ELECTRICITY AND OUR FUTURE

CWLP'S INTEGRATED RESOUCE PLAN

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Agenda

- IRP DEFINED
- WHY DO WE NEED AN IRP?
- IRP PROCESS
- INPUTS, ASSUMPTIONS & OUTPUTS
- PORTFOLIOS & OPTIONS

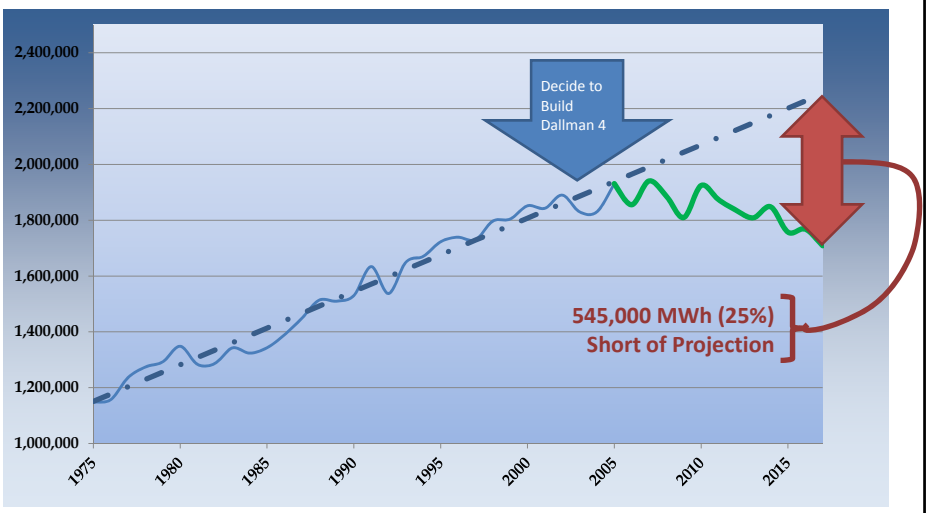
IRP Defined

An Integrated Resource Plan (IRP) is the result of a comprehensive planning study, which provides a recommended mix of supply- and demand-side resources a utility may use to meet its customers' future electricity needs.

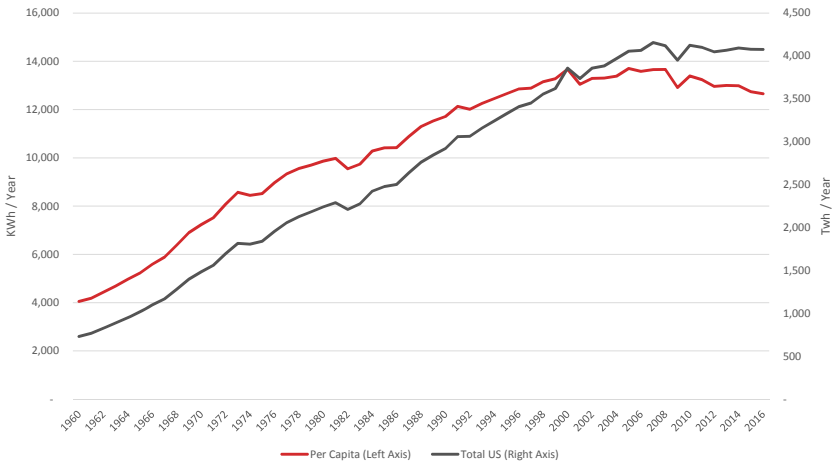
What's Included

- A forecast over a 20-year time horizon.
- An assessment of supply-side generation resources.
- An economic appraisal of renewable and non-renewable resources.
- An assessment of feasible conservation and efficiency resources.
- **A *least-cost* plan for meeting the utility's requirements.**
- **An action plan.**

