Portfolio Analysis

• Portfolio Descriptions
  – Energy Efficiency
  – Gas, Coal, Nuclear, Renewable

• Key Assumptions
  – Generation Capital, Fuel, O&M

• Results
  – Energy Mix
  – Gas Burn
  – CO2 Emissions
  – Capital Spending
  – Economics

• Sensitivity Analysis
• Conclusions
Portfolio Analysis

- **Resources** - APS existing generation, contracts, plus future resources required to meet APS load forecast plus 15% reserve margin
- **Simulation** - APS entire system simulated on hourly basis for twenty year + forecast period using PROMOD production costing tool
- **Model Outputs** - Model calculates cost to meet load requirements, emissions, fuel consumption, unit capacity factors, energy mix, etc.
- Data included herein is consistent with APS Resource Alternatives Report (January, 2008).
Energy Efficiency Assumptions

- **Reference Case**
  - Energy Efficiency programs funded by customers
  - All gas and renewable expansion plan
  - Includes effects of naturally occurring energy efficiency
- **Four levels of energy efficiency evaluated up to $75 million/year**
  - Based on Market Potential Study (ICF, 8/2007)
  - APS pays 50% of incremental cost as incentive
  - Program acceptance factor 0.6
- **Economic Results**
  - APS Revenue Requirements (Generation and incremental transmission)
    - Savings in Fuel, O&M, Purchased Power and G&T Capital Costs
    - Incentive and non-incentive costs (Promotional costs, education, training, program administration, etc.)
  - Total Resource Cost (TRC)
    - Revenue requirement plus customer incremental cost of EE measures over and above the incentive paid by APS
- **Risk Analysis**
  - Natural Gas Prices
  - CO2 Costs
- **APS Financial Impacts**
  - Assumes perfect cost recovery, i.e., disincentives removed through instantaneous rate setting so that APS fixed costs are recovered
Sources of Energy Efficiency
A/C Example

Old Unit

- 8.0 SEER

Replacement Units

- 13.0 SEER (Standard)
- 14.0 SEER

Naturally Occurring EE

8.0 to 13.0

Paid DSM Incentive?

Yes
- Program Participants

No
- Naturally Occurring EE

13.0 to 14.0 +

Influenced By DSM Incentive?

Yes
- Paid DSM Incentive?
  - Yes
    - Free Riders
  - No
    - Naturally Occurring EE

No
- Naturally Occurring EE

No DSM Incentive
# Energy Efficiency Cases

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
<tr>
<td><strong>Spending</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$Million/Year</td>
<td>29</td>
<td>40</td>
<td>58</td>
<td>75</td>
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<tr>
<td><strong>2020</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Peak Reduction (MW)</td>
<td>188</td>
<td>248</td>
<td>316</td>
<td>374</td>
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<tr>
<td>Energy Reduction (GWH)</td>
<td>956</td>
<td>1264</td>
<td>1613</td>
<td>1908</td>
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<td><strong>2027</strong></td>
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<tr>
<td>Peak Reduction (MW)</td>
<td>243</td>
<td>325</td>
<td>425</td>
<td>514</td>
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<tr>
<td>Energy Reduction (GWH)</td>
<td>1239</td>
<td>1661</td>
<td>2181</td>
<td>2643</td>
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**Notes:**

(1) Spending includes APS incentive and non-incentive costs.

(2) Peak and energy reductions are net reductions due to the implementation of the energy efficiency programs, i.e., these are on top of naturally occurring EE of 398 MW and 1644 GWH in 2020; 518 MW and 2135 GWH in 2027. Shown at generation level (grossed up for losses).
Annual Natural Gas Burn
Year 2020 & 2027

BCF

- Ref
- $29
- $40
- $58
- $75

APS EE Spending Level ($Millions per Year)

- 4%
- 6%
- 8%
- 10%
Annual CO2 Emissions
Year 2020 & 2027

APS EE Spending Level ($Millions per Year)

<table>
<thead>
<tr>
<th>Base Case</th>
<th>$29</th>
<th>$40</th>
<th>$58</th>
<th>$75</th>
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<tbody>
<tr>
<td>2020</td>
<td>1.6%</td>
<td>2.3%</td>
<td>3.5%</td>
<td>4.7%</td>
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<tr>
<td>2027</td>
<td></td>
<td></td>
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</table>

Millions of Short Tons

Ref $29 $40 $58 $75
Annual System Cost
Year 2020 and 2027

APS EE Spending Level ($Millions per Year)

- Ref $29
- $40
- $58
- $75

Percentages:
- 2.7%
- 2.7%
- 3.6%
- 4.0%
Revenue Requirements
Generation and Incremental Transmission
Net Present Value 2007-2034

Billions of Dollars ($2007)

<table>
<thead>
<tr>
<th>APS EE Spending Level ($Millions per Year)</th>
<th>Ref</th>
<th>$29</th>
<th>$40</th>
<th>$58</th>
<th>$75</th>
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</thead>
<tbody>
<tr>
<td>Billions of Dollars ($2007)</td>
<td>37.2</td>
<td>37.4</td>
<td>37.6</td>
<td>37.8</td>
<td>38.0</td>
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</table>
Energy Efficiency Case D ($75 Million per Year) Compared to Business As Usual
Range of Sensitivity Results
Revenue Requirements (NPV 2007-2034)

