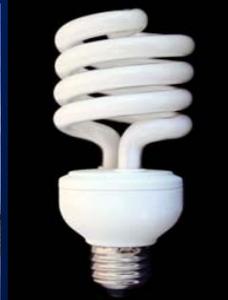


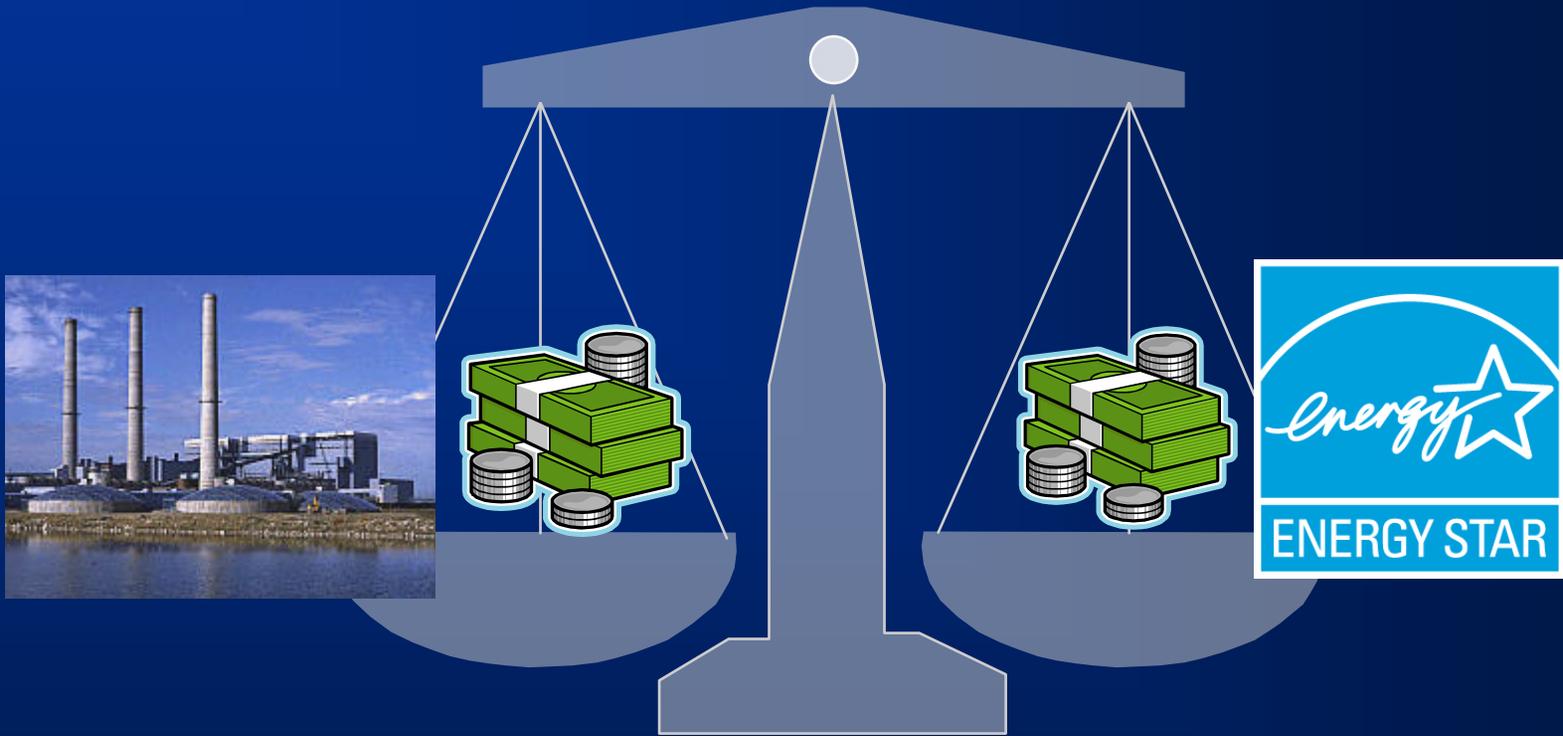
City Water and Light Public Meeting IRP Interim Report May 28, 2008



Agenda

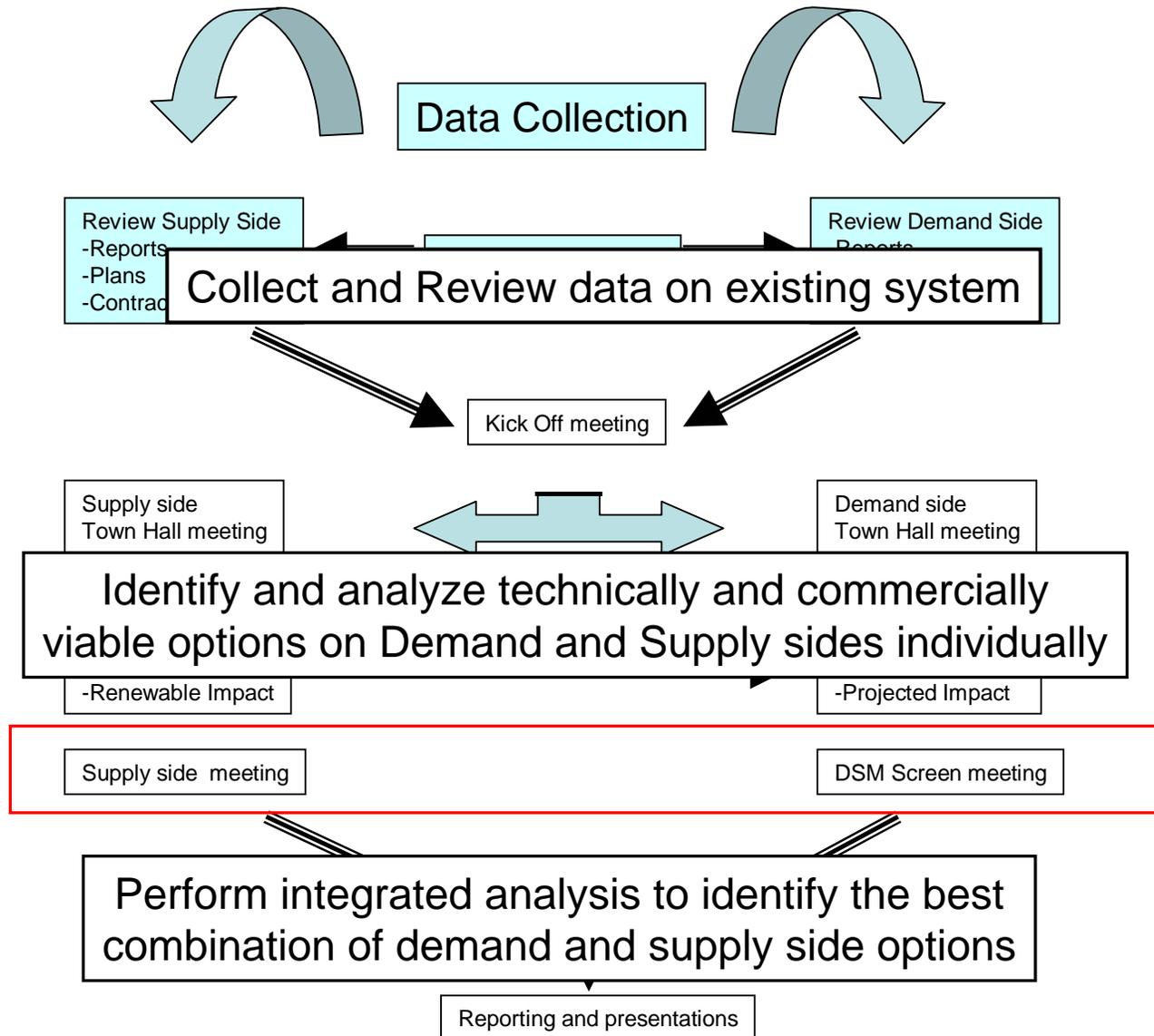
- Review of what an IRP is/how it is performed
- Where are we in the process?
- Supply Side options reviewed
 - Technologies
 - Evaluation process
- Summary of supply findings
- Demand Side options reviewed/not reviewed
 - Technologies
 - Evaluation process
- Summary of demand side findings
- Issues for integration phase
- Comments/Questions?

