

WTD ENERGY STATUS REPORT

KING COUNTY CLEAN WATER | WASTEWATER TREATMENT DIVISION



Clean Effluent After Clarifying



Climate Benefit



Reliability & Independence



Savings to Ratepayers

WHY?



South Treatment Plant, Renton



West Point Treatment Plant, Seattle



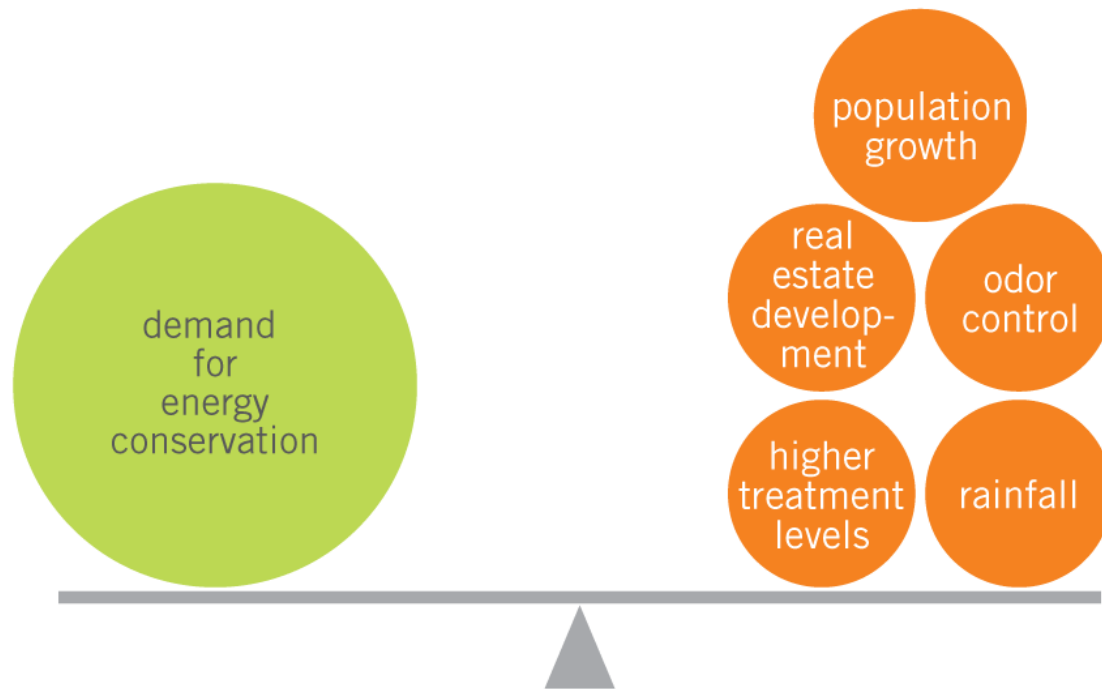
Brightwater Treatment Plant, Woodinville



Conveyance System, Hundreds of Miles

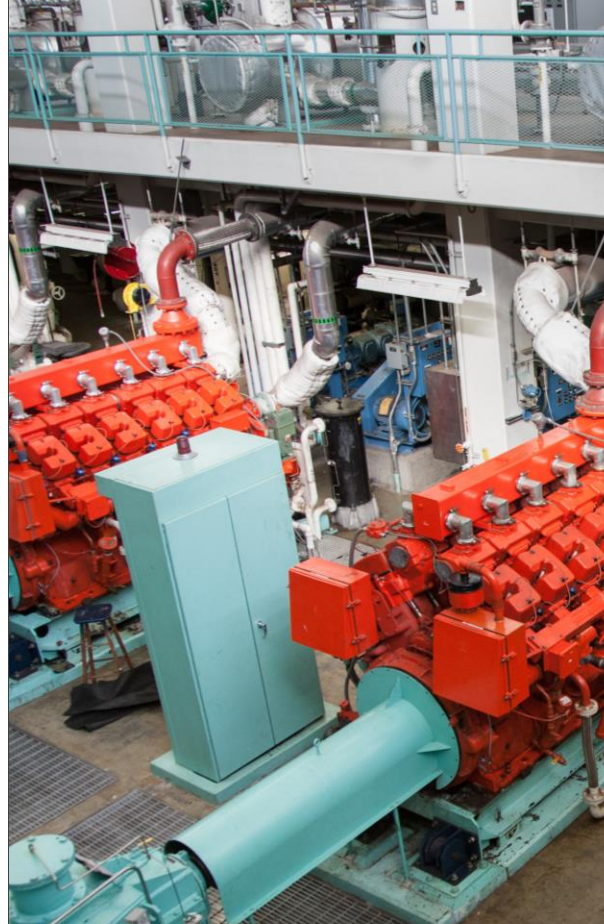
WHERE?

ENERGY USE & OTHER VARIABLES: IT'S A BALANCE





Cogeneration Engines
Electricity to Seattle City Light
(1983, 2013)



Raw Sewage Pump Engines
Industrial Waste Heat Recovery
(1966)

