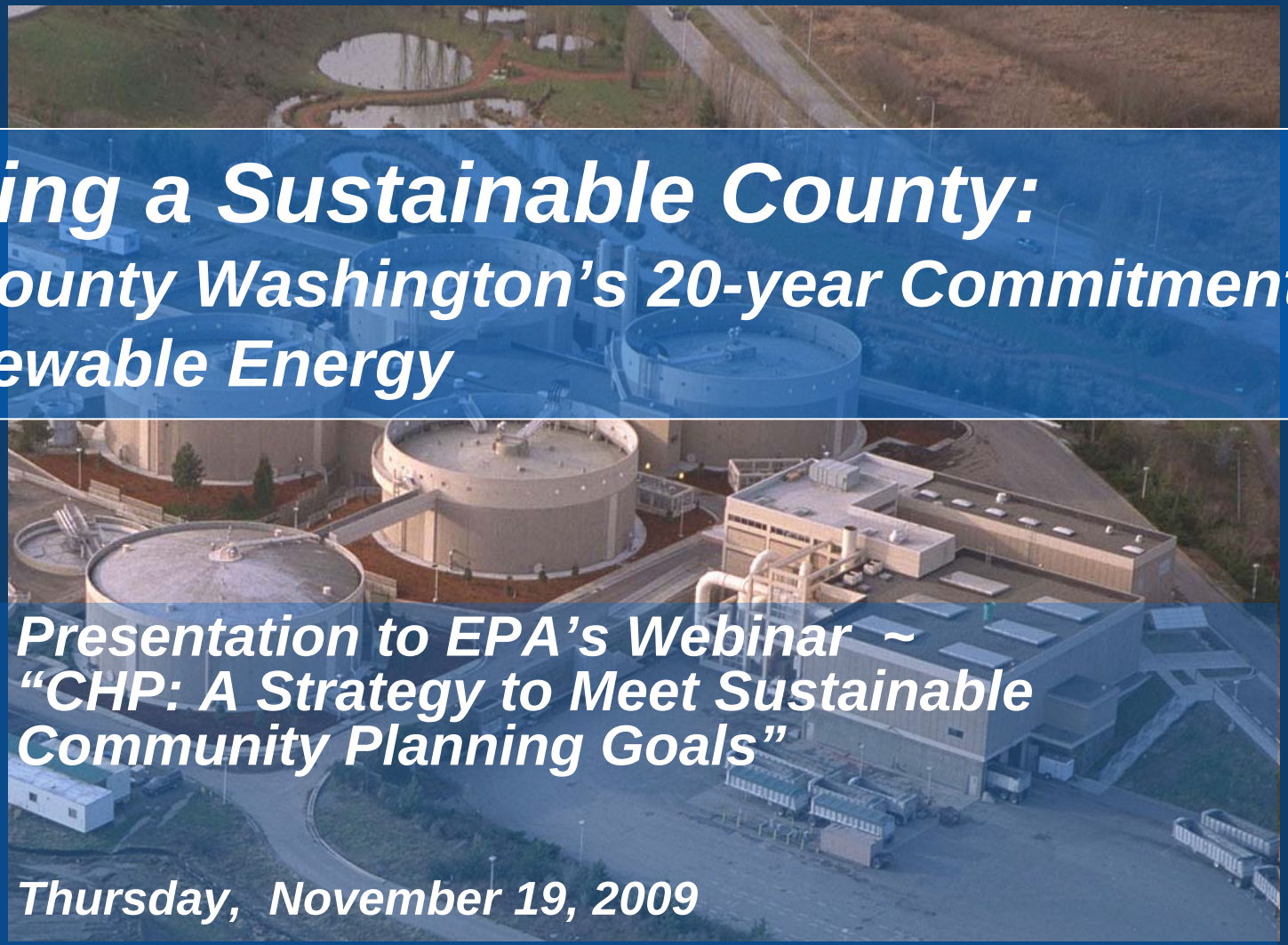


Building a Sustainable County:
King County Washington's 20-year Commitment to Renewable Energy