Integrated Planning Objective

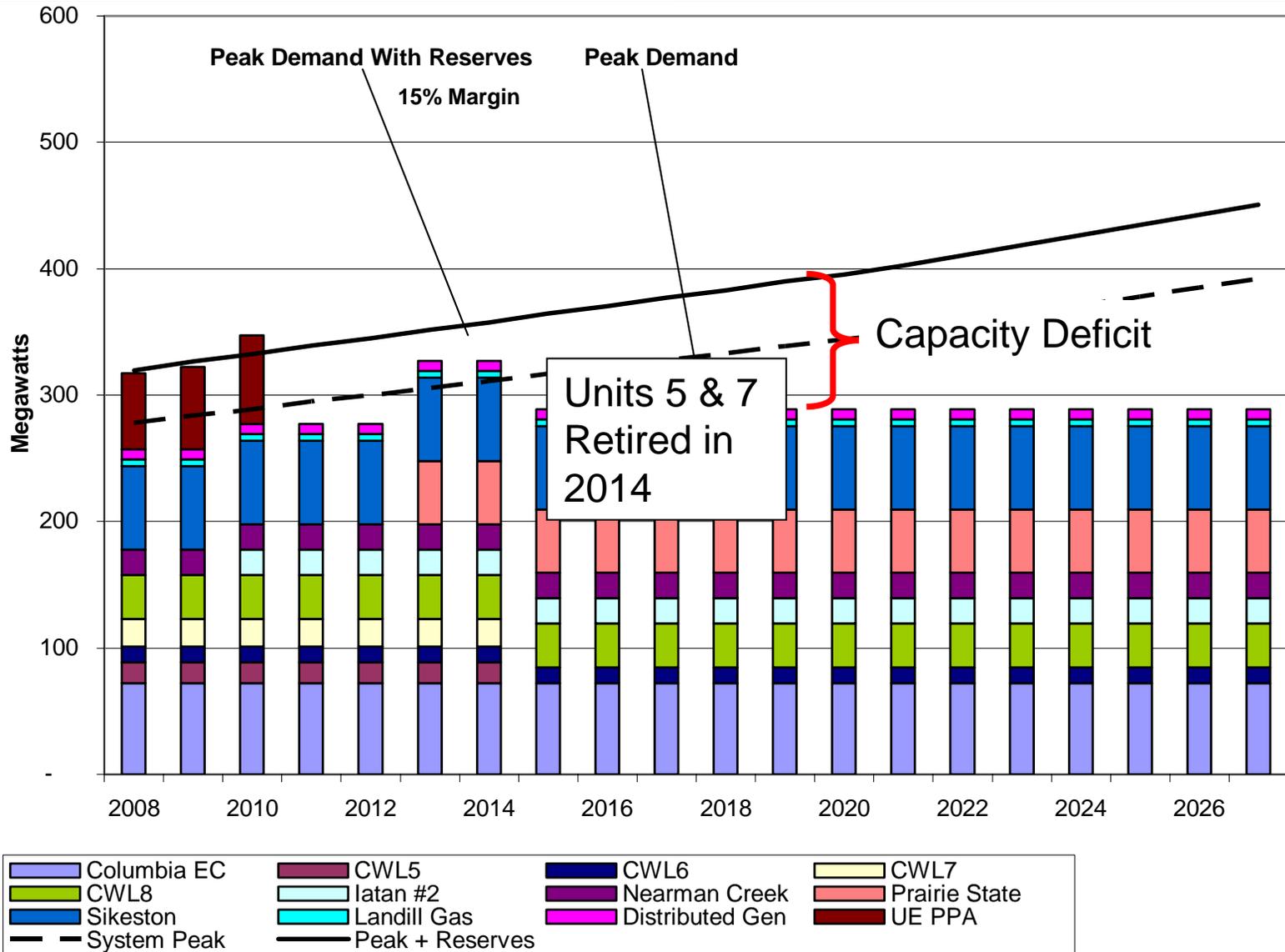


Balance costs of supplying electricity
versus saving electricity

Overview of Study Process

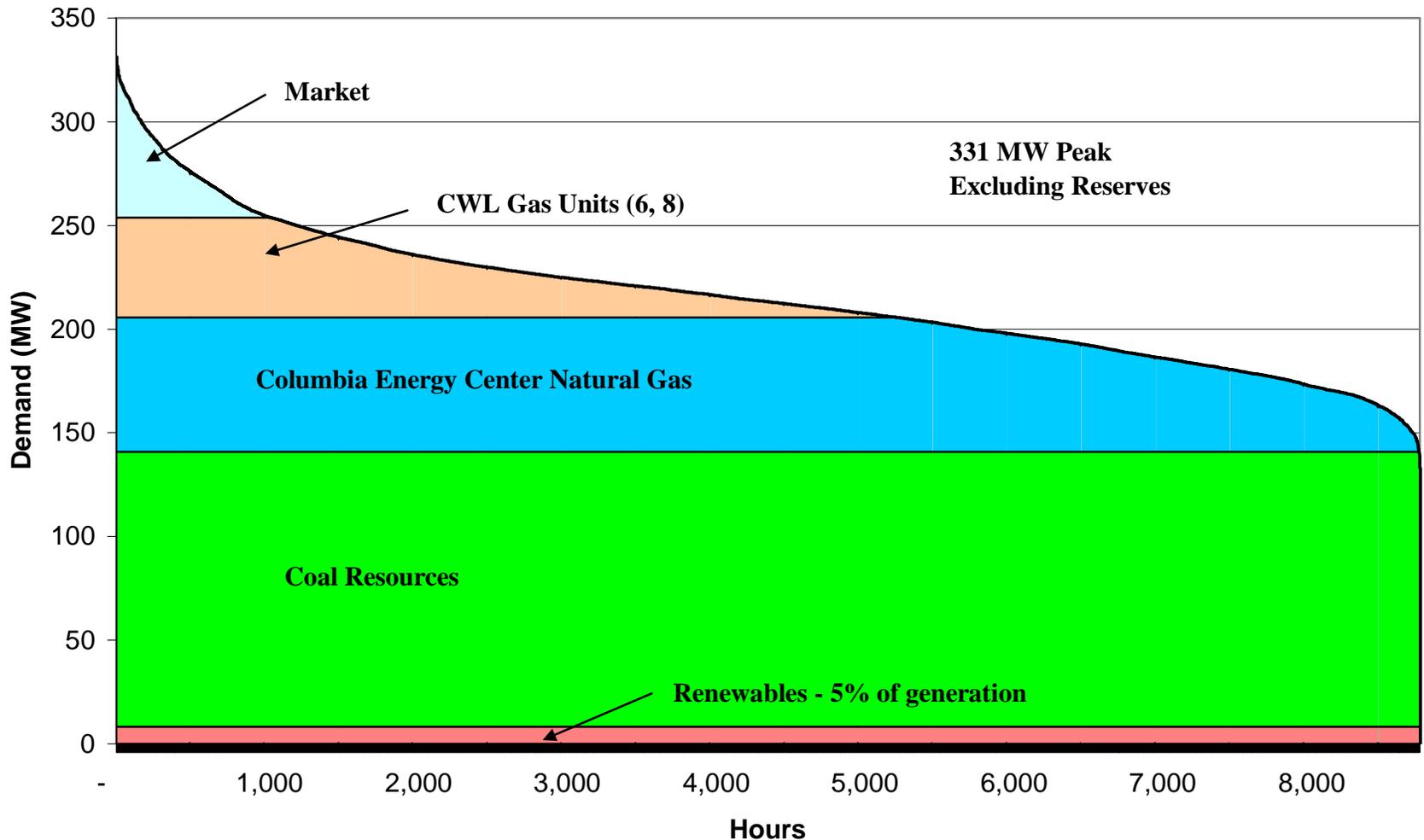


Current Forecast of Demand Compared to CWL Resources



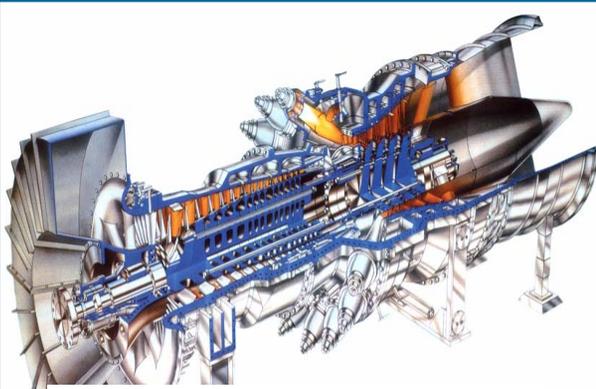
With Existing Resources, energy post 2015
will come increasingly from natural gas,
market, renewables

Example 2015 Load Duration Curve and Available Energy

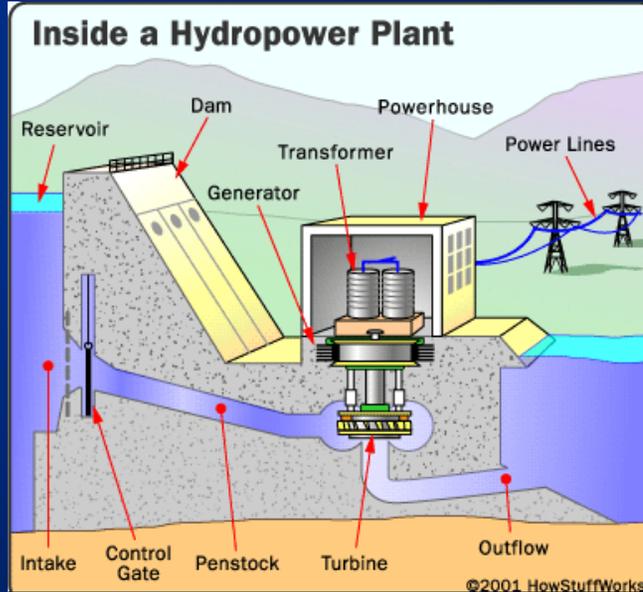


Supply Side Discussion

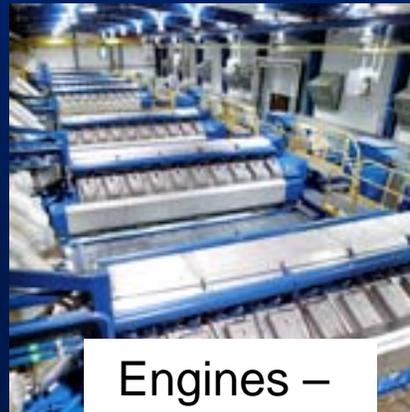
Supply Side Options



Combustion
Turbine – Natural Gas



Coal/Biomass



Engines –
Natural Gas



Supply Side Options are Reviewed to Develop Portfolios



Technology,
MW and Year Needed

- Resource options included in portfolio analysis
 - Regional coal unit – Participation levels of 100MW, 50MW, 25MW
 - Local fluidized bed unit – 110MW, 70MW
 - Local IGCC unit -150MW
 - Local Combustion turbine-50MW
 - Local Engine sets – 8MW
 - Local Solar 10MW PV
 - Regional Wind
 - Area Pumped Hydro – 60MW
 - Market
 - Combined Heat and Power 5MW

Supply Options Not Considered Practical or Competitive at this point...

- Nuclear-
 - Although discussions about a potential project are being considered in the region, the project was not sufficiently developed to be considered.
 - On line date for nuclear is extremely uncertain. Earliest would probably be 2018 to 2020.
- Wind in Columbia
 - Columbia wind regime is not as good as areas to the west and therefore not as cost effective as other projects.
 - Large turbine projects can be difficult to site (300 foot towers, 200 to 250 foot diameter propellers.
 - Small, residential units conflict with zoning ordinances (typically have a 100 foot tower)
- Other Solar
 - Solar concentrating sterling engines are being installed in California. These devices are not in a fully commercial status and price/performance are not available from vendors for general application in studies.
 - Solar concentrating thermal plants have target price of \$170 per MWh with solar insolation in southwest. This cost is not competitive with other options CWL has available even before adjusting for Midwest insolation.
- Small/Micro Hydro-electric
 - Performance and costing is very site specific
 - Permitting is under control of a variety of agencies and can significantly add to the cost

Other Considerations

- Carbon tax at \$0, \$10, \$30 per ton were included
- Reviewed transmission import issue
 - Requires investment in upgrades to improve import capability
- Reserve margin (backup capacity required by MISO) of 15% maintained