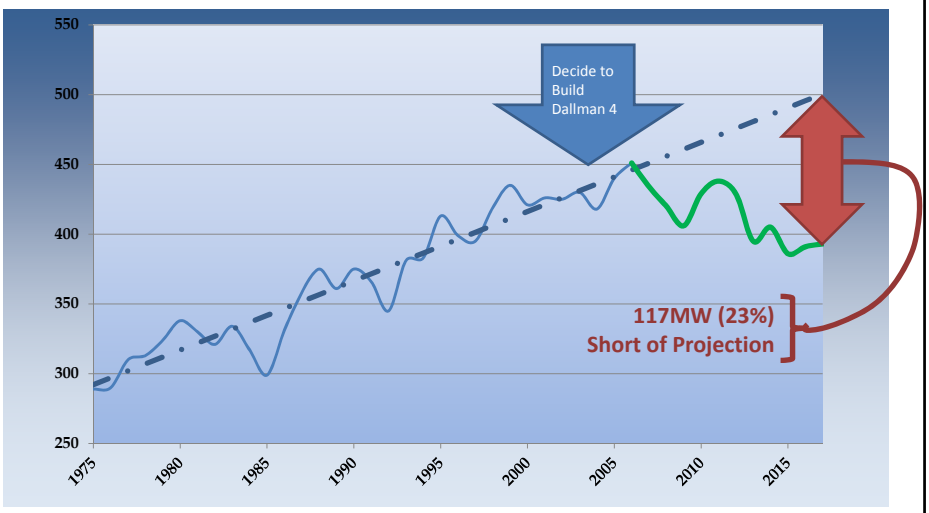
CWLP Energy Growth



US Electricity Consumption

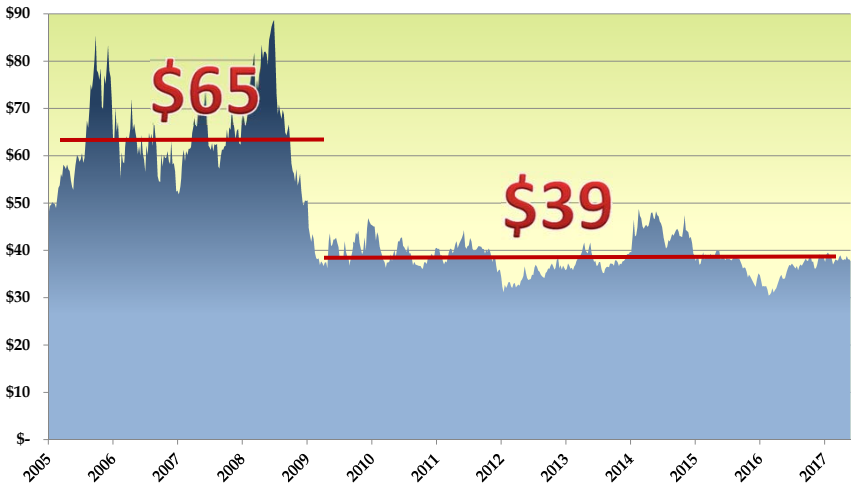


CWLP Demand Growth



Forward WholeSale Power Prices

(Indiana Hub | On-Peak | 12 mo. Strip | Rolling Avg.)



Why Does CWLP Need an IRP?

- Unprecedented Load Decline
- CAPEX for Environmental Regulations
- Low Energy & Capacity Prices
- Decreasing Costs of Gas, Wind & Solar

IRP Process Step 1
Load Forecast

- Econometric Load Forecast
- 20 Years
- Energy & Demand

IRP Process Step 2
Market Model → Prices

INPUTS/ASSUMPTIONS

- MISO MTEP
- Gas Price
- Load Levels
- Energy Efficiency
- Demand Response
- Gas Additions
- Renewables Add's
- Coal/Nuc Retirements
- Gas Retirements
- Emission Regulations

PROJECTED MARKET PRICES (20 Years x 9 Scenarios)

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IRP Process Step 3
CWLP Model → Optimal Portfolios

Plant Costs

- Fixed
- Variable (coal, water, ammonia, etc.)
- CAPEX (environmental upgrades, turbine overhauls, etc.)

