come.

Parks, Green Space, and Landscaping

The City's history, essence, and future vision all center on the substantial environmental assets located within its boundaries. Indeed, the first two focus areas discussed in Lewisville 2025 are Big Move: Green Centerpiece and Big Move: Extending the Green. Lewisville 2025 states that one of its greatest strengths is its "natural resources."[50] Particularly, a green centerpiece and network will improve health, aesthetics, attract new businesses, promote green lifestyles, and revitalize older neighborhoods. The vision states that, "…sustainability can change this community's character."[51]

"Enhance the Community Culture"[52]: Throughout Lewisville 2025, the importance of parks and green space is addressed. The vision plan clearly demonstrates the value of such amenities and their effect on a community's culture. It promotes "*Places to work, play, and study surrounded by nature and within walking distance of trails*."[53] It embraces *"Improved health results from investments such as trails, recreation facilities, and community gardens."*[54] Its entire essence is that a community with a strong green space network is a community with a strong culture and identity.

"Enhance the City's Image"[55]: What attributes really set communities apart from one another? Lewisville 2025 advocates that much of the difference orients around a community's natural resources, stating that "…people want to live near parks and open spaces."[56] Whether it relates to a prospective resident or business, by establishing a premier green space network, the City will create an image that appeals to one of humankind's strongest desires - Where to establish a home.

This assessment offered recommendations to ensure the City's parks, green spaces, and landscaping reach their fullest potential, helping the City reach Lewisville 2025 goals and establishing itself as "the community to live (in) and visit" in the north Texas region. Holistically employing the recommendations within this assessment to support Lewisville 2025, places strong emphases on resource management, preservation, and utility to maximize the benefits of the City's green space network.

Solid Waste & Recycling

Establishing a viable solid waste and recycling management program, will further institute several cornerstones called for in Lewisville 2025.

Lewisville 2025's Big Move, Green Centerpiece, encourages activities to reduce landfill waste. The plan posits that the City should *"Work with Waste Management and Lewisville Landfill to develop use and closure plans for the landfills that create environmentally desirable sites within the Green Centerpiece."*[57] It further states that the City should *"Evaluate and, if appropriate, modify solid waste programs to create financial incentives to recycle and reduce waste."*[58] The City can position itself as a leader by diminishing its need for landfill space through a comprehensive recycling program at City facilities.

"Enhance the community culture"[59]: One of Lewisville 2025's Common Themes encourages sustainability, to foster *"…the everyday actions and choices of residents, businesses, and the public sector."*[60] To accomplish this, Lewisville 2025 urges that the City should *"Find creative ways to engage the community, particularly children and young adults, to take advantage of their ideas and interest in sustainability."*[61] As well, the City should *"Include sustainable living in the educational programs offered by the city. Topics could include Smartscaping, recycling, home food production, water and energy conservation, and others.*[62] A comprehensive and effective recycling program will be a powerful educational tool for many community members.

Recycling programs can represent and complement foundational initiatives for cities touting less wasteful and more sustainable practices. However, infrastructure and outreach programs must be convenient and uniform to maximize waste diversion and behavior change. Ineffective and inefficient recycling invites criticism and undermines additional sustainability initiatives, such as renewable energy installations, water capture, and energy conservation. Therefore, it is necessary to bolster recycling in order to reduce the City's environmental impact, reinforce the intentions of Lewisville 2025, and enhance the municipal and community culture to be supportive of future sustainability initiatives. Linking the recommendations in this assessment to Lewisville 2025 will accomplish these goals.

Concluding Remarks

The findings of this Resource and Efficiency Assessment for the City of Lewisville show a city with a broadly implemented commitment to efficient resource use. It also shows that while there are areas of high achievement, there are many areas for potential improvement. The City of Lewisville is uniquely positioned in north Texas with great resources in its parks, green spaces, the nature preserve of LLELA, and Lewisville Lake. It has also demonstrated considerable effort to reduce its consumption of energy and water through enhancements in infrastructure, programs, policies, and activities. Such resources and accomplishments can contribute, not just to environmental and operational excellence, but to the overall strengthening of the community as well.

This report is an excellent starting point, a catalyst to facilitate engagement and innovation between stakeholders. The next step of building a tracking framework for the six performance areas will give the City a comprehensive picture of municipal operations environmental performance, and allow on-going tracking of progress. This tracking will enable measuring progress toward goals to ensure improvements are made and rewarded.