Future with Blend of In Town and Out of Town Traditional Options

Engine sets at
CWL Plant



34MW

2011

Participate in Remote
Coal Unit



25MW

2015

25MW

2016

Market Purchases
Up to 60MW



2027

Future with More Renewable Energy from Wind

Engine sets
at CWL Plant



34MW

Wind to Replace New Coal



Market Purchases
Up to 110MW

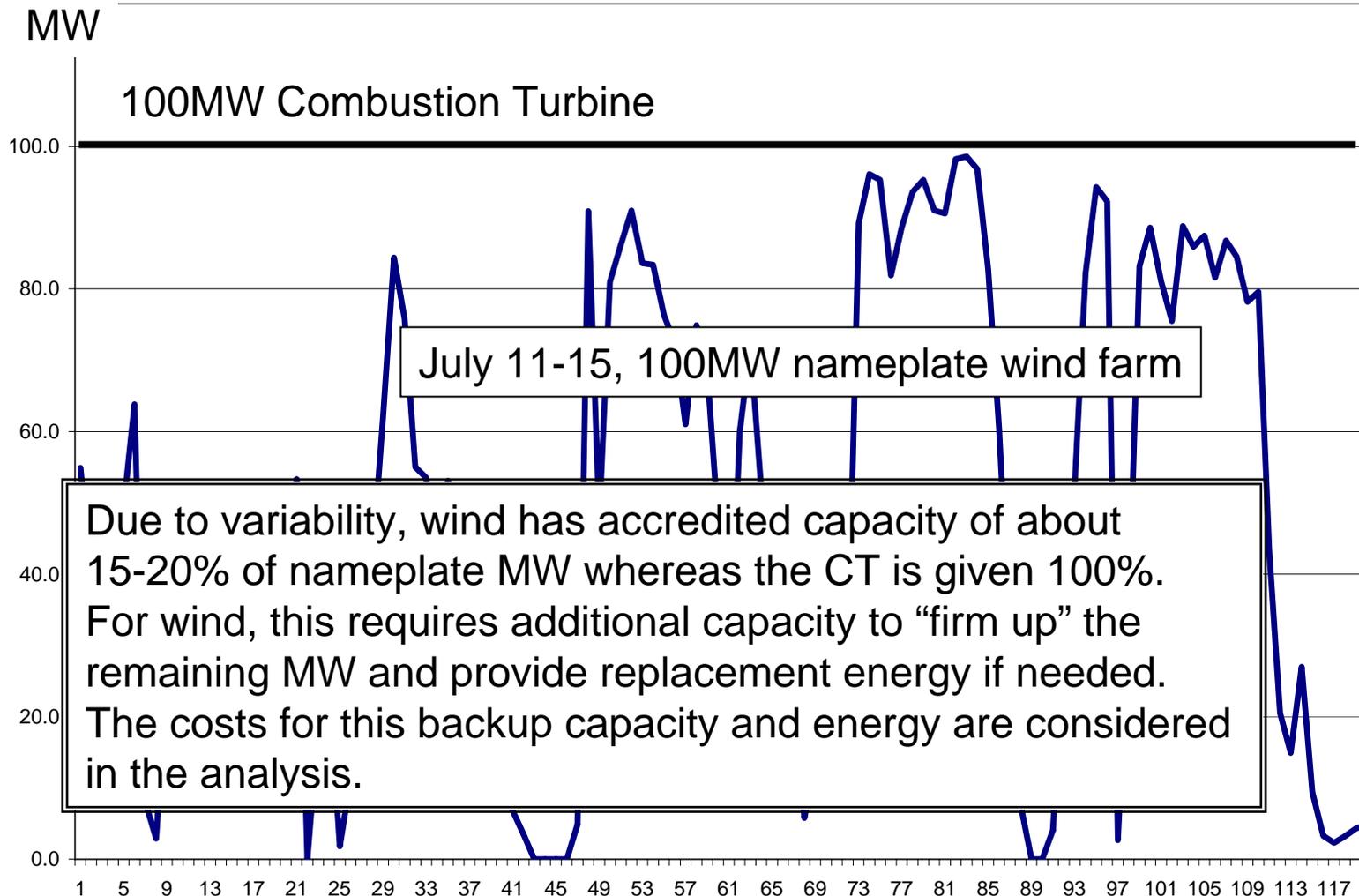
2011

2015



2027

Example of Wind Turbine Output – Texas vs Combustion Turbine



Hours

Future with In Town Options Biomass

Engine sets at
CWL Plant



34MW

2011

Local Biomass Plant



73MW

2015

Market Purchases
Up to 100MW



2027

Future with In Town Options Biomass and Solar

Fixed PV on
Commercial rooftops



Engine sets at
CWL Plant



Local Biomass Plant



Market Purchases
Up to 110MW

10MW

8MW

73MW

2009

2011

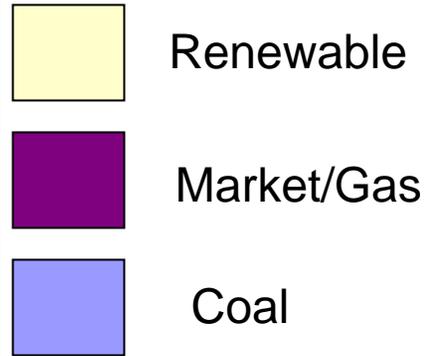
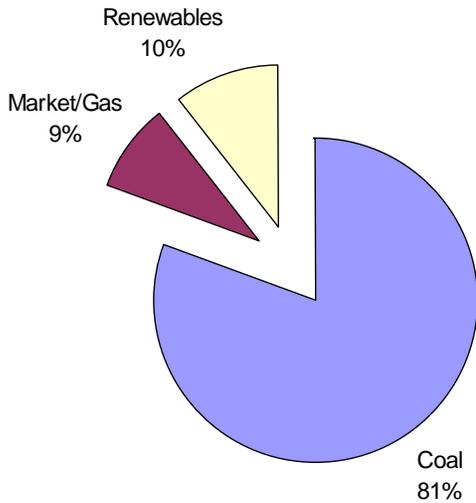
2015