Presentation to EPA's Webinar ~
"CHP: A Strategy to Meet Sustainable Community Planning Goals"

Thursday, November 19, 2009

David Van Holde, et al: King County Dept. of Natural Resources and Parks

King County

Our Policy Frame: Key County Climate / Energy Goals

Direction from a "Renewable Energy" Executive Order in 2006 …

- ≥ 50 % of King County's total non-transit energy use to come from renewable energy sources by 2012
  - implementing programs to minimize existing energy use through increased efficiency, optimized operation and maintenance, and conservation efforts
  - This drives continuing work to maximize the conversion and use of waste for energy
  - purchasing electricity produced from renewable sources as appropriate
- ≥ 35 % of transit energy use to come from efficiencies and renewable energy sources by the year 2015
- ≥ 50 % of transit energy use to come from efficiencies and renewable energy sources by the year 2020

King County Goals for Climate and Energy				
Program/ Commitment	2007 Results	2008 Results	End Target	Scope:
Comprehensive Plan (County Wide)	undefined	2% below 2007 levels	80% below 2007 levels by 2050	All greenhouse gas (GHG) emissions in County
Comprehensive Plan (Govt Ops)	undefined	3% below 2000 baseline	6% below 2000 by 2010	All GHG emissions from govt. sources
Cool Counties (County Wide and Govt. Ops)	undefined	slow emissions growth	80% below 2007 by 2050	All GHG emissions from govt. and in the County
Chicago Climate Exchange (Govt Ops)	-5.1% compared to 2000 baseline (-1.5% goal)	+1.3% compared to 2000 baseline (-3.0% goal)	6% below 2000 by 2010	Carbon dioxide emissions from Gasoline, Diesel, Natural Gas, Heating Oil and Steam
Renewable Energy Order (Govt Ops) Stationary Sources	15% Renewable Energy	7% MORE energy from renewables (22% total)	50% energy by renewables by 2012 (assumes 2007 baseline)	Stationary govt. sources
Renewable Energy Order (Govt Ops) Mobile Sources	11% total usage by renewables	3% MORE usage by renewables or effeciences (14% total)	35% energy by efficiencies and renewables by 2015. 50% by 2020 (assumes 2007 baseline)	Mobile govt. sources
Energy Plan (Govt Ops)	3,448,919 MMBtu/Year total Use	2% reduction in normalized net energy usage (2% total)	10% reduction in normalized net energy usage by 2012 (assumes 2007 baseline)	

KEY	
	Undefined
	Meeting or exceeding the target
	Not meeting target
	Defined Baseline or Goals

Becomes: "A Goals Matrix"

King County

Anchor it with a Baseline… (2007)

Measure it to manage it: The county's first roll-up of *All Energy Use* in 2007

Appendix B: 2007 King County Energy Use Baseline

(Available in Excel spreadsheet format with additional detail)

