

Alaska Railbelt Regional Integrated Resource Plan

Fourth Advisory Working Group (AWG) Meeting

October 8, 2009

Project Update

Project Activities

- Evaluation scenarios
- Definition of renewables
- Review of initial results
- Large load growth scenario
- Transmission analysis
- Fuel price forecasts
 - Deterministic
 - Natural gas probabilistic decision tree analysis
- DSM/energy efficiency programs
- Susitna evaluation
- Financial modeling

Evaluation Scenarios

- **Scenario 1 – Base Case Load Forecast**

- Current regional loads with projected growth
- All available resources – fossil fuel, renewables, and DSM/energy efficiency
- Probabilistic estimate of gas supply availability and prices
- Deterministic availability/price forecasts for other fossil fuels
- Emissions including CO2 costs
- Transmission system investments required to support selected resources
- ***Scenario 1A – Unforced Selection***
- ***Scenario 1B – Force 50+% Renewables***

- **Scenario 2 – Large Growth Load Forecast**

- Significant growth in regional loads due to economic development efforts
- Base case resources, fuel availability/price forecasts and CO2 costs
- Transmission system investments required to support selected resources
- ***Scenario 2A – Unforced Selection***
- ***Scenario 2B – Force 50+% Renewables***

Definition of Renewables – B&V Proposal

- 50% by 2025 target
 - Applies to Railbelt region, as well as the State
 - 50% of energy not capacity
- Include existing renewable resources
- DSM/EE program impacts would be in addition to renewables
- Inclusion of developing technologies in future RIRPs as they become commercially available

Renewables

- Hydroelectric
 - New
 - Existing
 - Dam
 - Lake Tap
- Wind
- Tidal
- Geothermal
- Municipal Solid Waste

Significant Load Growth Opportunities

- Large new loads (mines, etc.)
- Conversion from gas to electric space and water heating
- Electric vehicles

New Large Load Scenarios

- 500-1,000 MW Increase in Loads in 2025
- 75 Percent Load Factor
- 600 MW in Anchorage/Kenai Area
- 400 MW in Inland Area

Potential Large New Loads

- Ore processing – Anchorage Area 300 MW
- Beluga coal mine – Anchorage Area 50 MW
- Nitrogen/urea fertilizer – Kenai Area 50 MW
- Internet server – Anchorage Area 300 MW
- Donlin Creek mine – GVEA Area 200 MW
- Gold mine – GVEA Area 150 MW
- Pebble Mine

Conversion From Gas to Electric Space and Water Heating

	<u>GWh</u>	<u>MW</u>
● Residential	4,223	1,243
● Commercial	3,991	1,174
● Total	8,214	2,417

Electric Vehicles

<u>Year</u>	<u>Penetration</u>	<u>GWh</u>	<u>Coincident</u>	<u>MW</u>	
				<u>Noncoincident</u>	
2015	1%	12	0	4	
2020	2	25	0	9	
2040	16	266	4	90	
2060	25	552	9	186	

Transmission Analysis

Transmission - GRETC Concept

- Transmission system to be upgraded over time to remove transmission constraints that currently prevent the coordinated operation of all the utilities as a single entity. This is projected to happen within ten years of the base year of the study.