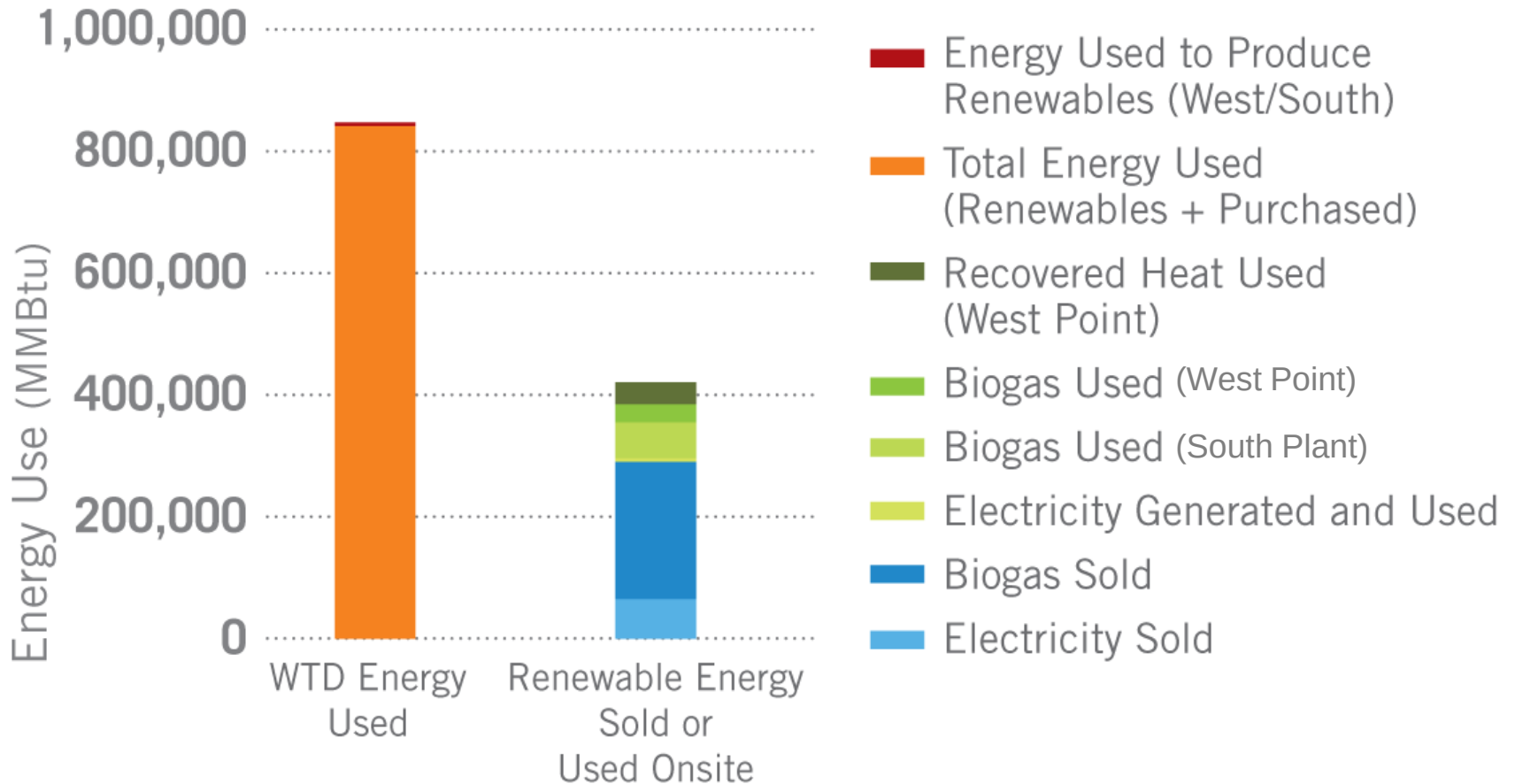


Methane Scrubbing Towers
Biogas to Natural Gas Pipeline
(1987)

HISTORY OF RENEWABLE ENERGY PRODUCTION

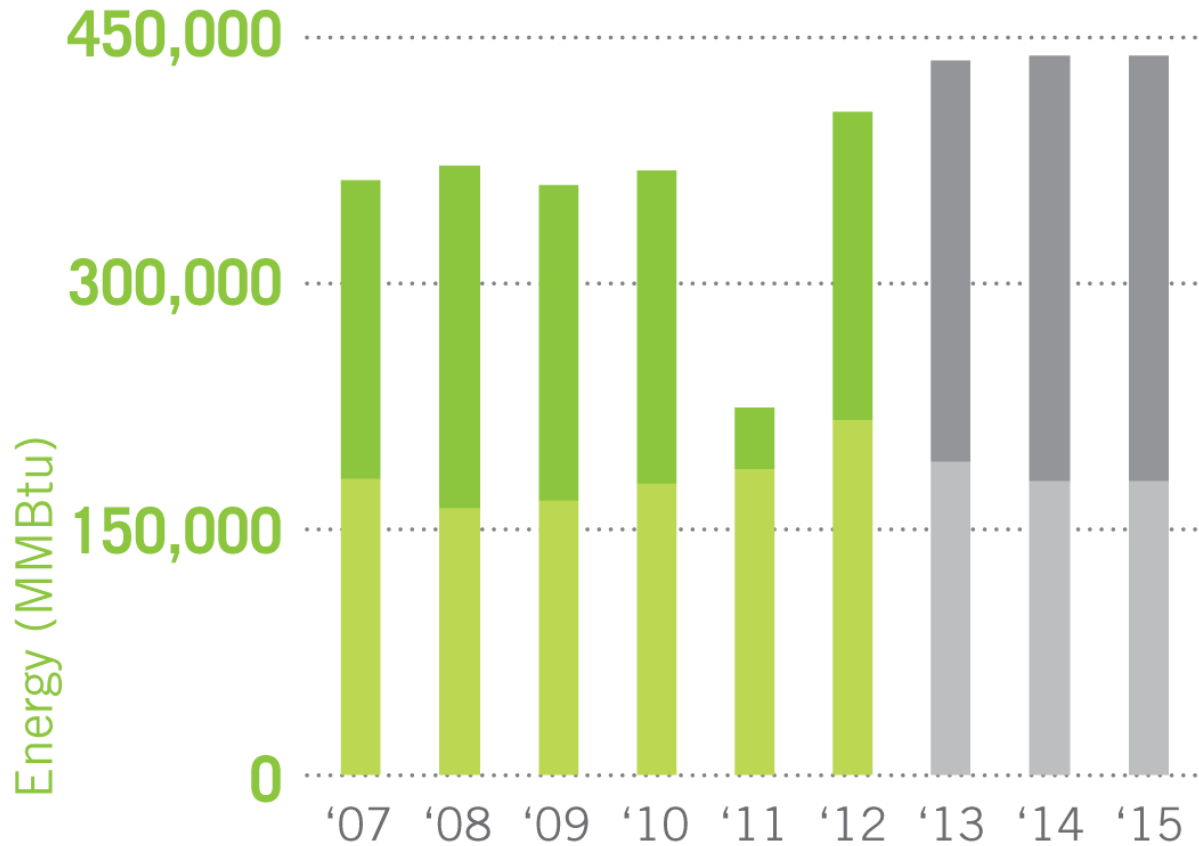
WTD ENERGY USE VS. PRODUCTION

(WEST POINT & SOUTH PLANT - PROJECTED 2014)