Notes: (1) Low gas price sensitivity 30% lower than baseline forecast, ~ 5.50 $/MMBtu.
Resource Portfolio Assumptions

- Resource Portfolios - Designed to highlight characteristics and trade-offs of four technology choices -- Gas, Coal, Nuclear, and Renewables
- Portfolios are energy equivalent for ease of comparison (7,000 GWH per year from subject resources)
- Concentrates on resources needed in 2015-2020 time frame
- All plans meet RES requirements, and are otherwise “all gas” expansion
- No generation retirements in the planning period, although there are some purchase power contract roll-offs
- Technology portfolios are compared to the All Gas Plan
Generation Capacity Additions Needed By 2020 is 4,740 MW

Notes: (1) Existing generation and purchase power contracts are projected to be 6,842 MW in 2020.
(2) Renewable capacity represents the generation expected to be available on peak.
## Resource Technologies
### Cost and Performance Assumptions

<table>
<thead>
<tr>
<th>Resource</th>
<th>Capital Cost ($/kw)</th>
<th>Fuel ($/MWH)</th>
<th>Transmission (Miles)</th>
<th>CO2 Emissions (Metric tons/MWH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficiency</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Solar Thermal</td>
<td>3,500-4,500</td>
<td>0</td>
<td>20 - 60</td>
<td>0</td>
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<tr>
<td>Wind</td>
<td>1,600-1,800</td>
<td>0</td>
<td>5 - 155</td>
<td>0</td>
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<tr>
<td>Gas Combined Cycle</td>
<td>900-1,000</td>
<td>62</td>
<td>20</td>
<td>0.43</td>
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<tr>
<td>Nuclear</td>
<td>2,500-3,200</td>
<td>12</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>Pulverized Coal</td>
<td>2,000-2,500</td>
<td>21</td>
<td>155</td>
<td>0.86</td>
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</table>

**Notes:**
1. Capital cost is in 2007 dollars and includes AFUDC
2. Fuel Cost is lifetime levelized assuming 2007 in service date.
3. CO2 is not monetized in the base analysis.
Projected Energy Mix (Year 2020)

- **Gas Plan**: Gas 41%, Coal 32%, Renewable 7%, Nuclear 21%
- **Coal Plan**: Gas 25%, Coal 30%, Renewable 7%, Nuclear 32%
- **Renewable**: Gas 27%, Coal 30%, Renewable 22%, Nuclear 21%
- **Nuclear Plan**: Gas 7%, Coal 30%, Renewable 7%, Nuclear 38%
Cumulative Capital Spending Through 2020
Generation Plus Incremental Transmission

Billions of Dollars

- Gas
- Coal
- Nuclear
- Renewable

Note: Capital spending excludes AFUDC and is not intended to indicate ownership preference; it is meant to provide data on a comparable basis.
Annual Natural Gas Burn
Year 2020

<table>
<thead>
<tr>
<th>Source</th>
<th>BCF</th>
<th>2008</th>
<th>Gas</th>
<th>Coal</th>
<th>Nuclear</th>
<th>Renewable</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>140</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>36%</td>
<td></td>
<td></td>
<td>35%</td>
<td>32%</td>
<td></td>
</tr>
</tbody>
</table>

36% for Gas
35% for Coal
32% for Renewable
Annual CO2 Emissions
Year 2020

Millions of Short Tons

- 2008
- Gas
- Coal
- Nuclear
- Renewable

- 15%
- 16%
- 15%
Annual System Cost
Year 2020 and 2027
System Revenue Requirements
Net Present Value 2007-2034

Billions of Dollars ($2007)

- Gas
- Coal
- Nuclear (Capital Cost +40%)
- Renewable

The chart shows the net present value of system revenue requirements for different energy sources from 2007 to 2034, with renewable energy requiring the highest capital cost increase.
# Predominant Risk Factors

<table>
<thead>
<tr>
<th>Plan</th>
<th>Favorable</th>
<th>Unfavorable</th>
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</thead>
<tbody>
<tr>
<td>Gas</td>
<td>Low Gas Prices (-30%)</td>
<td>High Gas Prices (+30%)</td>
</tr>
<tr>
<td>Coal</td>
<td>High Gas Prices</td>
<td>High CO2 Prices*</td>
</tr>
<tr>
<td>Nuclear</td>
<td>High CO2 Prices*</td>
<td>High Capital Cost (+40%)</td>
</tr>
<tr>
<td>Renewable</td>
<td>High CO2 Prices*</td>
<td>No PTC or ITC</td>
</tr>
</tbody>
</table>

*Note: High CO2 price sensitivity: 12 $/ton in 2012, growing to 50 $/ton in 2020.*
Technology Alternatives versus Gas Plan
Range of Sensitivity Results
Revenue Requirements (NPV 2007-2034)
Portfolio Analysis Conclusions

• Energy Efficiency scenario provides fuel diversity, environmental, and sizeable economic benefits. Utility financial disincentives and unrecovered fixed costs must be dealt with.

• Natural Gas, Coal and Nuclear scenarios are nearly equivalent from long term economic perspective

• Renewable scenario is projected to result in higher costs than the other three plans

• Coal, Nuclear and Renewable reduce gas burn by about 35%, representing a sizeable reduction in customer gas price risk

• Renewable and nuclear reduce CO2 emissions by 15-17% compared to the natural gas scenario

• The coal scenario (Conventional pulverized coal without CCS) emits 36% more CO2 emissions than the nuclear scenario