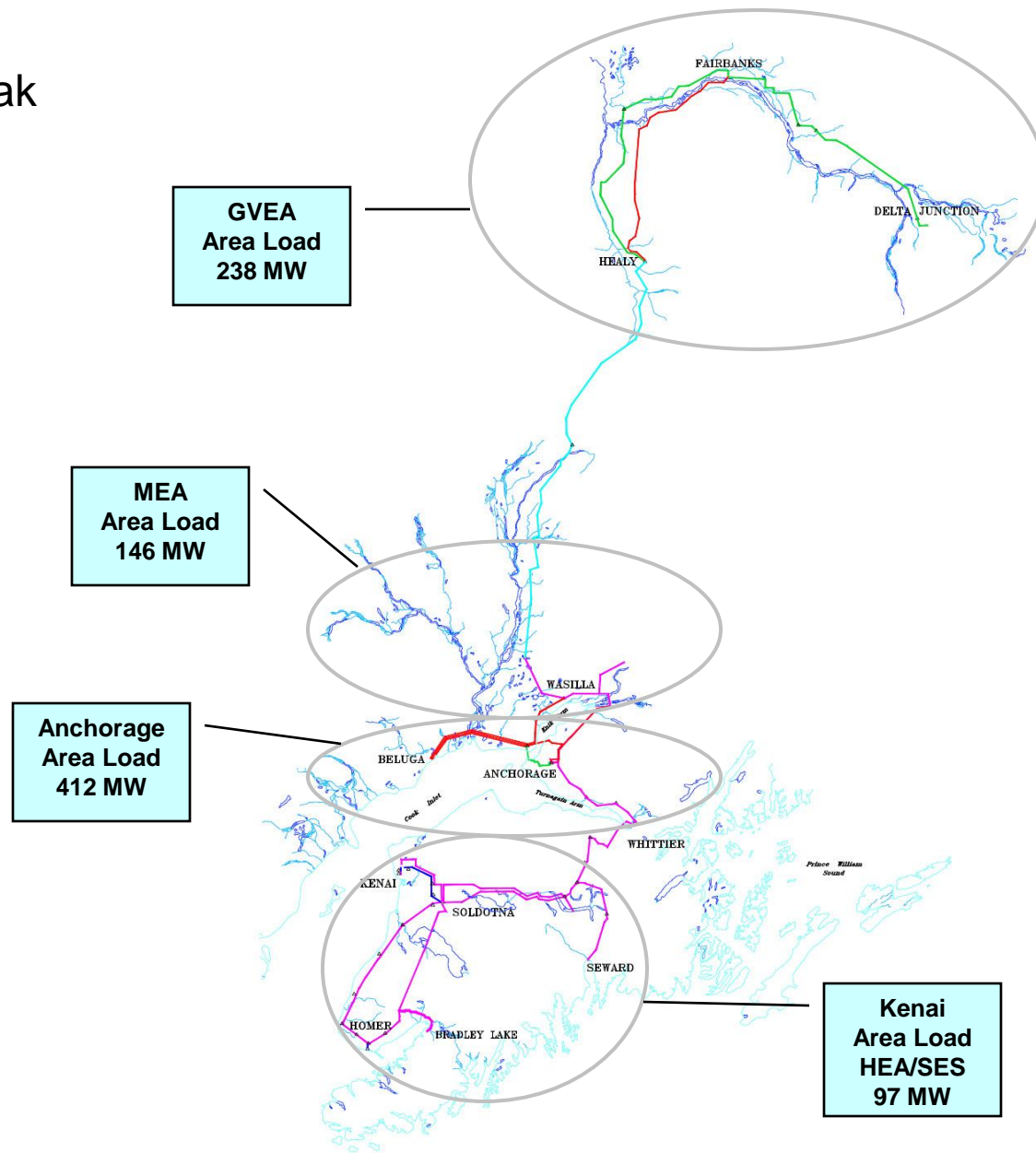
Starting Assumptions for Transmission Analysis

- Study to include all the utilities' assets 69 kV and above. These assets, over a transition period, flow into GRETC and form the basis for a phased upgrade of the system into a robust, reliable transmission system that can accommodate the economic operation of the interconnected system.
- Assumes that all utilities participate in GRETC with planning being conducted on a GRETC basis. The common goal will be the tight integration of the system operated by GRETC.

Railbelt Transmission Projects

- Projects to be classified in following categories
 - Transmission projects to connect new generation projects to the grid (Generation Interconnections)
 - Transmission projects to upgrade the grid required by the new generation project (Generation Upgrades)
 - Replacement projects that need to be done because of age and condition (Replacement)
 - Upgrade projects to the grid to implement the GRETC concept, based on existing generation (GRETC)

Load Profile – 2011 Peak



List of HEA Projects

From	To	kV	Cost	Year	Type
Soldotna	Quartz Cr	115			Replacement

List of Chugach Projects

From	To	kV	Cost	Year	Type
University	Quartz Cr	115	\$25M		Replacement
Lake Lorraine	Douglas	230			GRETC
Pt Mackenzie	Plant 2	230			Replacement
Pt Mackenzie	Pt Woronzof	138			Replacement
Soldotna	International	230			GRETC

List of MEA Projects

From	To	kV	Cost	Year	Type
Eklutna	Lucas	115			Replacement
Douglas	Hollywood	115 (138)			Replacement
Lucas	Teeland	230			GRETC