Renewable Energy

South Plant, West Point, Brightwater



Renewable energy sold



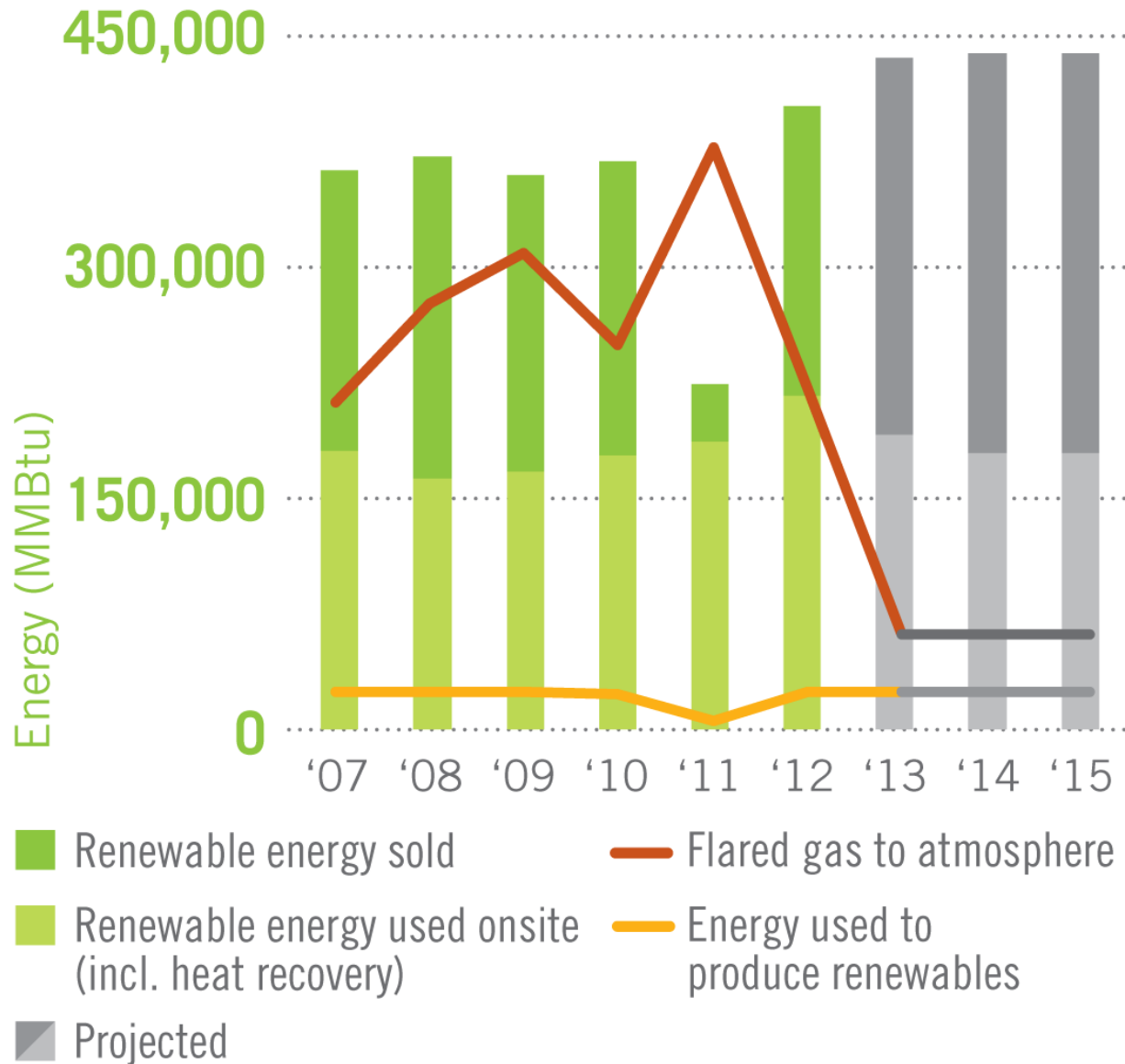
Renewable energy used onsite (incl. heat recovery)