Non - Renewable Energy Use

	2007 Totals w/o Renewables	Electrical MMBTU	Natural Gas MMBTU	Steam MMBTU	Propane MMBTU	Heating Oil MMBTU	Gasoline MMBTU	Diesel MMBTU	Jet Fuel MMBTU	2007 Non renewableMMBTU
DNRP	Parks & Recreation Division	18,760	24,983	0	0	513	0	0	0	44,256
DNRP	Solid Waste Division	26,463	0	0	0	2,222	4,332	135,913	0	168,930
DNRP	Water & Land Resources Division	5,803	6,775	0	0	0	0	0	0	12,578
DNRP	Wastewater Treatment Division	516,390	24,764	0	6,681	0	90	33,103	0	581,027
DNRP	DNRP Subtotal	567,416	56,523	0	6,681	2,734	4,422	169,016	0	806,792
DOT	Fleet Administration	778	1,400	0	0	0	155,168	40,690	0	198,036
DOT	King County Airport	17,865	6,618	0	0	0	2,568	715	0	27,766
DOT	Road Services	0	869	0	0	0	0	0	0	869
DOT	Metro Transit	161,243	74,191	25	0	0	91,280	1,276,435	0	1,603,174
DOT	DOT Subtotal	179,886	83,077	25	0	0	249,016	1,317,840	0	1,829,845
FMD	Adult & Juvenile Detention	80,681	46,954	44,531	0	0	0	0	0	172,166
FMD	Community and Human Services	1,348	1,309	0	0	0	0	0	0	2,656
FMD	Executive Services	2,572	3,269	0	0	0	0	0	0	5,841
FMD	General Office Administration	53,269	3,793	3,128	0	0	0	0	0	60,189
FMD	Judicial Administration	37,624	1,907	33,543	0	0	0	0	0	73,074
FMD	DES Subtotal	175,493	57,231	81,202	0	0	0	0	0	313,926
	Public Health	8,839	3,518	0	0	0	6,569	0	0	18,927
	Sheriff's Office	7,557	4,606	0	0	0	6,720	448	2,009	21,340
	Subtotal	16,397	8,124	0	0	0	13,289	448	2,009	40,266
	TOTAL	939,192	204,954	81,227	6,681	2,734	266,727	1,487,547	2,009	2,990,829
	Transit Use alone	*161,243*	*74,191*	*25*	*0*	*0*	*91,280*	*1,276,435*	*0*	*1,603,174*
	Everything BUT Transit	*777,949*	*130,763*	*81,202*	*6,681*	*2,734*	*175,447*	*211,112*	*2,009*	*1,387,655*

Renewable Energy, Total Energy and Percentages

	2007 Totals with Renewables and percent renewables	Renewable Electric Power MMBTU	Biogas (Digester and Landfill) MMBTU (4)	BioDiesel MMBTU	Total Renewable MMBTU	Total Energy Use MMBTU including Renewables	Percent Renewables	Normalization Basis	Normalization Units	2007 Normalized Total Energy use	Normalized Energy Units	Percent of County Energy Use
DNRP	Parks & Recreation Division	0	0	0	0	44,256	0%	227,250	Sq-ft	195	Kbtu/sq-ft	1%
DNRP	Solid Waste Division	0	0	12,761	12,761	181,691	7%	1,010,429	Tons SW	89.9	Btu/lb	5%
DNRP	Water & Land Resources Division	0	0	0	0	12,578	0%	23,000	Sq-ft	547	Kbtu/sq-ft**	0%
DNRP	Wastewater Treatment Division	0	196,502	2,619	199,114	780,142	26%	64,902	Million Gal	12	Btu/gal	23%
DNRP	DNRP Subtotal	0	196,502	15,373	211,875	1,018,666	21%		N/A			30%
DOT	Fleet Administration	0	0	8,125	8,125	206,161	4%	18,412,965	Vehicle-miles	11,196	Btu/mile	6%
DOT	King County Airport	0	0	0	0	27,766	0%	451,761	Sq-ft	61	Kbtu/sq-ft	1%
DOT	Road Services	33,193	0	0	33,193	34,062	97%	233,814	Sq-ft	146	Kbtu/sq-ft**	1%
DOT	Metro Transit	0	0	204,897	204,897	1,808,071	11%	110,600,190	Riders	16,348	Btu/ride	52%
DOT	DOT Subtotal	33,193	0	213,022	246,215	2,076,060	12%		N/A			60%
FMD	Adult & Juvenile Detention	0	0	0	0	172,166	0%	1,166,686	Sq-Ft	148	Kbtu/sq-ft	5%
FMD	Community and Human Services	0	0	0	0	2,656	0%	68,276	Sq-Ft	39	Kbtu/sq-ft	0%
FMD	Executive Services	0	0	0	0	5,841	0%	84,450	Sq-Ft	69	Kbtu/sq-ft	0%
FMD	General Office Administration	0	0	0	0	60,189	0%	1,309,552	Sq-Ft	46	Kbtu/sq-ft	2%
FMD	Judicial Administration	0	0	0	0	73,074	0%	667,635	Sq-Ft	109	Kbtu/sq-ft	2%
FMD	DES Subtotal	0	0	0	0	313,926	0%		Sq-Ft			9%
	Public Health	0	0	0	0	18,927	0%	130,399	Sq-Ft	145	Kbtu/sq-ft**	1%
	Sheriff's Office	0	0	0	0	21,340	0%	88,198	Sq-Ft	242	Kbtu/sq-ft**	1%
	Subtotal	0	0	0	0	40,266	0%		N/A			1%
	TOTAL	33,193	196,502	228,395	458,090	3,448,919	13%	N/A	N/A	N/A	N/A	100%
	Transit Use alone	*0*	*0*	*204,897*	*204,897*	*1,808,071*	*11%*					52%
	Everything BUT Transit	*33,193*	*196,502*	*23,498*	*253,193*	*1,640,847*	*15%*					48%