With input from City elected officials and residents, it is hoped that the City will be able to embrace the concepts of the Lewisville 2025 vision and supporting recommendations delineated in this assessment to allow the City to be a model for smart resource management, nature-centered living, and community involvement.

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[2] U.S. EPA. (2013). Energy Efficiency in Water and Wastewater Facilities: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs. Local Government Climate and Energy Strategy Guides. Attained from http://www3.epa.gov/statelocalclimate/documents/pdf/wastewater-guide.pdf. Retrieved on 14 September 2015.

[3] Daw, J., Hallet, K., DeWolfe, J., & Venner, I. (2012). Energy Efficiency Strategies for Municipal Wastewater Treatment Facilities. NREL (National Renewable Energy Laboratory. Attained from http://www.nrel.gov/docs/fy12osti/53341.pdf. Retrieved on 5 September 2015.

[4] Data on use of natural gas may be incomplete, with some buildings not matched to meters. Reference Appendices for buildings that are missing data.

[5] Osborne, James. (2015). Luminant enters solar rush. *Dallas Morning News: Energy*. Attained from http://www.dallasnews.com/business/energy/20150907-luminant-enters-solar-rush.ece. Retrieved on September 8, 2015.

[6] Resource for energy efficiency subsidies in Texas: http://programs.dsireusa.org/system/program?state=TX and http://www.energystar.gov/taxcredits.

[7] For more information on local wind information, see https://weatherspark.com/averages/30045/Dallas-Fort-Worth-Texas-United-States.

[8] For more information see American Wind Energy Association at http://www.awea.org/Issues/Content.aspx?ItemNumber=4638&navItemNumber=727

[9] U.S. Department of Energy. (2010). Guidelines for Estimating Unmetered Landscaping Water Use. *Federal Energy Management Program: Energy Efficiency and Renewable Energy.* Attained from http://www1.eere.energy.gov/femp/pdfs/est_unmetered_landscape_wtr.pdf. Retrieved on 9 September 2015.

[10] Note: Water goes from Trinity River into Lake #2, then is used for irrigation in Railroad Park. This may be distributed by subsurface piping. Irrigation data for some parks was not available. See Appendix for details.

[11] U.S. EPA. (2011). Energy Efficiency in Local Government Operations: A Guide to Developing and Implementing Greenhouse Gas Reduction Programs. *Local Government Climate and Energy Strategy Series*. Attained from http://www3.epa.gov/statelocalclimate/documents/pdf/ee_municipal_operations.pdf. Retrieved on 27 August 2015.

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[13] Pittsburgh 2030 District. (2015). *Pittsburgh 2030 District Water Baseline*. Attained from https://www.go-gba.org/wp-content/uploads/2015/02/Pittsburgh-2030-District-Water-Baseline-Final-Web-2_23_15.pdf. Retrieved on 9 July 2015.

[14] Sharrard, Aurora. (2015). 2030 Districts: Communities Collaborating to Reach Inspirational Goals with Measured Performance. *GBIG (The Green Building Information Gateway)*. Attained from http://insight.gbig.org/2030-districts-communities-collaborating-to-reach-inspirational-goals-with-measured-performance/. Retrieved on 5 August 2015.

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[20] U.S. Energy Information Administration. (2003). *2003 CBECS Survey Data*. Attained from http://www.eia.gov/consumption/commercial/data/2003/index.cfm?view=consumption. Retrieved on 4 September 2015.

[21] U.S. Energy Information Administration. (2003). *U.S Climate Zones for 2003 CBECS*. Attained from http://www.eia.gov/consumption/commercial/maps.cfm. Retrieved on 4 September 2015.

[22] BuildingGreen. (2015). *High Performance Buildings Database*. Attained from http://www.buildinggreen.com/hpb/index.cfm. Retrieved on 5 August 2015.