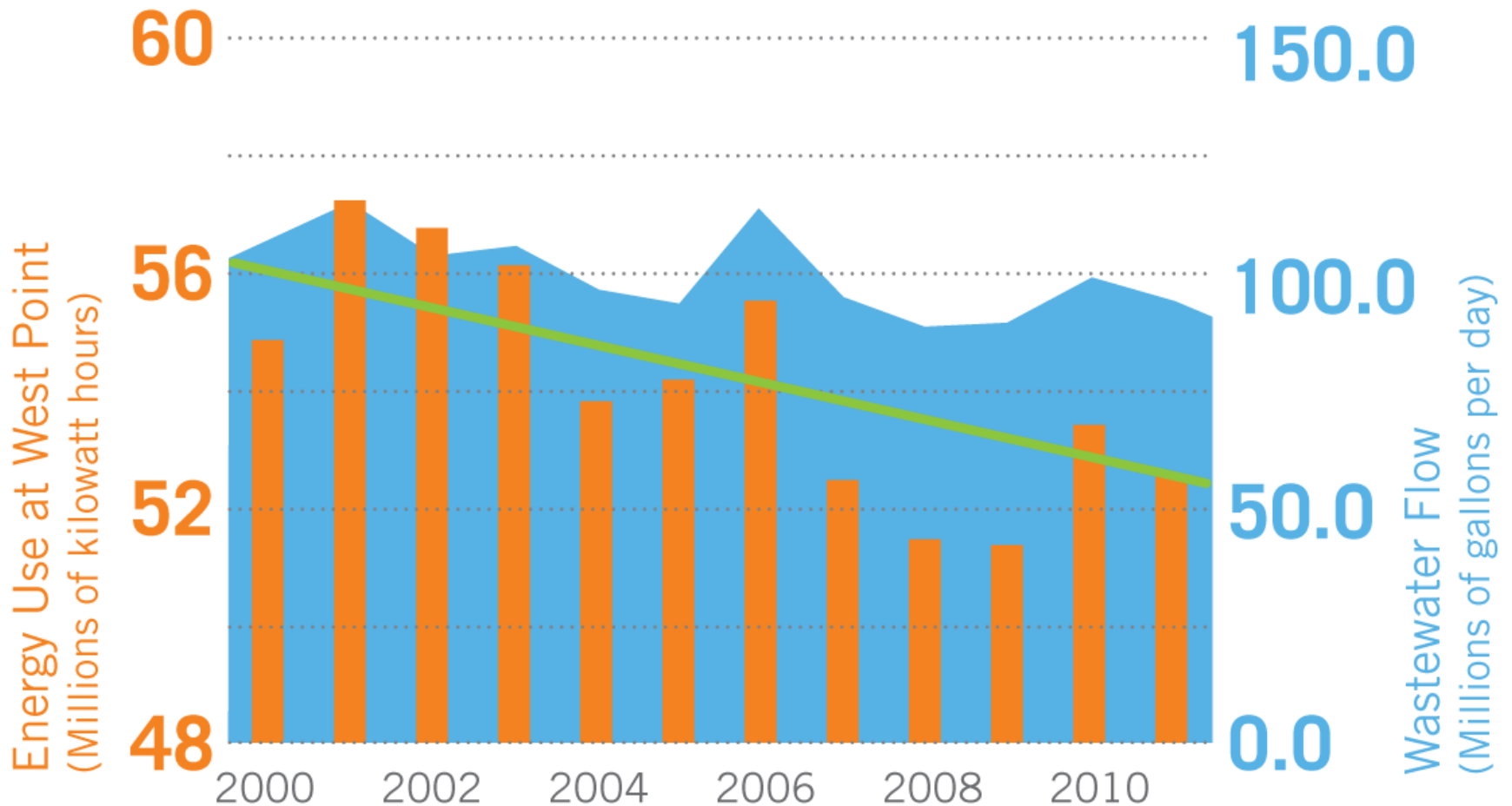
Projected

Renewable Energy

South Plant, West Point, Brightwater



HISTORY OF ENERGY CONSERVATION: WEST POINT TREATMENT PLANT AND THE 2001 PRODUCTIVITY INITIATIVE



ENERGY RELATED PROJECTS: WHAT'S CURRENTLY UNDERWAY

- \$10.3 million in grants
- \$4.3 million in low-interest loans & bonds for energy efficiency
- 68,000 MMBtu additional renewables production
- \$1.4 million per year in avoided energy costs once completed and underway projects are complete**

See handout for detail

***Based on an average regional fuel rate of \$0.07/kWh*

LOOKING FORWARD: ENERGY SAVING STRATEGIES

ONGOING ENERGY SAVINGS EFFORTS savings indicate projected 2013 efficiency (MMBtu/year)

LOW ENERGY SAVINGS (less than 500 MMBtu/year)	MEDIUM ENERGY SAVINGS (500-8,000 MMBtu/year)	Implementation Complexity
- Green Motor Initiative (~100) - Behavior Change Initiative - Capital Improvement Project Involvement – Energy analysis on all projects with over \$250,000 of powered equipment - Facility/System Energy Audits - Tag and Fix Process Air Leaks (~40)	- Equipment Shutoff (~3,000) - Plant Energy Teams (~6,600)	- Low - Medium - High

PROJECTS/EVALUATIONS CURRENTLY APPROVED IN CAPITAL IMPROVEMENT PROGRAM (CIP)

savings indicate projected annual project efficiency upon completion (MMBtu/year)

MEDIUM ENERGY SAVINGS (500-8,000 MMBtu/year)	HIGH ENERGY SAVINGS (over 8,000 MMBtu/year)
- Facility Lighting Upgrades (~1,500) - Pump Station HVAC – Control Optimization (~1,500) - Pump Station HVAC – Mechanical Optimization (~900) - Process Agitation Air Blower Replacements (~4,300) - West Point Energy Savings Performance Contract (~2,000)	- Install or Replace Variable Frequency Drives (~10,300) - South Plant Digester Gas Optimization (~17,000) - West Point Oxygen Generation (OGADS) and Aeration Mixer Replacement (~20,000)

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3

MEDIUM ENERGY SAVINGS (500-8,000 MMBtu/year)

- Equipment Shutoff (~3,000)
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2

Implementation Complexity

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- High

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Objective:
Get **high complexity, high savings** projects in the pipeline first

ONGOING TECHNOLOGY REVIEW & DEMONSTRATION



Co-digestion



**Biosolids
Incineration**



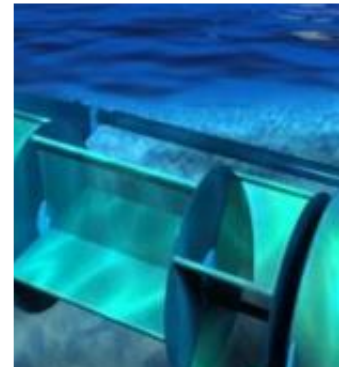
CHP/Cogen



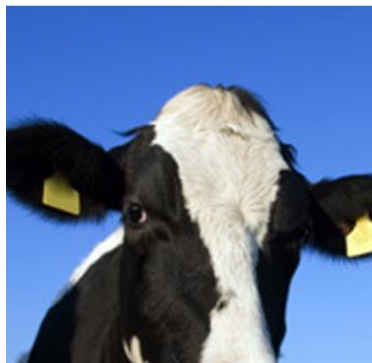
Gasification



Fuel Cell



**Hydrokinetic
Turbines**



**Dairy
Digester**



**Sewage Heat
Recovery**



**In-pipe Heat
Recovery**

EVALUATION: BROWN GREASE

Get grease out of sewer pipes
and turned into renewable
energy



Fats, Oils, Grease

WHO TAKES THE BROWN STUFF?

Open for Business:

- ✓ Rendering Facilities
- ✓ Some Wastewater Agencies

Not (yet):

- ✓ New Technologies?
- ✓ Biodiesel Production?



Wastewater Treatment Agencies with Brown Grease Receiving Sites:

Riverside, CA
East Bay Municipal Utility District, CA
Millbrae, CA
Oxnard, CA
Watsonville, CA
So. Bayside Authority (Redwood City), CA
Lincoln, NE
Pinellas County, FL
(partial list)