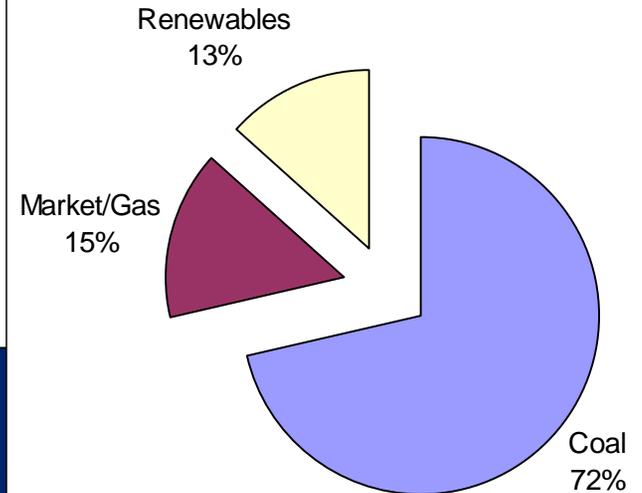
2027

Sources of Energy

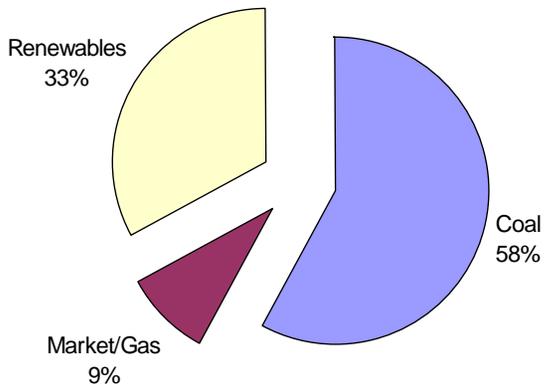
Coal Case MWh Output



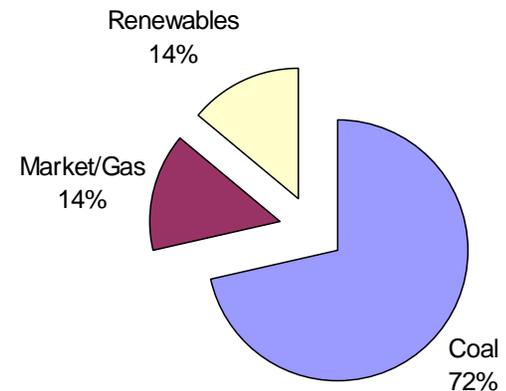
Biomass Case MWh Output



**Wind Replace
New Coal**

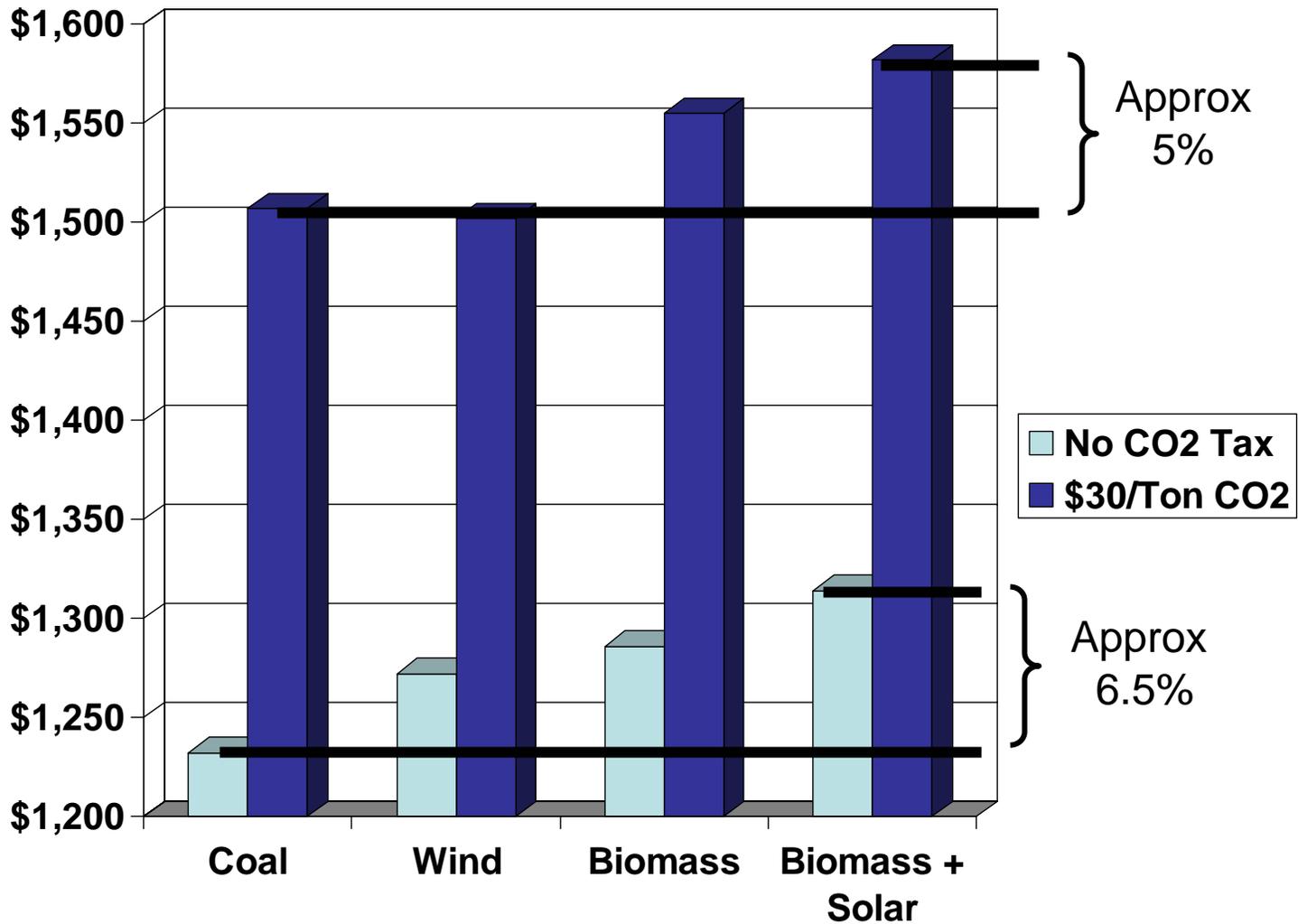


Biomass Solar MWh Output



Comparison of Portfolio Costs (Incremental Cost Basis-No DSM Effects)

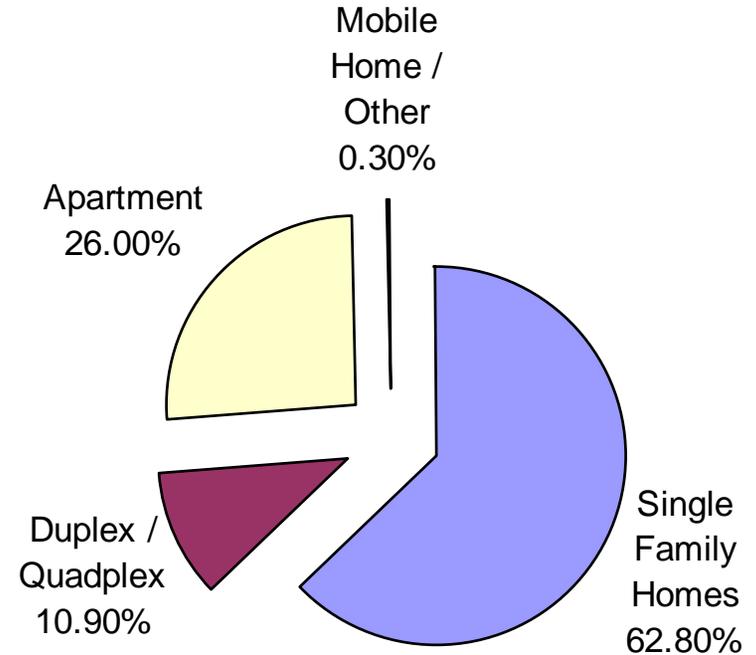
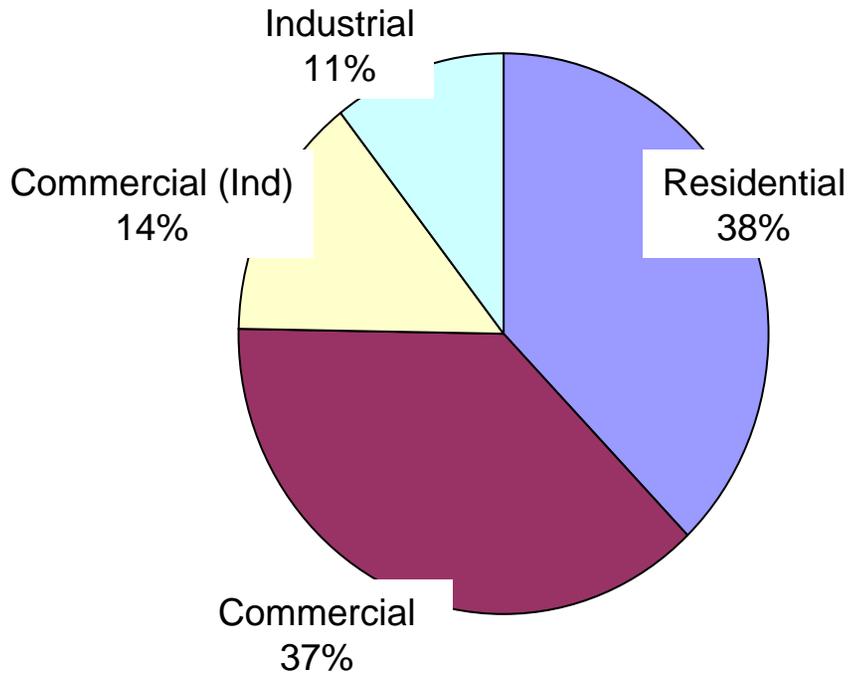
\$millions



Demand Side Management Discussion

- Develop Options
 - Options had to be quantifiable and measurable to translate into load reductions in forecast.
 - “Soft” programs like energy audits, education programs, etc would continue to be offered by CWL, but are outside this analysis
- Screen Options-Identify Options with Benefit/Cost ratios greater than one.
 - Benefits
 - kW and kWh impacts by option
 - Inventory of option on CWL system
 - Cost of implementation was based on either
 - Total installed cost or
 - Portion of installed cost (CWL rebate)
- Determine total DSM load impact
- Determine total CWL system impact

Columbia Energy Uses by Customer Class

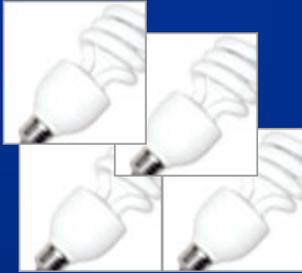


National Averages for Energy Usage

Residential Function	Electricity %
Space Cooling	18.8%
Lighting	17.0%
Refrigeration	11.8%
Electronics	11.6%
Space Heating	11.4%
Water Heating	9.7%
Laundry/Drying	7.4%
Cooking	5.8%
Other	4.5%
Computers	1.9%