[23] The following are **High Performance Comparison Sources.** Visitor Bureau Comparison: Zion Visitor Center, Utah. Memorial Park Recreational Center & Fred Herring Recreational Center Comparison: Cesar Chavez Elementary School & Recreation Center, California. More information can be found at BuildingGreen's web site located at http://www.buildinggreen.com/hpb/overview.cfm?ProjectID=16http://www.buildinggreen.com/hpb/overview.cfm?ProjectID=635 and http://www.buildinggreen.com/hpb/overview.cfm?projectid=635. Hedrick House Comparison: Public Assembly - Energy Conservation Audit and Disclosure Ordinance, Austin, Texas. More information can be found at https://data.austintexas.gov/Utility/2013-ECAD-Commercial-Portfolio-Manager-Reported-Da/rka3-mjzi.

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[25] The following is a **High Performance Comparison Source.** City Hall Comparison: Chandler, Arizona City Hall. More information can be found at http://www.hpbmagazine.org/attachments/article/12132/13Sp-Chandler-City-Hall-Chandler-AZ.pdf.

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[33] Funding discussion does not include allocations to the Library, as it is no longer positioned in that division

[34] City of Lewisville. (2011). *The 2011 Lewisville Parks, Recreation, & Open Space Vision Plan*, p. 47.

[35] Waste Management. (2014). *Waste Management Annual Report to the City of Lewisville: January – December 2014*, pages 6-7.

[36] Waste Management. (2014). *Waste Management Annual Report to the City of Lewisville: January – December 2014*.

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[38] *Ibid*, p. 8.

[39] *Ibid*, p. 7. The monthly report quantity does not capture the sludge tonnage that goes to the landfill or any of the materials being recycled within operations such as motor oil, tires, etc.

[40] For more information, visit http://chiefsenergychallenge.org.

[41] City of Lewisville. (2014). *Lewisville 2025: Creating a vision for a bright future*, page xi.

[42] *Ibid*, p. 11.

[43] *Ibid*, p. 11.

[44] *Ibid*, p. 12.

[45] *Ibid*, p. 13.

[46] *Ibid*, p. 68.

[47] *Ibid*, p. 70.

[48] City of Lewisville. (2014). *Lewisville 2025: Creating a vision for a bright future*, page 70.

[49] *Ibid*. p. 29.

[50] *Ibid*. p. viii.

[51] *Ibid*, p. 70.

[52] *Ibid*, pp. 13, 31.

[53] *Ibid*, p. 31.

[54] *Ibid*, p. 25.

[55] *Ibid*, pp. 30, 31.

[56] *Ibid*, p. 15.

[57] *Ibid*, p. 39.

[58] *Ibid*, p. 71.

[59] *Ibid*, pp. 13, 31.

[60] *Ibid*, p. 25.

[61] *Ibid*, p. 71.

[62] *Ibid*, p.71.

Main Street & Mill Street Transit Oriented Development Streetscape Improvements

Project (Grant) Goals

- Walkability
- Provide for and support multiple modes of transportation
- Encourage mixed use re-development
- Enhanced Aesthetics
- Sustainability
- Context Sensitivity

Project History

- Received & Accepted Sustainable Development Grant through NCTCOG in 2010 for Main Street & Mill Street improvements
- With Council direction, Staff added alley improvements south of Main Street to the project.
- Council Approved Original Design Contract with Nathan D. Maier Engineering on January 27, 2014 to include original grant scope plus alley improvements including underground utilities in alley
- Council Approved Amended Design Scope to add South Poydras Plaza on October 20, 2014 including mid-block crosswalk on Main Street
- Staff approved a change order to extend Mill Street design north of Walters Street to tie into existing Mill @ College Street Improvements.
- Staff approved separate PSA for design of improvements to Charles Street intersections at Main & Church. Charles Street Intersection project will be added to Main & Mill Street project.
- Staff has been working with NDM to create Preliminary Schematics
- Receive additional Council input and direction based on Draft Schematics.