List of GVEA Projects

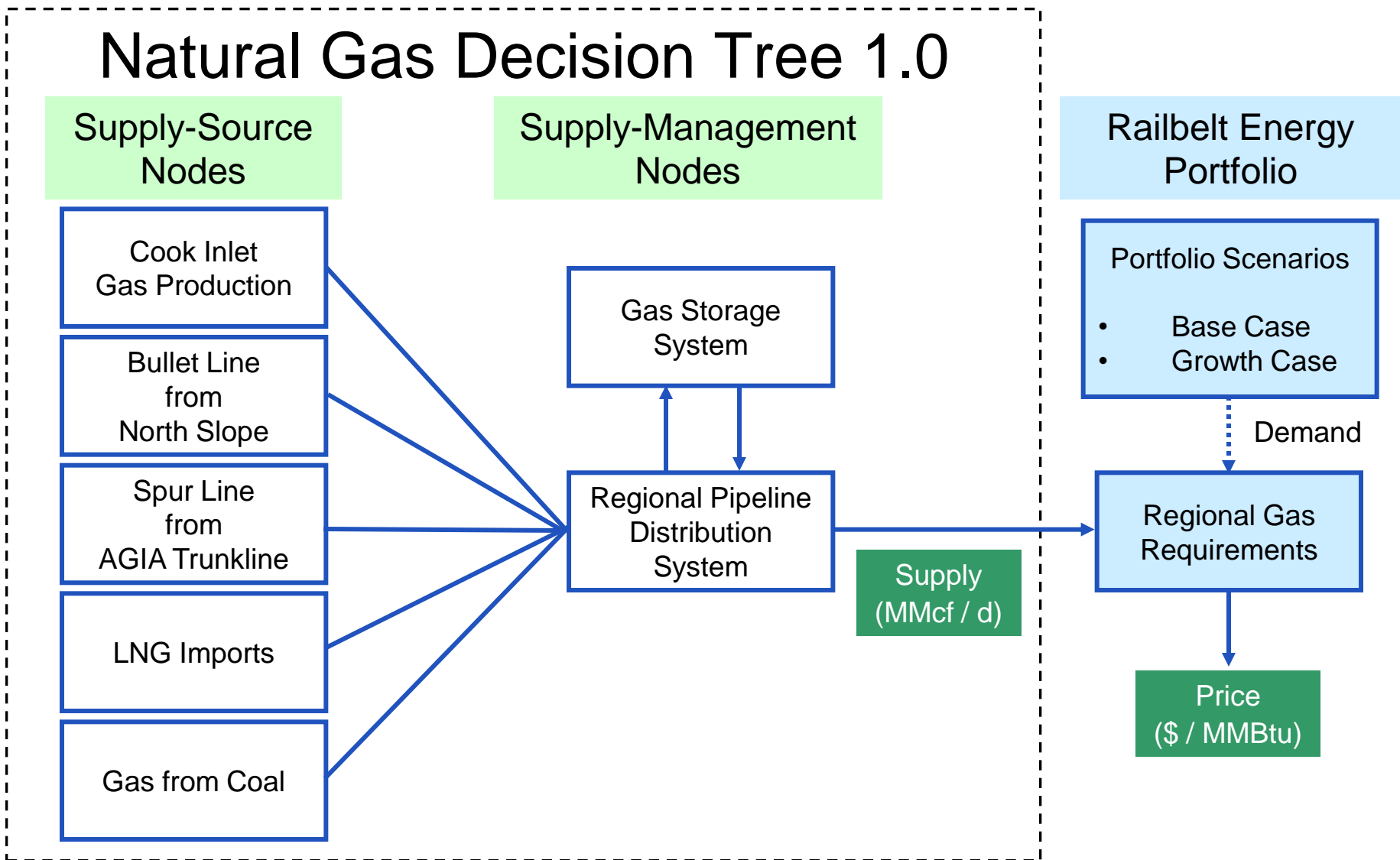
From	To	kV	Cost	Year	Type
Healy	Goldhill	138 (230)	\$80.0 M	2017-2021	Replacement
Douglas	Healy	138 (345)	\$20.0M		Replacement

Generation Related Transmission Projects Projects

Name	Connect To	MW	kV	Cost \$M	Year	Type
Chakachamna	Beluga	330	230		2017	Generation Interconnection
Mount Spurr	Beluga	100	115		2016	Generation Interconnection
Glacier Fork	Lucas	75	115		2014	Generation Interconnection
Susitna	Gold Creek	1200	230	\$196.3	2025	Generation Interconnection