Source: DOE
–Natural Gas Heat

DSM Benefit/Cost



Number of
End uses

X

kWh(old)-kWh(new)

kW(old)-kW(new)

Impact per
End use
(kW or kWh)

=

Expected energy or
demand reduction for CWL



- \$ for DSM option
- Cost of device
 - Cost of rebates
 - Cost of operations & maintenance

Compared to

- \$ for Power Production
- Cost of Investment
 - Cost of fuel, emissions
 - Cost of operations & maintenance

DSM Option Evaluation – Major Areas

- Residential
 - HVAC
 - Thermal Envelope
 - Appliance
- Commercial
 - HVAC
 - Appliance
 - Lighting
- Industrial
 - Machine Drive
 - HVAC
 - Lighting

40 Options Evaluated
Cost was CWL rebate=
50% of installed cost.

Lighting and HVAC change out options
affected by Federal Energy Stds
-SEER 13 to 16 existing program
-Compact Fluorescent existing program

More effective Residential
options included:
-Building envelope modifications
-Tighten ductwork
-Programmable thermostats
-Retire old refrigerators/recycle
second units

DSM Option Evaluation – Major Areas

- Residential
 - HVAC
 - Thermal Envelope
 - Appliance
- Commercial
 - HVAC
 - Appliance
 - Lighting
- Industrial
 - Machine Drive
 - HVAC
 - Lighting

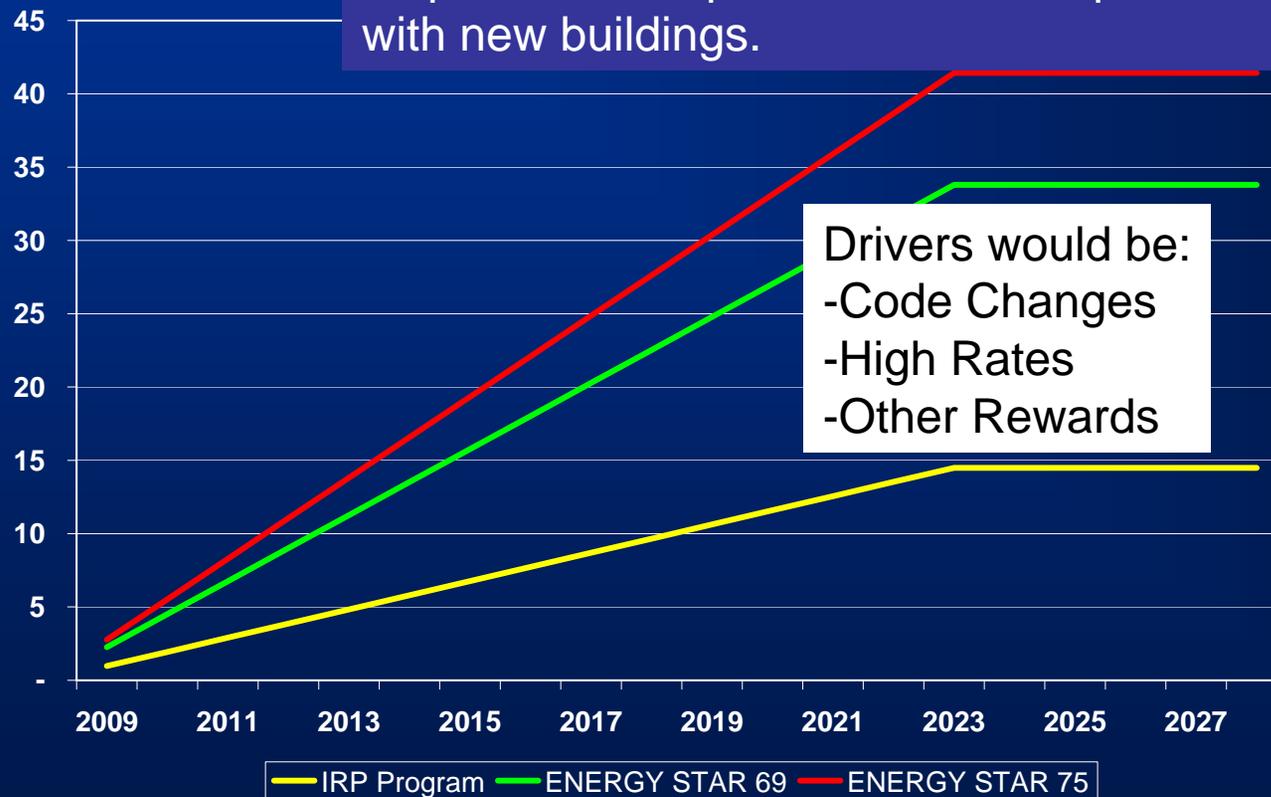
Options did not include building envelope modifications to existing structures:

- Variety of commercial buildings
- Uncertainty of acceptance of architectural changes
- Wide differential in cost to implement

Commercial Demand Side Savings Potentials

To obtain savings above those analyzed building envelope changes would have to be part of the improvement. More probable with new buildings.