Notes:

1 Gasoline totals for Fleets include personal vehicles used for County business.
2 Known account omissions exist, primarily in Parks and Roads, for electric utility data. These are relatively small scale and will be added when received from the utilities.
3 In some cases there may be multiple or different normalizations for different sites / energy supplies - add these disaggregations as needed, keeping as simple as practical
4 Biogas counted in this inventory is only that which is effectively employed to displace other "non renewable" fuels
5 Biodiesel reported gallons are from CCX reporting by Matt Kuharic, 05/2008
6 Energy content of biodiesel is assumed: **131,496** Btu/Gal Per Todd Ellis of Imperium Renewables 206.254.0207 (6/4/08)
7 ** Energy Intensity (EI) values for WLRD, Roads, Public Health and Sheriff's Office are problematic. Is sqft the measure of service?. Consider alternate normalization

ENERGY PRIMARY USES
In or Dominated by Buildings & Stationary Facilities
In Waste Handling & Treatment
In or Dominated by Rolling Stock Fuels
Mixed Facilities / Rolling Stock Energy

King County

Make a Plan: High Level Strategies

The King County Energy Plan is our policy implementation roadmap. And it's pretty simple, *Conceptually*:

- Efficiency & Conservation First!
- Clean Fuels
- Clean Energy
- Offsets

As always, the challenge is in effective implementation…

A significant early step was to codify requirements into our legal policies – in 2008 we put key Energy Plan elements in the King County Comprehensive Plan update.

King County

Practical Strategies for Implementation

1. Energy strategies and implementation plans developed by *cross-county Energy Task Force* – as directed by the Executive;
2. Accountability: *annual reporting* to Executive on County energy use, percent renewables as well as actions taken and progress to increase renewables and efficiency;
3. Energy and sustainability teams *acting at Department and Division level – coordinated through Task Force* and linked to other teams, a such as our Green Building Team

King County

Energy Plan Key Implementation Goals

1. ***Convert 100 percent of all reasonably usable waste products at landfills and wastewater treatment plants to energy by 2012.***
2. *Increase use of renewable fuel and efficiency of county buses and vehicles.*
3. *Departments and divisions will set targets to achieve energy savings, using the agreed on baseline energy use...*
4. *Adopt mandatory energy efficiency and resource use guidelines for operation and maintenance of all county occupied facilities.*
5. *Create an initiative to encourage employees to implement energy conserving measures at work.*
6. *Conduct and/or update efficiency audits of all significant county buildings by 2010 and create a prioritized action plan for reducing energy use at each building.*

Passing the Sniff Test:
Successful Commercial Biogas from Waste Products

King County

Well… How Did We Get Here?

- Why so many Renewable Energy Projects?
  - Great resources: have and must dispose of biogas. So, policy developed to use waste-to-energy where practical
  - Local government with a long history of environmental leadership
- Policy Frame
  - Largely built "bottom up" by staff to meet needs to manage energy and gas – carried forward by political leaders
- Economic Frame
  - Generally in past, energy resources were valued at nominal market – had to make that work
  - Consistent grant support from EPA and others for leading edge environmental technology development
- Win-Win-Win! Renewables and CHP have brought money AND good environmental policy… For the county and utility partners. Utilities brag about using our resources…

Gas Application Strategies

- Wastewater biogas came first: concentrated source driven by need to reduce biosolids. First use was gas-powered raw sewage pumps…
- Landfill gas later – driven by need to remove gas from landfill for environmental and safety reasons
- Projects involved energy commodity sales to recover costs or better…
- Prime motivations have been reliability, high net system efficiency and low emissions. Example: Direct use in pumps often is “best use” to meet these objectives.
- CHP has not been our first choice, because of very low electricity cost in NW – price of gas still much higher. Thus the development of gas scrubbing for pipeline sale.