Natural Gas Probabilistic Decision Tree Analysis

Components of the Natural Gas Decision Tree



Components of the Natural Gas Decision Tree 2.0

- Simulate each year in the first decade (2010-2019)
- Divide other decades into two 5-year parts
- Annualize outer decades by interpolation using 5-year intervals

Risk-Based Natural Gas Forecast																	
<i>Strawman</i> Simulation Matrix 2.0A (<i>one of a few</i> arrays that might be chosen)																	
● = Primary node (major supply) ○ = Secondary node (minor supply)																	
Model Node	Annualized Gas Supply by Decade (P ₁₀ , P ₅₀ , P ₉₀ as MMcf / d)																
	2010-2019										2020-2029	2030-2039	2040-2049	2050-2059			
	10	11	12	13	14	15	16	17	18	19							
Cook Inlet Gas Production (3 options)	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○
Bullet Line from North Slope						○	○	○	●	●	●	●	●	●	●	●	●
Spur Line from AGIA Trunkline								○	○		●	●	●	●	●	●	●
LNG Imports (incl. Storage)				○	●	●	●	●	●	●	●	●	●	●	●	●	●
Other Railbelt Gas				○	○	○	○	○	○	○	○	○	○	○	○	○	○

Changes to be Made to Version 1

- Yearly resolution of simulations run for the first decade (2010-2019)
- Outer decades (2020-2059) divided into 5-year segments per decade
- Cook Inlet Gas Production node sub-divided into three sub-nodes:
 - Known, producing fields
 - Re-developed, known fields
 - New field brought online through E&P
- Incorporate updated DNR estimate of Cook Inlet reserves, once available

Changes to be Made to Version 1 (continued)

- Additional placeholder supply nodes
 - LNG trucked from North Slope (Fairbanks Natural Gas)
 - New gas from development of other Railbelt gas fields (Nenana)
- Remove assumption that Bullet Line would be retired prematurely
- Economic ranking of physical supply nodes as part of probability assessments
- Build in seasonality to the extent possible
- Incorporate completion risks
- Update demand curves

DSM/Energy Efficiency (EE) Program Update

Objectives

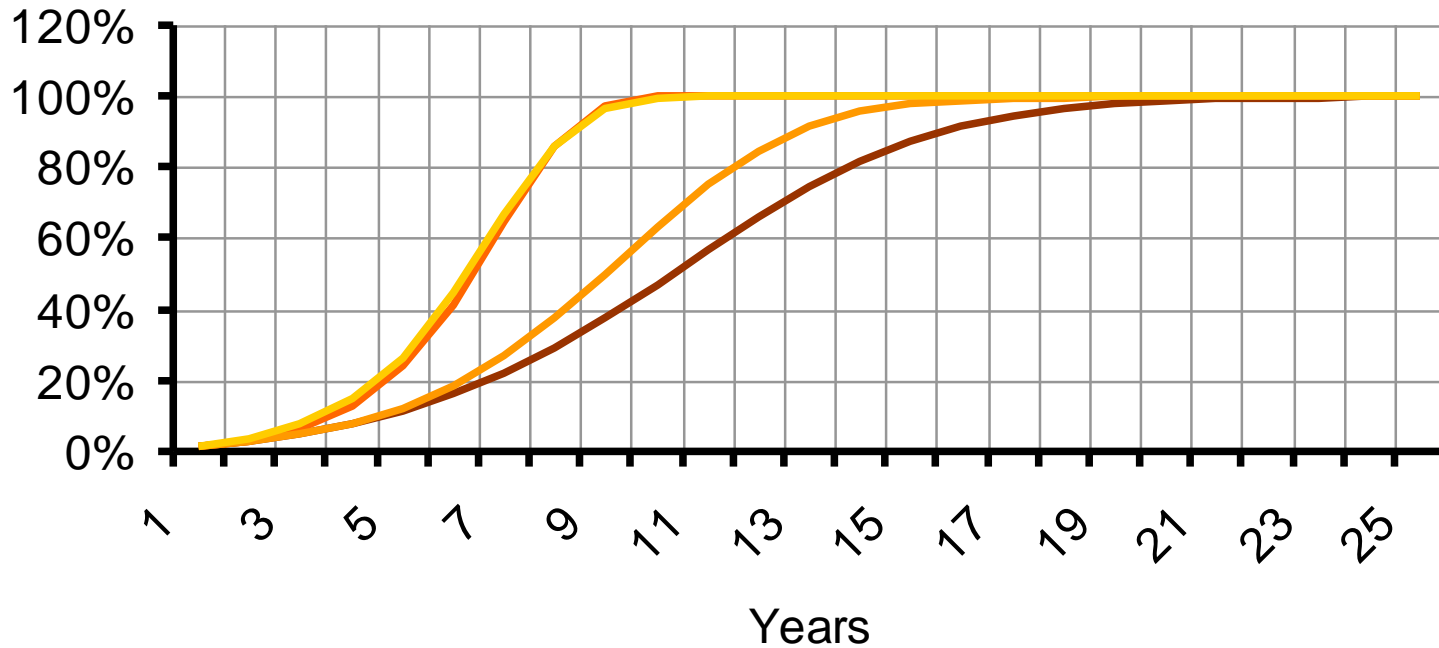
- Develop a portfolio of appropriate DSM/EE programs that make sense for the region from a customer, market and economic standpoint
- Provide inputs to IRP modeling characterizing the DSM/EE portfolio
- Suggest program designs and implementation roadmap for consideration going forward that could be implemented at the regional level