MW Reduction



LEED Minimum

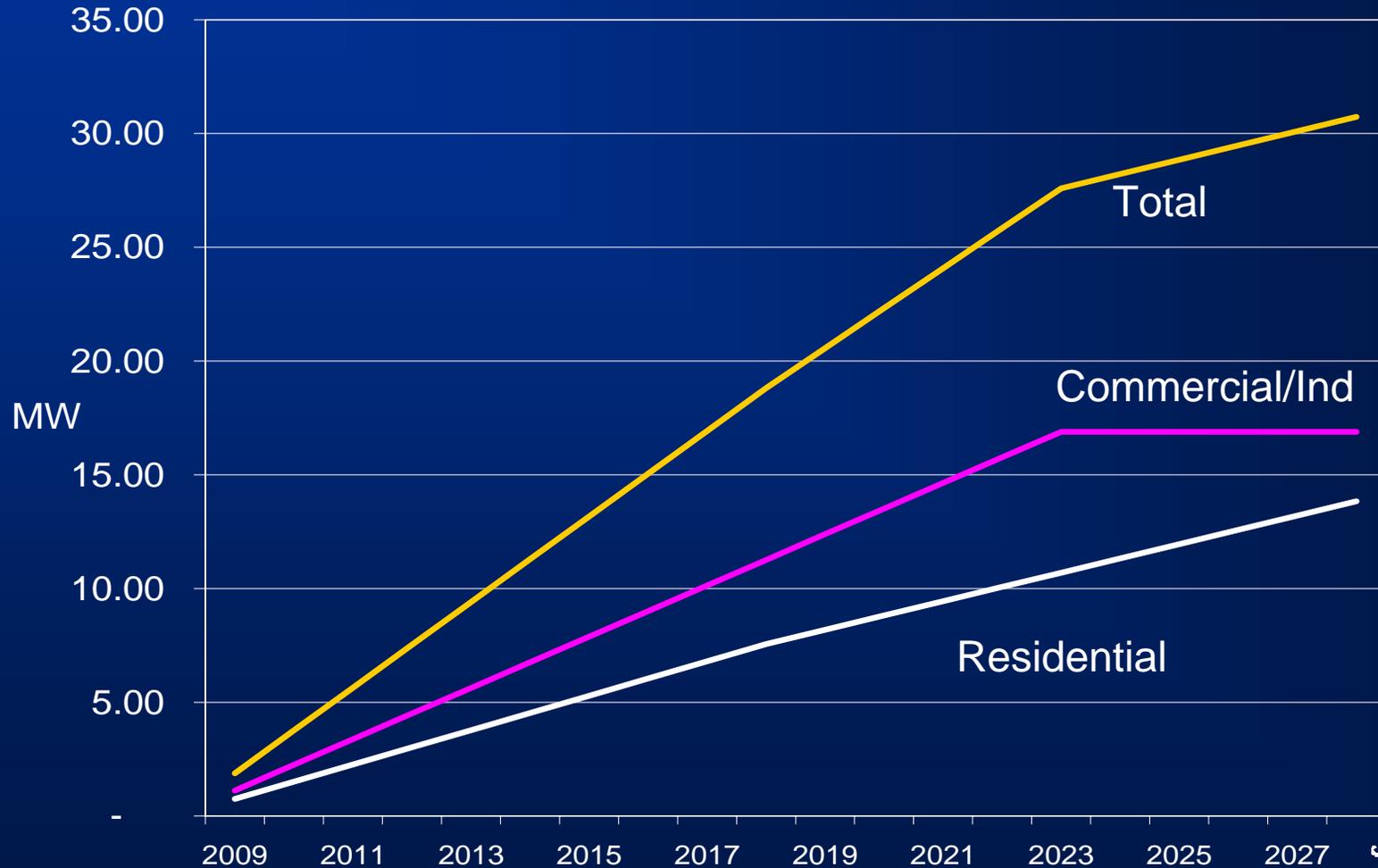


Columbia average for this analysis

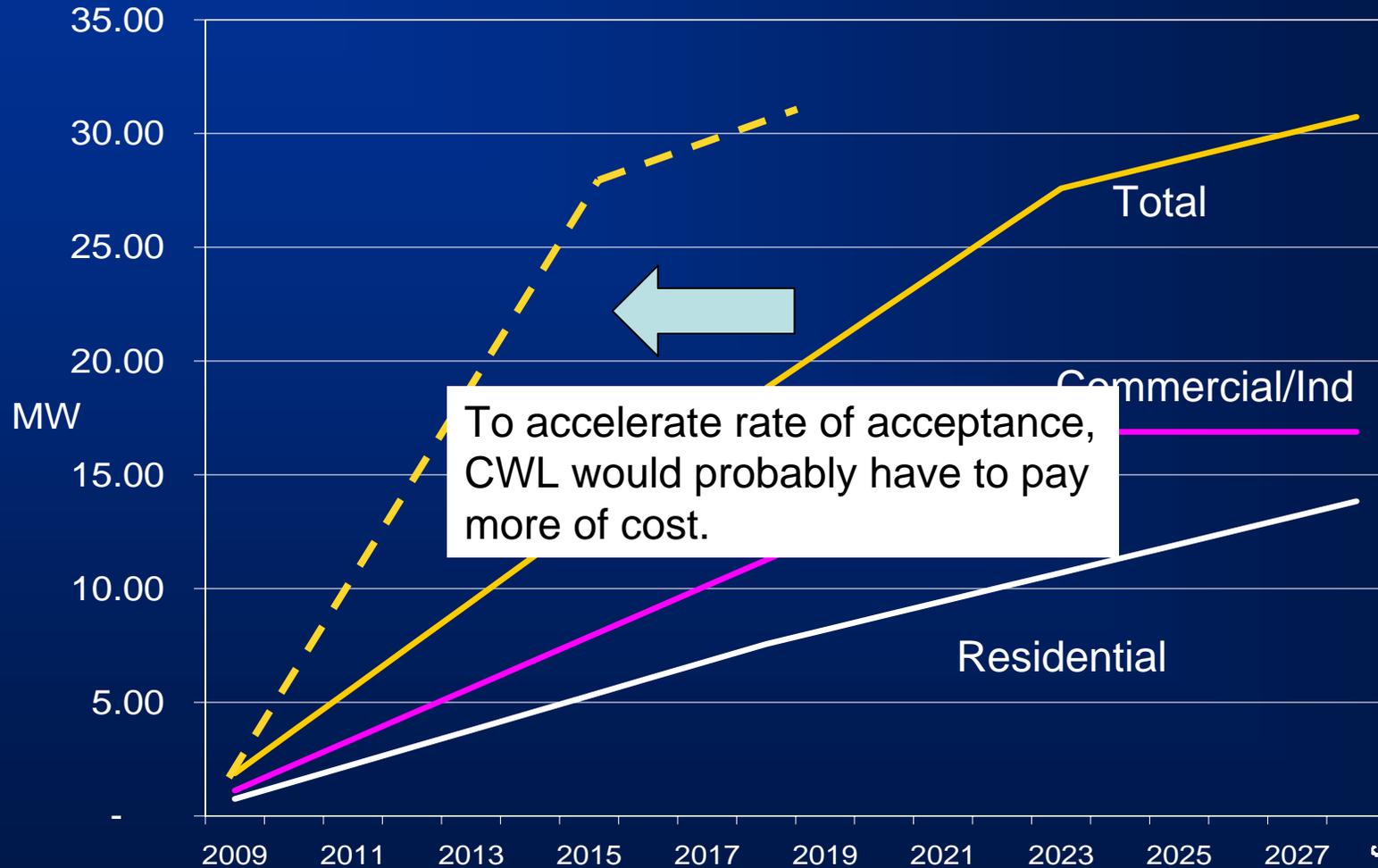
DSM Option Evaluation – DSM Load Impact

- Total amount of demand and energy reductions from options over the study period:
 - MW savings=33MW
 - MWh savings=1035GWh
- Some options are accepted by public at a faster rate than others
 - Residential acceptance ranges from 0.2% to 10% for options
 - Faster acceptance is for options such as appliance change outs,
 - A 3% acceptance rate means that it would take CWL 33 years to achieve full potential savings based on inventory in Columbia.
 - Commercial acceptance is assumed over 15 years due to equipment replacement cycles, depreciation and investment decisions

Demand Savings DSM Options-Existing System



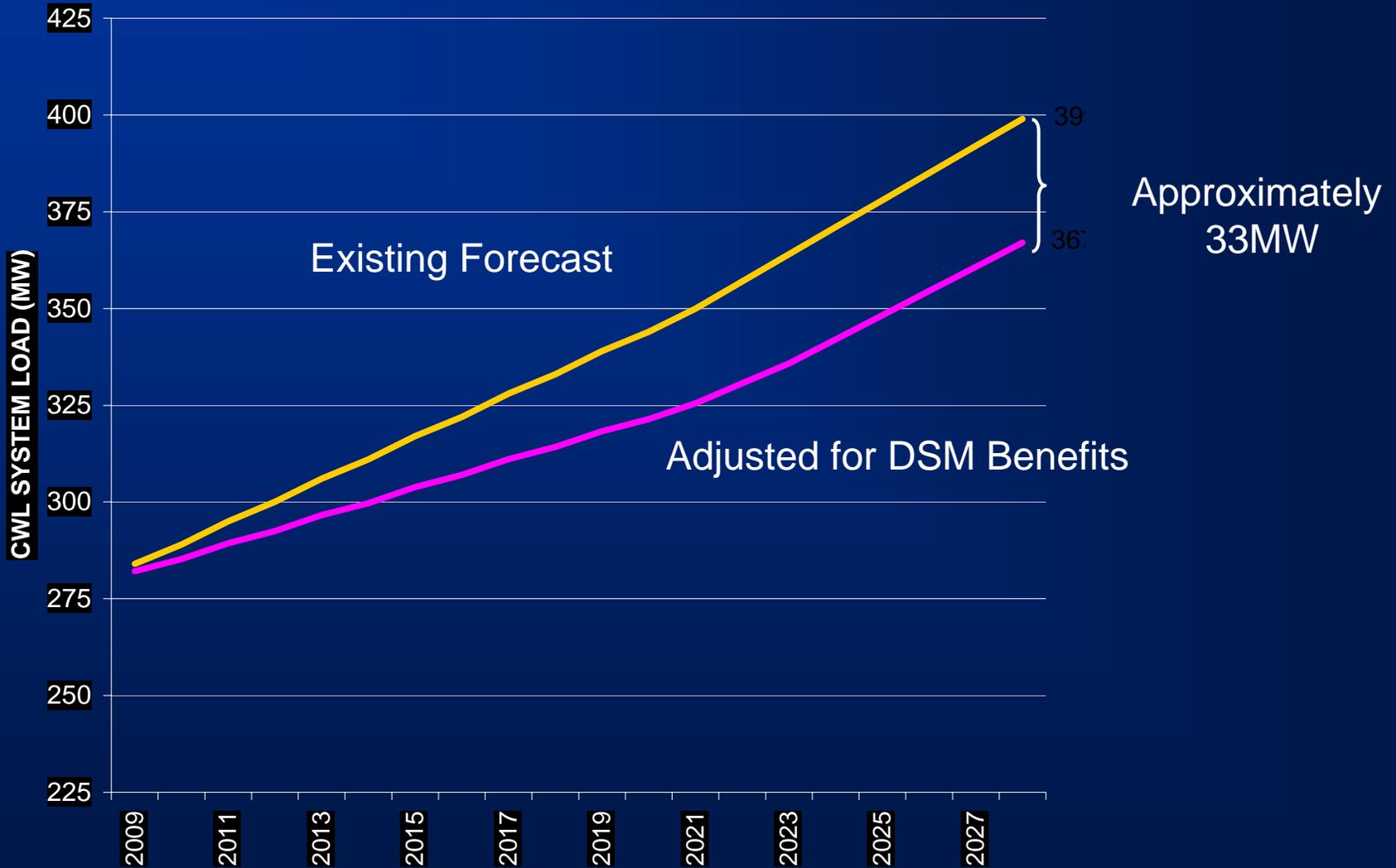
Demand Savings DSM Options-Existing System