EVALUATION: HEAT MINING

More efficient than any form of energy generation

350 billion KWH unused annually:
down drains in the form of
heated water

40-50% of a buildings energy
requirements go out via the
sewer everyday



EVALUATION: HEAT MINING

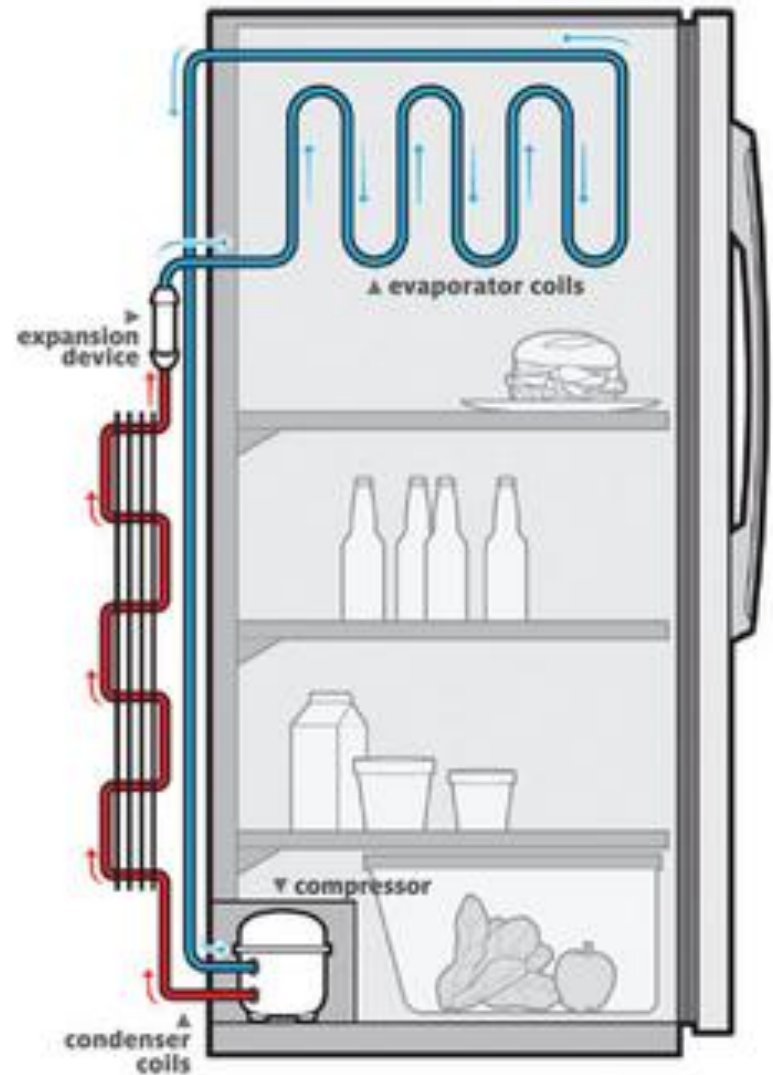
How Heat Recovery Works:

Wastewater has an average temperature of about 65°F

Heat pumps/exchangers transfer & condense heat

Clarification: Warm wastewater is not getting funneled through buildings to provide heat

One example technology showing sewage heat recovery COP of 550% (versus geothermal heat pump COP of 350%)



Kate Francis/Brown Bird Design

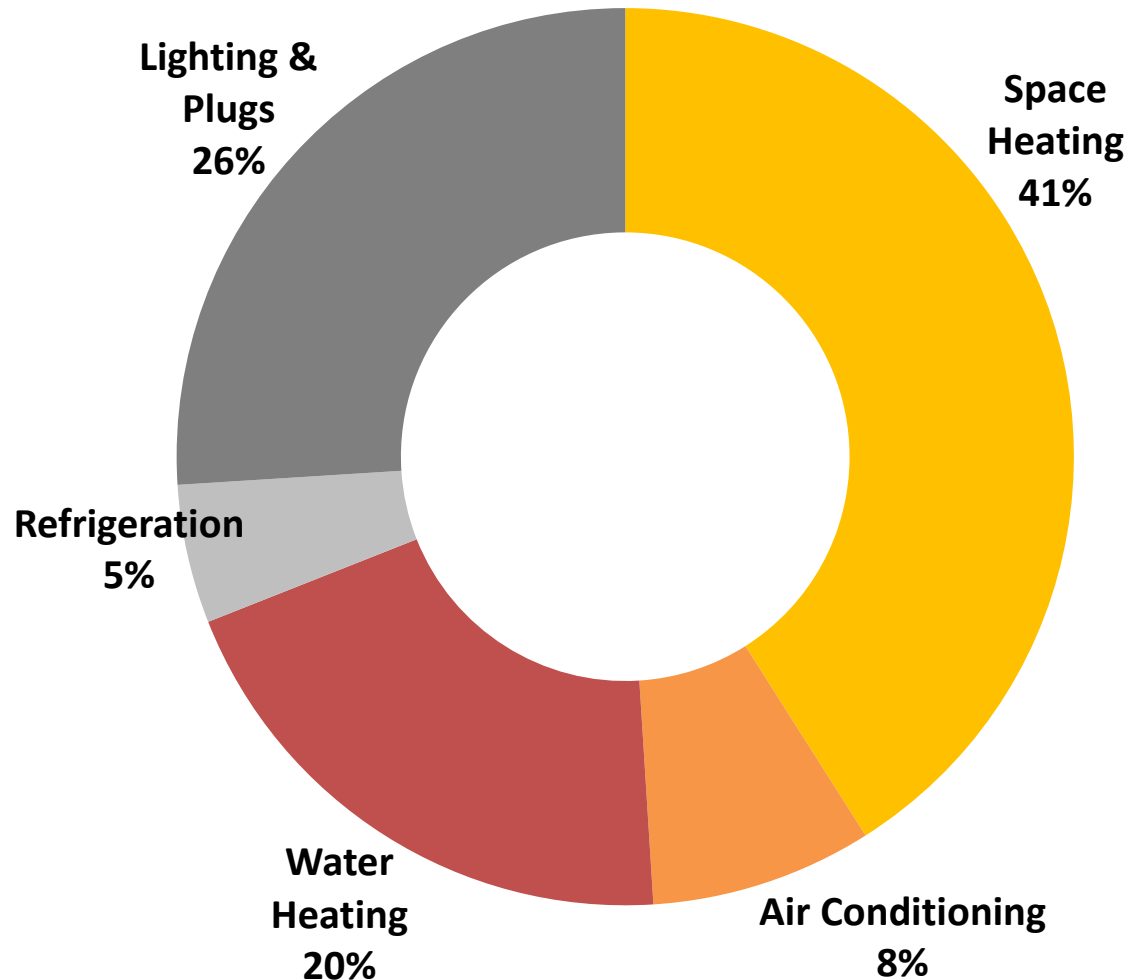
EVALUATION: HEAT MINING

Why Heat Recovery Works:

70% of our energy consumption is thermal – used to heat/cool space & water (rather than electricity)

Source: U.S. Energy Information Administration, Residential Energy Consumption Survey

How Energy Is Used In Homes.



2012 REQUEST FOR INFORMATION:

DISTRICT ENERGY USING WASTEWATER

Who:

Those with interest in owning, operating, developing and/or financing district energy or heat recovery systems that want to use King County wastewater as a fuel source

Listen to what obstacles might be when getting the first generation of sewage heat mining projects off the ground in our area



Privately funded district energy owners & operators will have specific needs to make projects viable.