Refining digester gas for sale on pipeline

- Anaerobic Digesters – produce biogas
- Mix Biogas & Water under Pressure
  - Gas Compressors: 300-psi
  - Water Pumps/Turbines: 0.7-gal/ ft3-Biogas
  - Contact Tower: Packed Bed
- Drier
- Quality Control Monitoring
- Diversion Valves/Waste Gas Burners
- Sales Meter

King County

South Plant Stats – A Valuable Resource

- Operating since 1987
  - Predated "Carbon Markets" – *so no GHG offset credits or renewable energy certificates (RECs) can be produced (though this is clearly renewable energy!)*
- 2007 Gas Sales: $1.25 million
  - 1.8 million Therms (180 million ft^3 NG)
  - 3000 homes (~50 Therms/month/house)
- 2007 Production Costs: $0.5-0.7 million estimate
  - Electricity used: 4-million kWh (7% of South Plant's total)
- 2007 Biogas Recovery & Use
  - 89% recovery (11% was flared)
  - 57% sold to PSE
  - 16% used on-site to produce heat (boiler)
  - 16% used on-site to produce electricity (cogen)

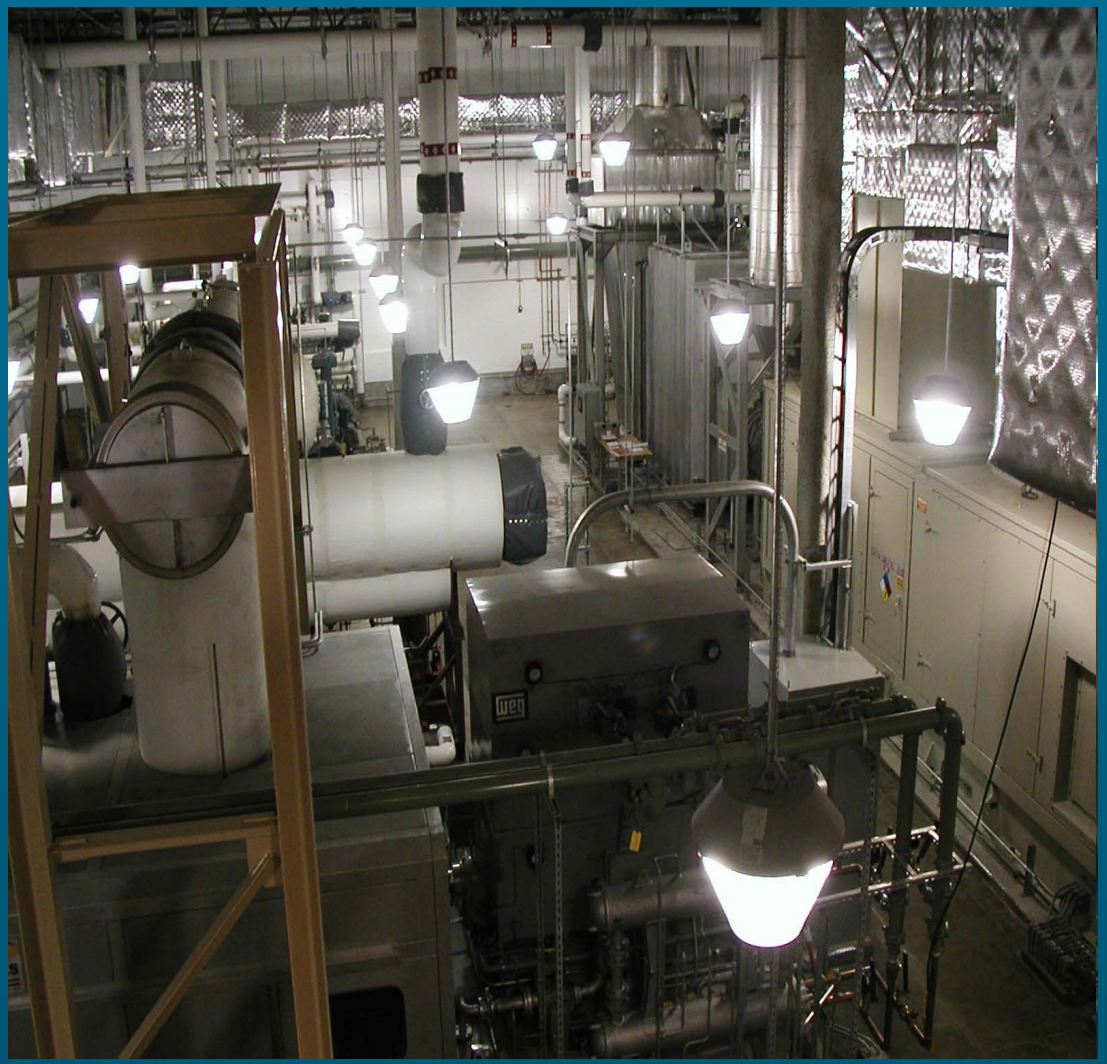
South Plant's Gas Sales Keys to Success

- Steady Supply of Biogas
  - 6000-8000 Therms/day (700,000 population)
  - Wastewater Rule of thumb: 1.25-Therms per 100-people
- Ready Supply of Water (effluent)
  - 0.8-1.0 million gpd (75-mgd plant flow)
- Equipment Reliability: 24-hr O&M
- Proximity to Major PSE gas pipeline
- Commodity prices: Electricity vs. Natural Gas
  - 6.5 ¢/kwh vs. 75 ¢/Therm

Added Modern Combined-Cycle CHP

South Plant CHP System:
2 X 3.3 MW Solar CT's + 2 MW Steam turbine…

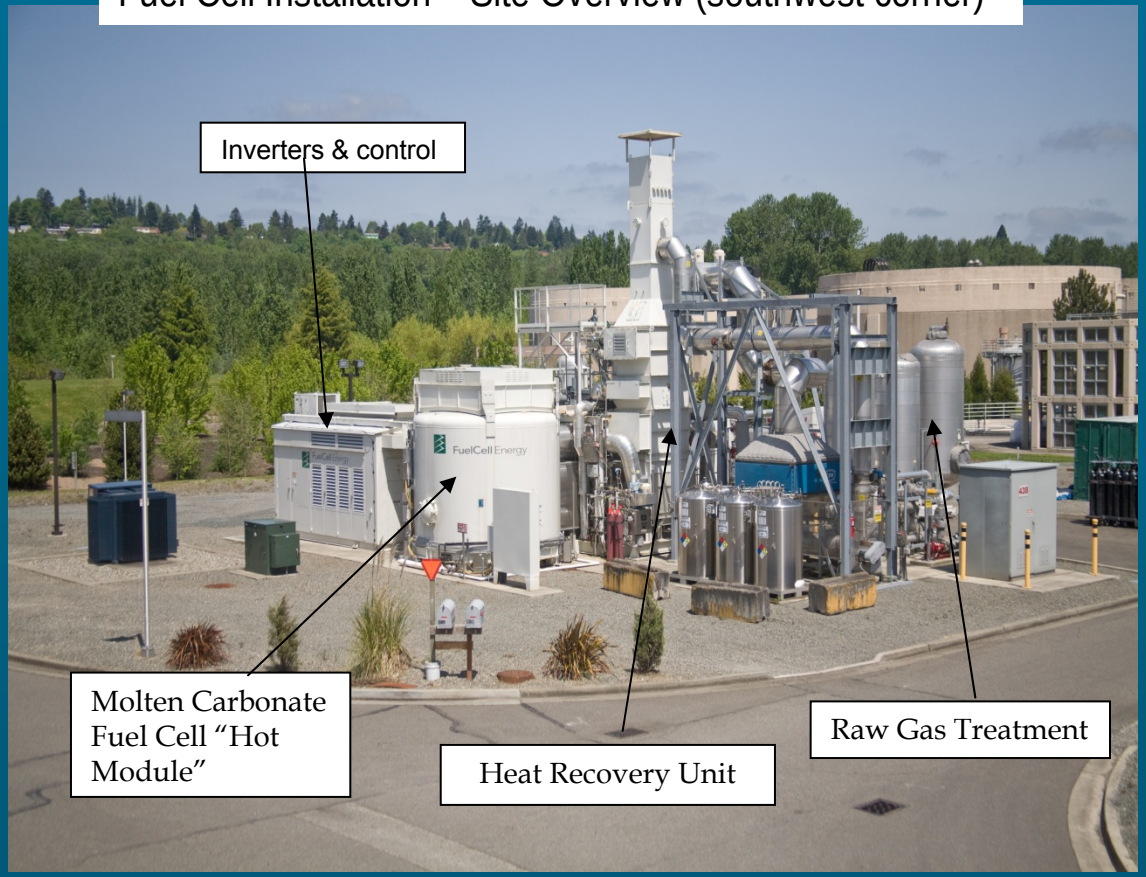
- Built for price arbitrage and energy flexibility in the wake of the 2001 west coast energy crisis.
- Steam also feeds plant heat loops