Investment for DSM Options

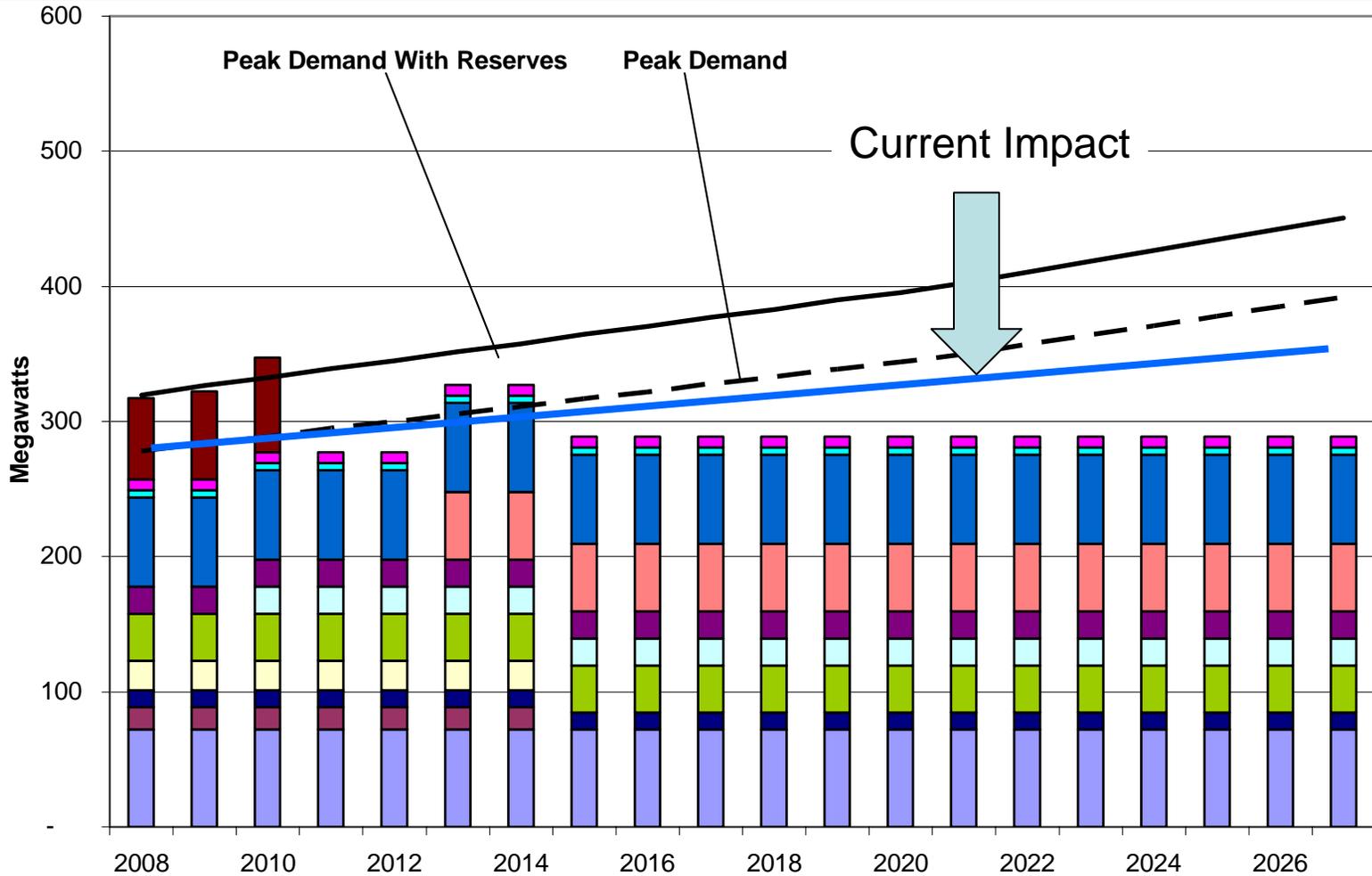
- Costs of options
 - Residential-\$22.6 Million
 - Commercial/Industrial-\$37.4 Million
- Approach is that CWL would pay half and customer would pay half
- If the amount paid by CWL was reduced, then more options would pass the screening.

DSM Results



Integration Issues

How Aggressive to be with DSM?



Issues for Consideration in Identifying Supply Options for Integration

- Aggressive building codes, DSM efforts, new appliance efficiencies, etc could reduce further the need for new resources.
 - Supply side projects under CWL control can be accelerated or delayed as needed.
 - Renewable and In Town options can be added more closely to match CWL load growth.
 - Current approach is to use the 50% CWL cost (rebate) level results
- In Town Supply Side Options
 - Supply side options within CWL's control are available
 - Biomass units and engines are possible at local plant
 - Solar applications on commercial space
 - Local jobs, area fuel sources
 - Reduces losses and transmission costs

Issues for Consideration in Identifying Supply Options for Integration

- Coal Participation Option
 - Capacity would not be available before 2014.
 - Coal price forecasts are climbing rapidly with exports increasing to China and Europe
 - Carbon regulations may be more defined with next federal administration and establish more certainty on cost and availability
 - Development is outside CWL's control
- Renewable Options
 - Concentrating solar cells are actively pursuing commercial status.
 - Missouri referendum on renewable portfolio standard this fall?
 - MISO market has considerable wind projects under development
 - New Midwest transmission system being announced

Next Steps

- Update costs for:
 - Coal and natural gas
 - Capital cost for options
- Current approach includes using
 - \$30 per ton carbon tax as base cost
 - 50% cost approach to DSM program selection
- With \$30 per ton CO₂ cost, portfolios with coal participation, engines and wind are options.
- Integration phase will determine the final amounts of
 - DSM to be implemented and
 - Technology, MW amount and year for installation of supply side options

Questions?