KING COUNTY INTERESTS

Use sewage heat as a new WTD asset

Support WTD's primary mission & asset integrity

Save ratepayer money

Developer finances, builds, permits, operates, maintains district energy project

Collaborate with Seattle and other public agencies

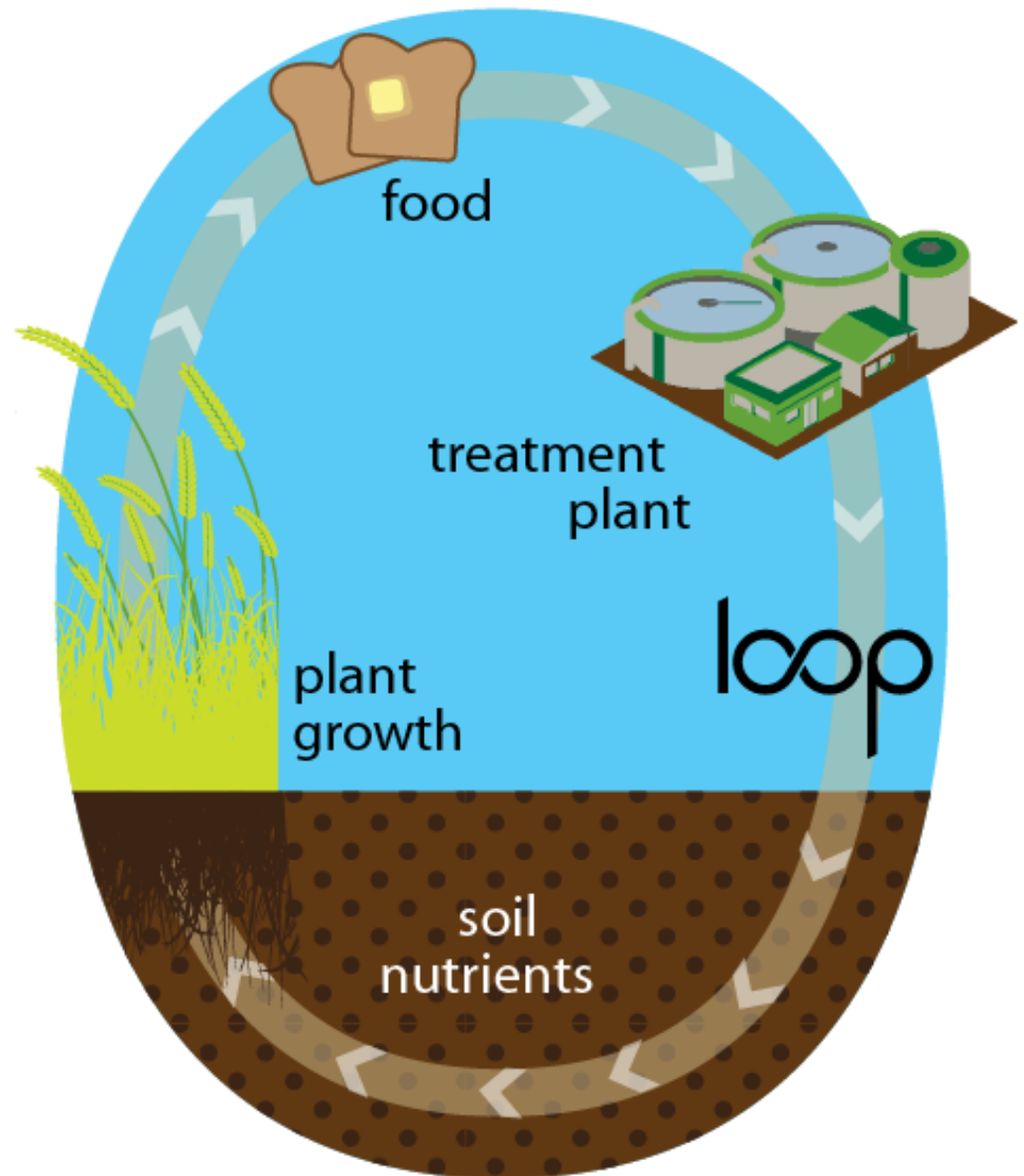
Evaluate future opportunities for WTD to reduce reliance on purchased power



- 1) ENERGY EFFICIENCY**
- 2) RENEWABLE ENERGY**
- 3)**

- 1) ENERGY EFFICIENCY**
- 2) RENEWABLE ENERGY**
- 3) CARBON RECYCLING**

WHAT IS CARBON & NUTRIENT RECYCLING?