King County

1 MW Digester Gas Fuel Cell Pilot

Fuel Cell Installation – Site Overview (southwest corner)



"First of Kind" in North America

- Used FuelCell Energy 1 MW Molten Carbonate Fuel Cell.
- Proved MCFC can operate on digester gas
- Decommissioned in 2007 – too costly to repair prototype

King County

Our New Projects: Leveraging Value from 'Renewable Resource Attributes'

- NEW Way – Crediting / monetizing renewable attributes – what's best use?
- NEW Way – Leverage value of renewables to help us meet our environmental goals
- Wild West mentality in renewables markets… Hard to secure clear information on value
  - Look at GHG offsets vs. RECs in most cases… But these markets not coupled, really.
- Consultants on these issues often a bit "disappointing" – relatively inexperienced

King County

Cedar Hills Landfill Gas Project

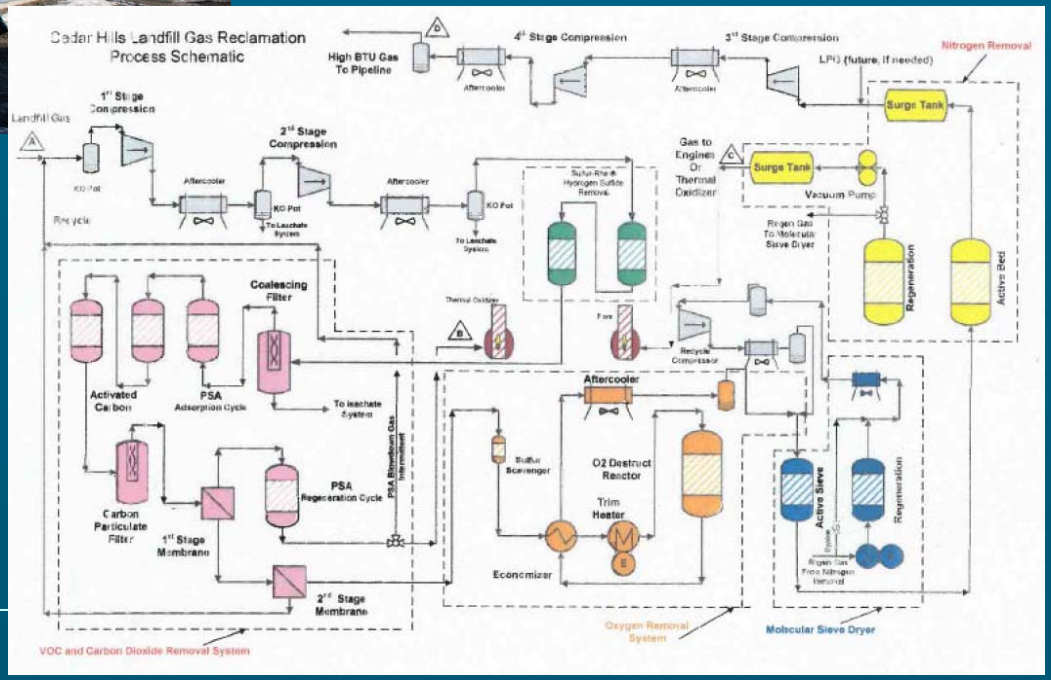
- Cedar Hills is currently the largest producer of landfill gas in the region – Very soon to be a major source of GHG-neutral pipeline gas
  - Gas purifying-compressing-sale plant in final tests by third party developer
  - Developer to sell gas and pay raw-landfill gas royalties to county
  - Estimated production of 4.5 million ft^3 per day
  - Again, proximity to major gas transmission pipeline is key
  - King County negotiating to sell environmental attributes that will be paired with gas and burned in turbines to make green electric power (RECs)