Sample Measure	Sector	Technology	Measure life	Target kWh per customer	Target kW per customer	Cost per installation
1) Refrigerator recycling	Residential- Non Weather	Appliance	6	1,672.0	0.191	\$ 130.00
2) Roof Insulation	Residential - Weather	Shell	20	41.7	0.025	\$ 441.32
3) LED Exit Signs Electronic Fixtures (Retrofit Only)	Commercial - Non Weather	Lighting	15	201.0	0.023	\$ 33.00
4) Window Film	Commercial-Weather	Cooling/ Heating	10	256.0	0.147	\$ 84.60

Penetration Rates

10 year BAAS Penetration Curves



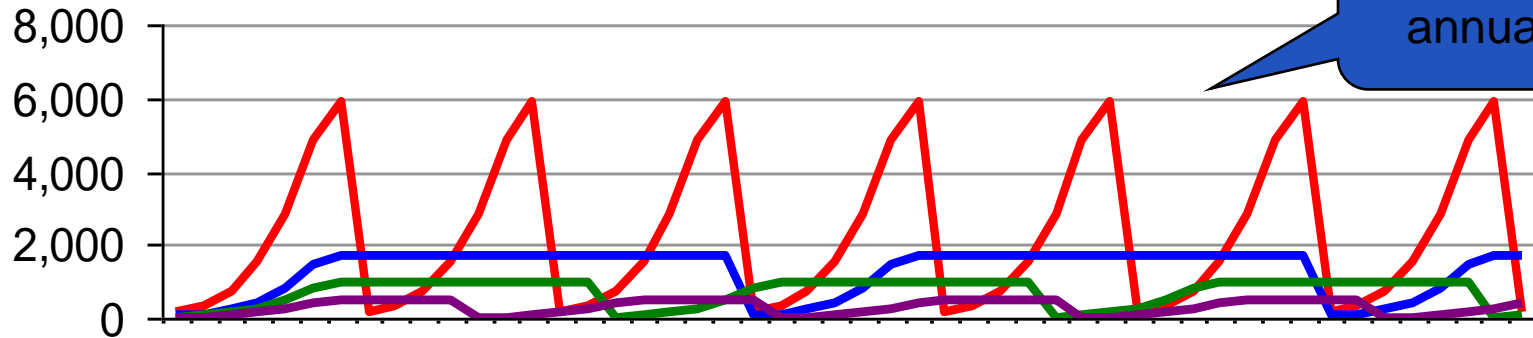
- 10-Year under Baseline
- 10-Year under Full Rebate
- 10-Year under Education
- 10-Year under Cool Update



CHUGACH ELECTRIC ASSOCIATION - Residential end use study

<u>AVERAGE APPLIANCE SHARES</u> (% of housing)	<u>2005</u>	<u>2010</u>	<u>2015</u>
Primary Space Heat	8.3%		7.6%
Secondary Space Heat	7.8%		7.8%
Ventilation	91.3%		92.1%
Freezer	56.4%		56.6%
Refrigerators	103.0%		103.0%
Dishwasher	84.4%		85.7%
Clothes Washer	92.4%		93.8%
Water Heater	18.6%		20.3%
Cooking	58.1%		52.2%
Dryer	75.4%		76.7%
Lights	100%		100%
Other	100%		100%