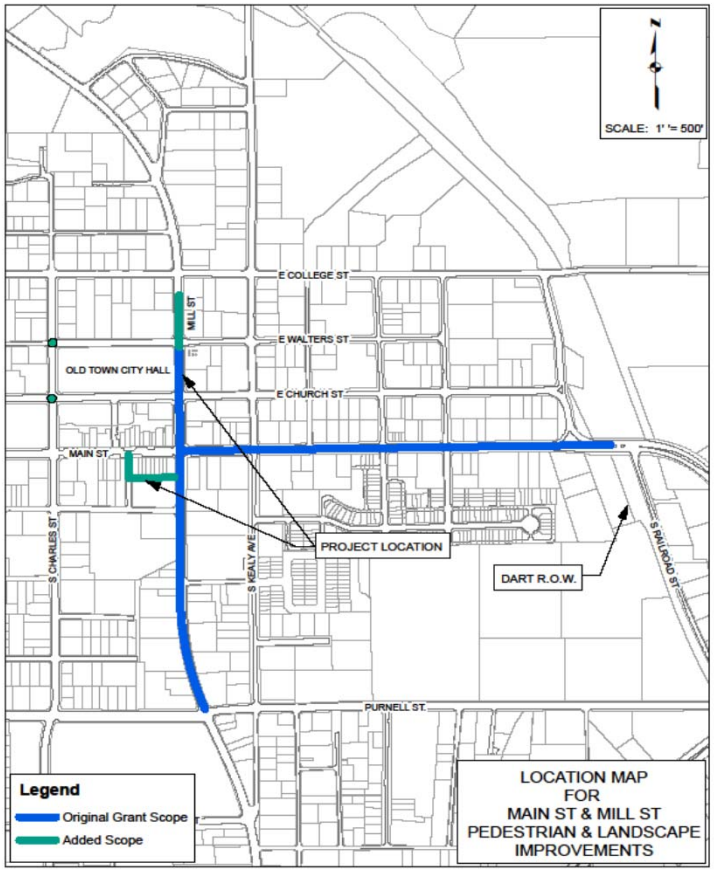
Funding

- $3,000,000 Grant
- $750,000 Local Match Requirement (Funded Original Scope)
- $1,500,000 estimated additional local funding required for items outside of grant scope (based on preliminary estimate). Council approved supplemental appropriation on January 27, 2014.
- Staff has requested an updated cost estimate from Consultant and expects additional funding will ultimately be necessary.

Project Description & Scope

- Original Grant Scope: Enhanced Parking, Landscape, Bike and Pedestrian improvements along Main Street (Mill to DART ROW) and Mill Street (Walters Street to Purnell Street) within existing right of way.
- Added Scope (not covered by grant funding): 1) Property dedication, paving, landscape and utility improvements in alley south of Main Street. 2) ADA, paving and landscape improvements in South Poydras Plaza including Main Street crosswalk improvements. 3) Reconstruct intersections of Church & Charles Streets, and Main & Charles Streets.

Project Description & Scope



Project Description & Scope

- Main Street – Convert from three to two eastbound lanes, add an eastbound bike lane, parallel parking on both sides, enhanced sidewalks on each side, landscaping. (Net increase of 98 parking spaces along Main Street Corridor)
- South Main Street Alley – Property dedication, Concrete Paving Improvements, enhanced parking, Outdoor receptacles with enclosures, Loading Zones, Underground Utilities, Water Main Extension, Landscaping, ADA Compliance
- South Poydras Plaza – Paving & Landscape Improvements to Reflect Wayne Ferguson Plaza, ADA Compliance. Includes mid-block crosswalk improvements on Main Street
- Mill Street – Convert from 4-lane undivided to three lanes (one lane each direction plus continuous left turn lane), bike lane on each side, enhanced sidewalks on each side, on-street parking, landscaping, tie into Mill at college Improvements under construction. (Net increase of 33 parking spaces along Mill Street Corridor)
- Charles Street Intersections – ADA compliance and concrete paving to match Wayne Ferguson Plaza Design.

Moving Forward

- Public Meetings Scheduled to roll out Draft Schematics and receive stakeholder input. Main Street stakeholders (Including south alley) on Thursday January 21, Mill Street Stakeholders on Tuesday January 26.
- Will set up individual stakeholder meetings as needed based on participation and input at public meetings.
- Begin 60% construction plans once Council direction and stakeholder input has been received (30% construction plan stage will be skipped due to intensive schematic phase)
- Will hold additional stakeholder meetings once 60% construction plans are complete and approved by staff.
- Target construction after Completion of Valley Ridge, estimated in late summer 2017.
- Will study and review speed limits once project is complete. Expect a reduced speed limit.

Discussion Points

- Number of traffic lanes.
- Driveways: removal, modifications, rebuild.
- Parking: Existing private head-in, parallel parking, public back-in parking.
- Pedestrian & bike facility designs.
- Landscape concept.

Walk Through Draft Schematics