King County

Cedar Hills, Cont'd

An innovative dry "molecular membrane sieve" type of process removes impurities and concentrates the landfill gas to pipeline quality

4 stages of gas compression assist with purification and bring gas to transmission pipeline pressure



King County

King County Biogas CHP Project in Design

- West Point Waste-to-Energy CHP Plant
  - At our north wastewater treatment plant – in planning / design to generate ~ 2.3 average megawatts electricity, and heat for plant
  - Qualifies under Washington renewables classification as both renewable and distributed power source – allowing double renewable energy credits (RECs)
  - Currently finalizing purchase of power and RECs by local utility

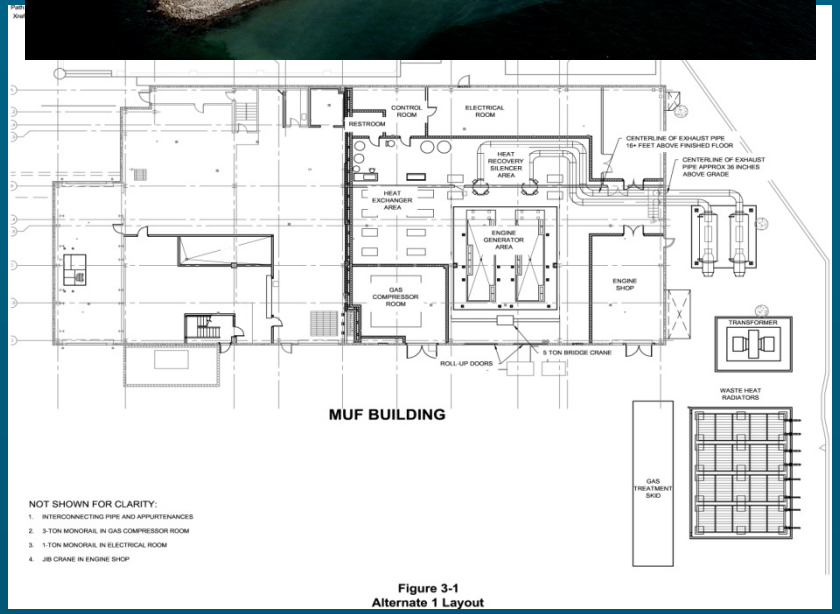


Figure 3-1
Alternate 1 Layout

King County

The Forward View

- Very challenging goals, long term – and these (Climate) are critical! Adjust tactics, but don't lose the strategy
- Governments must Lead by Example – we are built to take the long view. Have to make it work for elected officials
- Some failure is guaranteed… Not an excuse to slow down. Use what we've got…
- Keep dialogue and education ongoing – No one has the answers to the big questions.

King County

Thanks for your interest…

Questions?

David Van Holde, PE CEM
Energy Manager
King County Department of Natural Resources & Parks
Tel: 206.296.3748
Email: david.vanholde@kingcounty.gov

King County