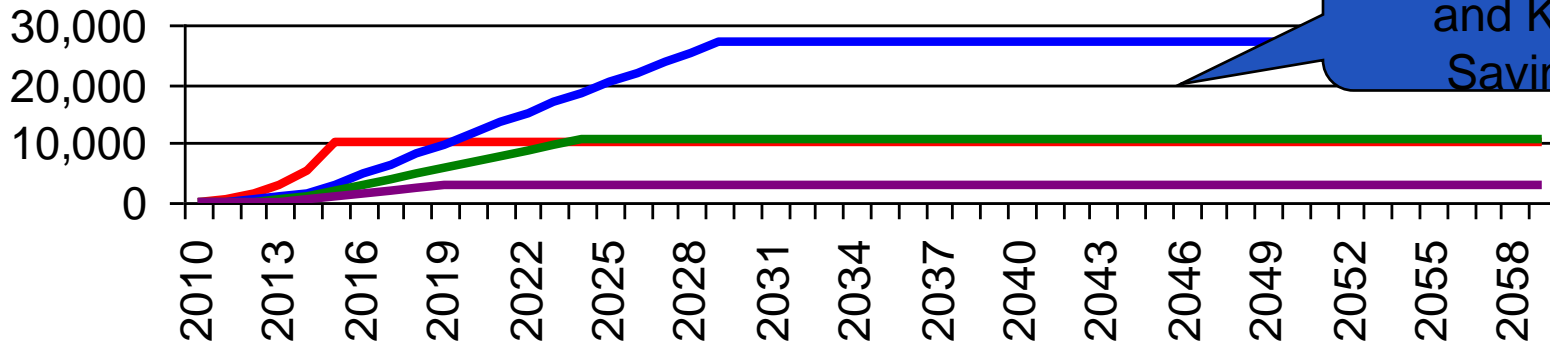
New Installations per year



Relevant to annual Costs

Cummulative Installations per year

= Active on Previous year – Retirements + New Additions



Relevant to KW and KWh Savings

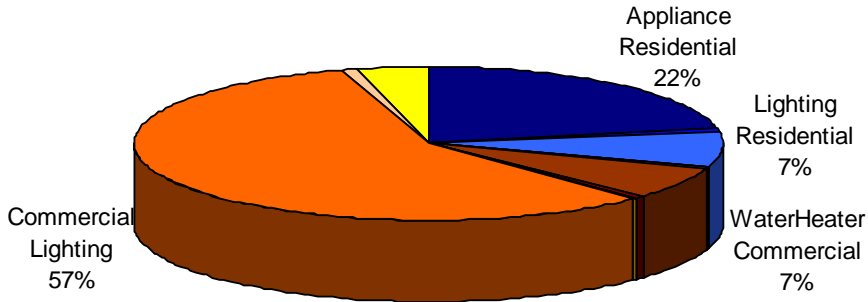
- Refrigerator recycling
- Roof Insulation
- LED Exit Signs Electronic Fixtures (Retrofit Only)
- Window Film



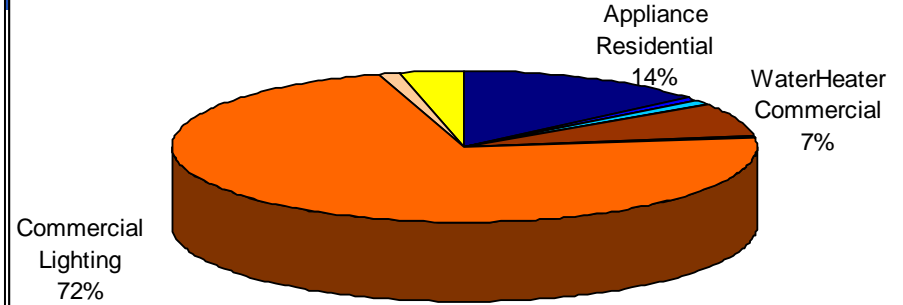
Energy Savings (KWh Savings per measure per year)			
Measure	2010	2011	2012
Refrigerator recycling	235188.7	790428.5	2032089
Roof Insulation	1706.707	5735.947	14746.37
LED Exit Signs	4.966338	15720.77	40416.06
Window Film	7448.401	10013.46	25743.3
Capacity Savings (KW Savings per measure per year)			
Measure	2010	2011	2012
Refrigerator recycling	27	90	232
Roof Insulation	1	3	9
LED Exit Signs	0	2	5
Window Film	4	6	15
Measure Cost (\$ Cost per measure per year)			
Measure	2010	2011	2012
Refrigerator recycling	\$ 18,286	\$ 43,171	\$ 96,541
Roof Insulation	\$ 18,081	\$ 42,686	\$ 95,457
LED Exit Signs	\$ 768	\$ 1,813	\$ 4,054
Window Film	\$ 984	\$ 2,324	\$ 5,197