Restores Carbon & Nutrients to the Land



Agriculture



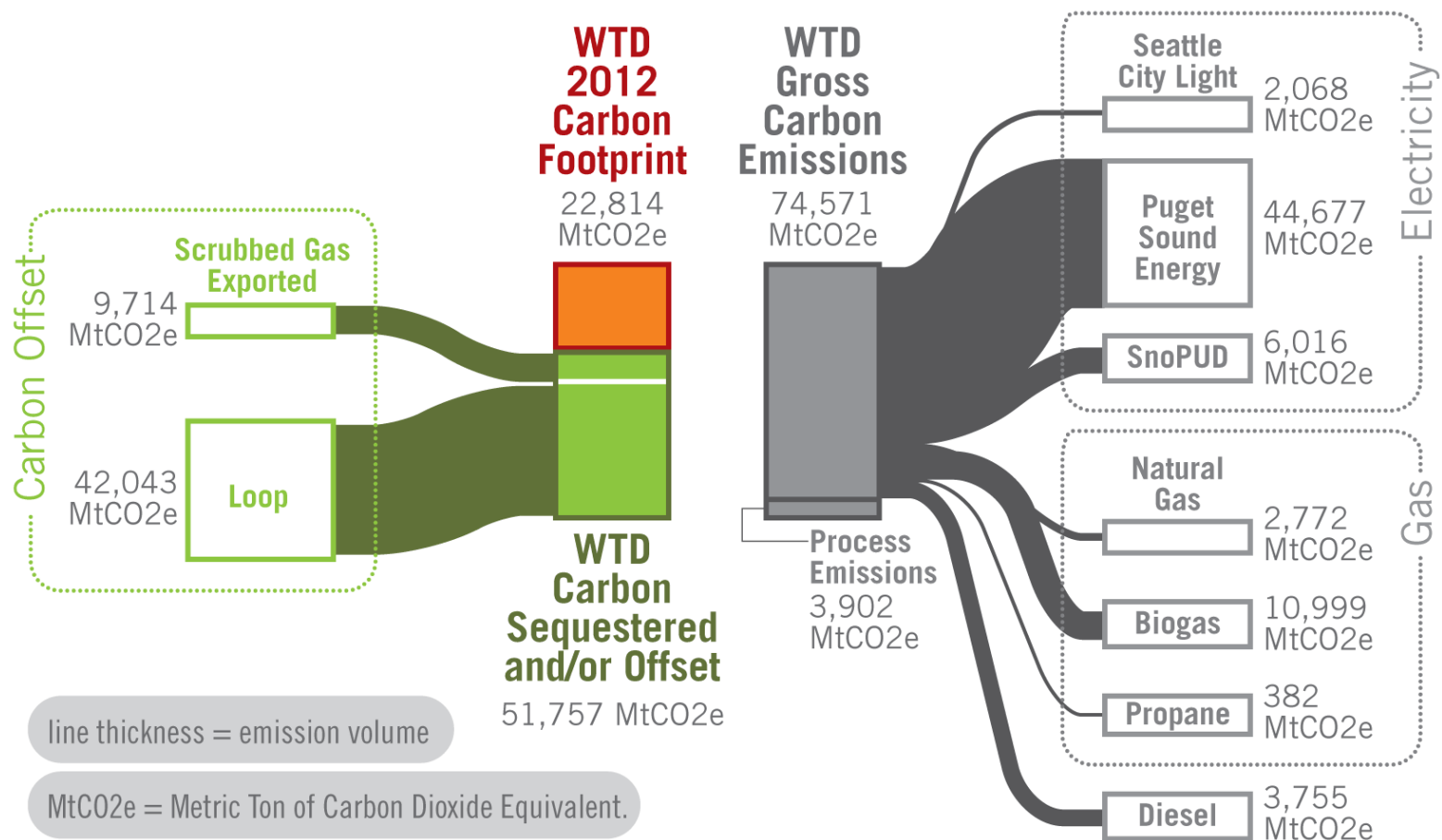
Forestry



Land
Reclamation



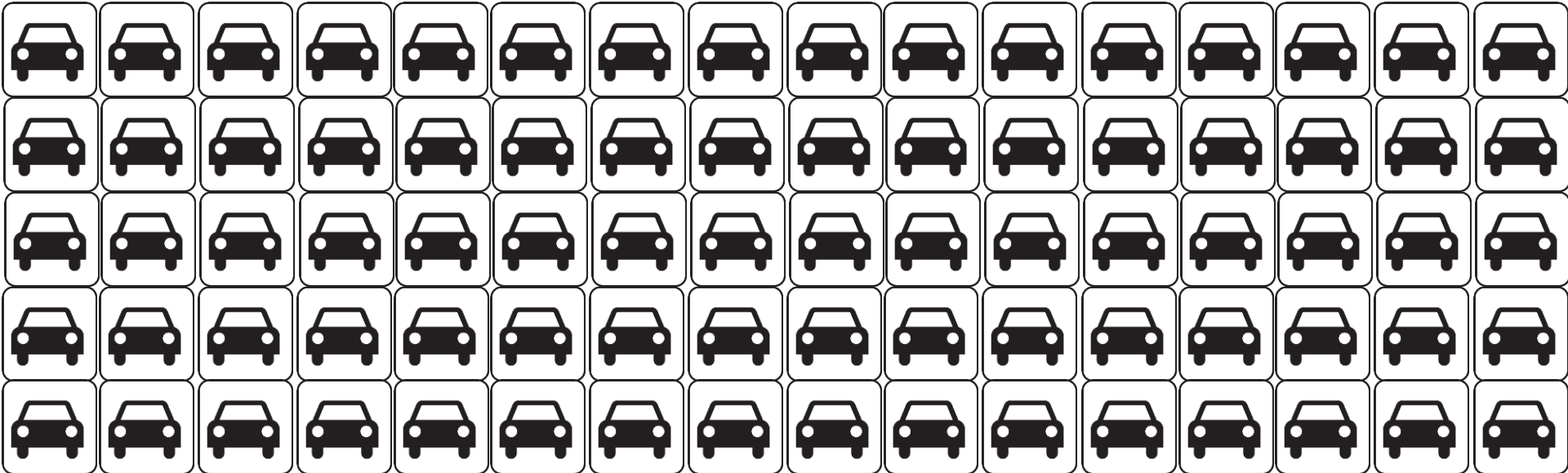
Urban
Gardening



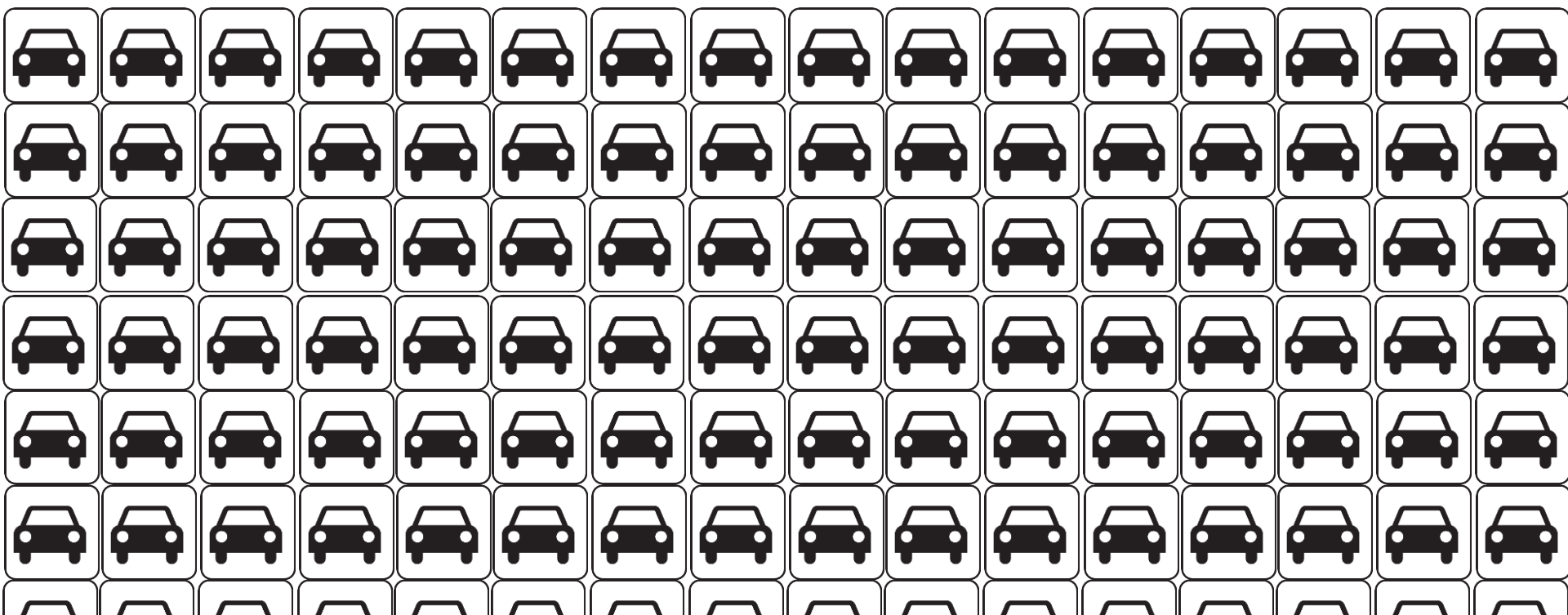
CARBON RECYCLING IMPACT: ENERGY & GHG EMISSIONS (2012)