2015 Energy Savings

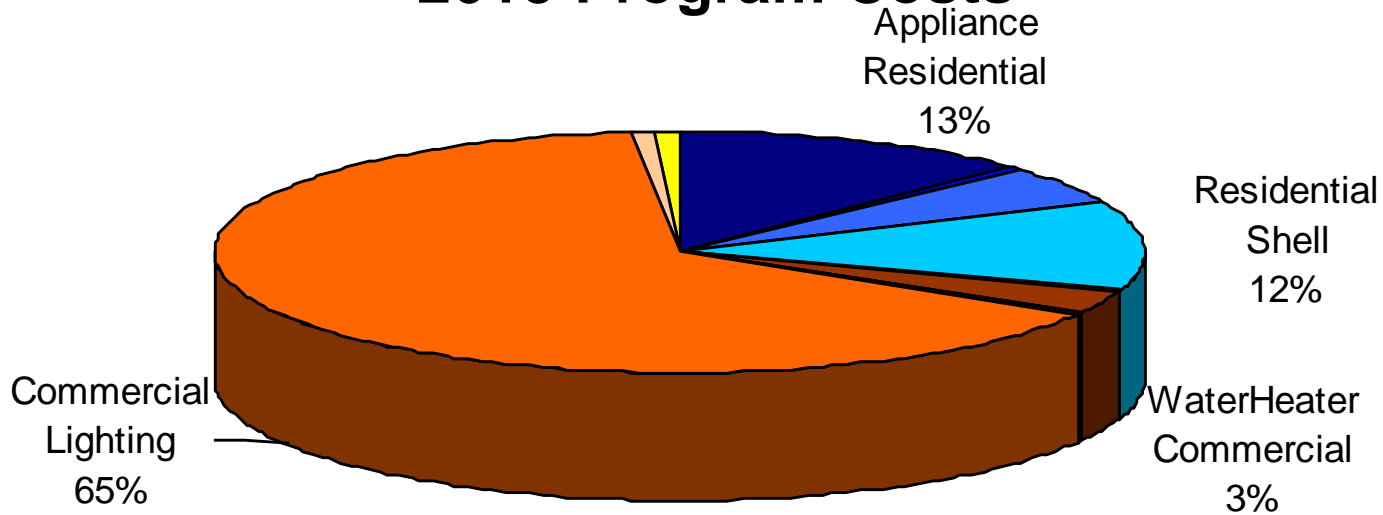


2015 Capacity Savings



- Residential Appliance
- Residential Lighting
- Residential Cooling/Heating
- Commercial Office Load
- Commercial Lighting
- Commercial Cooling/Heating

2015 Program Costs



- Residential Appliance
- Residential Lighting
- Residential Cooling/Heating
- Commercial Office Load
- Commercial Lighting
- Commercial Cooling/Heating
- Residential WaterHeater
- Residential Shell
- Commercial WaterHeater
- Commercial Motor
- Commercial Refrigeration

Other Topics

Public Outreach Activities

- Activities already included in RIRP work plan
 - Monthly Advisory Working Group meetings
 - Presentation of preliminary results and recommendations
 - Draft Report
 - Final Report
- Other planned activities
 - Utility Task Force meetings
 - Ongoing discussions with utility management teams and other stakeholders
 - Legislative outreach
- Other activities that should be taken

Important Activities Over Next Two Months

- Finalize RIRP modeling - October
- Develop resource plans for each evaluation scenario
- Develop implementation roadmap for each resource plan
- Presentation of preliminary results and recommendations
- Fifth Advisory Working Group meeting