**THAT IS LIKE TAKING 8,000 CARS
OFF THE ROAD.**





EVERY SINGLE YEAR.





Questions?

King County Wastewater Treatment | Your clean water utility

HANDOUTS

Energy Capital Projects Completed and Underway 2007 - 2020

LOCATION/PROJECT	TYPE	COMPLETION	EST. SAVINGS / PRODUCTION MMBtu / YEAR	GRANT/FUNDING
Hidden Lake Pump Station Replacement	Conservation	2008	160	n/a
South Plant Pre-Aeration Blower Replacement	Conservation	2009	1,508	\$323,726 (PSE Grant)
South Plant System 1 Chiller Replacement	Conservation	2009	524	\$151,505 (PSE Grant)
53rd Avenue Pump Station Upgrade	Conservation	2010	65	\$10,609 (SCL Grant)
Bellevue Pump Station Upgrade	Conservation	2011	192	n/a
Brightwater Aeration Blowers	Conservation	2011	12,408	\$281,323 (SnoPUD Grant)
West Point Pre-Aeration Blower Replacement	Conservation	2012	1,539	\$119,164 (SCL Grant) \$280,000 (Federal Grant – ARRA)
West Point Cogeneration	Renewable	2013*	68,000	\$8,200,000 (Federal Grant - EPA)
South Plant Secondary Agitation Air Blower Replacement	Conservation	2013*	2,805	\$331,785 (PSE Grant) \$668,215 (WA State Loan)
North Creek Pump Station HVAC System Optimization – Controls Replacement	Conservation	2013*	1,500	~ \$3,000 (PSE Grant) \$19,500 (Federal Grant – ARRA)
South Plant Lighting Upgrade	Conservation	2013 or 2014*	1,500	\$224,639 (PSE Grant)
Kirkland Pump Station Upgrade	Conservation	2014*	308	n/a
Environmental Lab HVAC System Upgrade	Conservation	2014*	1,082	PSE and SCL Grants TBD \$331,785 (WA State Loan)
South Plant Aeration Diffuser Membrane Replacement	Conservation	2015*	8,530	PSE Grant TBD
Interbay Pump Station Upgrade	Conservation	2015*	2,509	\$169,160 (SCL Grant)
West Point Influent Screening Improvements	Fleet Fuel Conservation	2015*	1,902	n/a
West Point Energy Savings Performance Contract – Replacement of Centrifuges, In-Line Mixers, and Biosolids Conveyors	Conservation	2016*	1,964	\$172,655 (SCL Grant) \$300,000 (WA State Loan)
South Plant Effluent Transfer Station VFD Replacement	Conservation	2016*	TBD	PSE Grant TBD
South Plant Raw Sewage Pump, Motor and Drive Replacement	Conservation	2017*	6,824	PSE Grant TBD \$3,000,000 (Federal Bonds – QECB)
West Point OGADS and Aeration Mixers Replacement	Conservation	2018*	20,200	SCL Grant TBD
Sunset/Heathfield Pump Station Upgrade	Conservation	2020*	TBD	PSE Grant TBD

*Estimated

Energy Efficiency Operational Efforts Completed and Underway 2007 - 2013

LOCATION/PROJECT	TYPE	COMPLETION	EST. SAVINGS / PRODUCTION MMBtu / YEAR	STATUS
WTD-Wide Maintenance – Panel Bulb Replacements with LEDs	Conservation	Ongoing	15	Completed / Ongoing
WTD-Wide Maintenance – Green Motor Initiative	Conservation	Ongoing	112	Completed / Ongoing
WTD-Wide Maintenance – Impeller Trimming	Conservation	Ongoing	TBD	Completed / Ongoing
WTD-Wide Maintenance – Pump Coating	Conservation	Ongoing	TBD	Completed / Ongoing
WTD-Wide Maintenance – Photocell and Occupancy Sensor Installation and Maintenance	Conservation	Ongoing	TBD	Completed / Ongoing
West Point and South Plant – Plug-In Hybrids	Emissions Reduction	2008	24	Completed
South Plant – Fuel Cell kW Draw Down	Conservation	2009	401	Completed
West Point – KTURBO Pre-Aeration Blower Test	Conservation	2009	741	Completed
Carkeek Pump Station – Shed Thermostat Repair	Conservation	2012	40	Completed
South Plant Agitation Air System – 4th Blower Shutdown	Conservation	2012	2,989	Completed
South Plant Agitation Air System – Blower PLCs Programmed to kW Control	Conservation	2013*	TBD	Completed
Black River Pump Station – Thermostat Upgrade*	Conservation	2013*	TBD	Completed
South Plant Aeration Tank 1 – Diffuser and Tank Cleaning	Conservation	2013*	546	Completed
South Plant Agitation Air System – Leak Repairs	Conservation	2013*	TBD	Underway
Matthews Park Pump Station – Energy Audit Recommendations	Conservation	2013*	TBD	Underway
South Plant – Wastewater Cohort OSU Industrial Energy Assessment Recommendations	Conservation	2013*	TBD	Underway
West Point – HPEM RAS Pumping Optimization	Conservation	2013*	TBD	Underway

**Estimated*