Market Prices

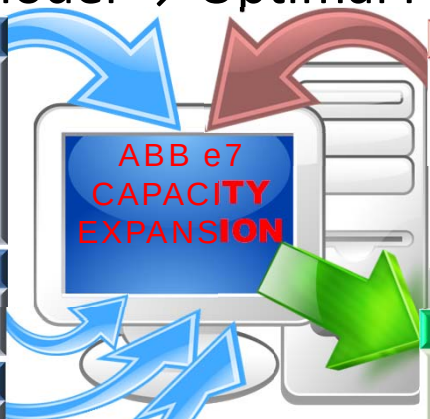
- Output from ABB PROMOD

Load Forecast

- Econometric Forecast Developed by TEA

Transmission Costs

- For Retirements or Additions



Portfolio Options

- Retirements
- Natural Gas
- Wind
- Solar
- Storage
- Demand Side
- Etc.

PORTFOLIO RESULTS (x9)

- Optimal Portfolio
- 2nd Optimal Portfolio
- 3rd Optimal Portfolio
- 4th Optimal Portfolio
- Etc.

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IRP Process (Step 4)

- TEA Presents Results
- Create the Action Plan
- Execute the Action Plan

CWLP Decisions

- What are the nine Market Scenarios to give the model?
- What Portfolio Options should the model be allowed to make?

MISO's 4 MTEP Cases

MISO Transmission Expansion Plan (MTEP) is MISO's industry vetted process to make billions of dollars in transmission investments. TEA will use MISO's four (out of the nine) MTEP cases

1. Continued Fleet Change (BASE CASE)
2. Limited Fleet Change
3. Accelerated Fleet Change
4. Distributed & Emerging Technologies

MISO's 4 MTEP Cases

1. Continued Fleet Change (BASE CASE)
   – Coal (and Nuclear) units continue to retire being replaced by gas, wind, et al, at an **expected** rate.
2. Limited Fleet Change
   – Coal (and Nuclear) units continue to retire being replaced by gas, wind, et al, **slower** than expected.

MISO's 4 MTEP Cases

3. Accelerated Fleet Change
   - Coal (and Nuclear) units continue to retire being replaced by gas, wind, et al., **faster** than expected.
4. Distributed & Emerging Technologies
   - Renewable resources, distributed solar, electric vehicles, et al. enter the market **faster** than expected.

Five Additional Scenarios

TEA/CWLP selects five more scenarios, possibly including:

5. Low Carbon Regulation
6. Strict Carbon Regulation
7. High Renewable Penetration
8. Low Load (CWLP Load)
9. Seasonal Extremes
10. High Coal Price

Feasible Portfolio Additions (Renewables)

LEVELIZED COST OF ENERGY

WIND

Build/Own/Operate

Power Purchase Agreement

HI

LO

SOLAR

Build/Own/Operate

Power Purchase Agreement

Feasible Portfolio Additions (Natural Gas)

OPERATING COST

INVESTMENT COST

LO

HI

Advanced Combined Cycle

Conventional Combined Cycle

Advanced Combustion turbine

Conventional Combustion Turbine

Reciprocating engines

HI

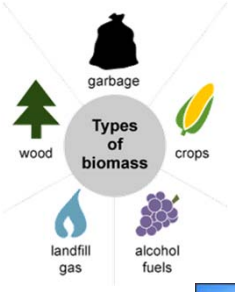
LO

Feasible Portfolio Additions (Other)

- Battery Storage
- Demand Side Management – Peak
- Demand Side Management – Base
- Energy & Capacity Market Purchases

Questionable Portfolio Additions

- Biomass
- Landfill Gas
- Fuel Cells
- Hydro
- Coal

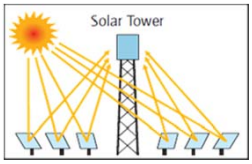


Unlikely Portfolio Additions

Nuclear

Offshore Wind

Solar Thermal



Summary

Market Scenarios

1)Continued Fleet Change
2)Limited Fleet Change
3)Accelerated Fleet Change
4)Distributed & Emerging Tech.

5)Low Carbon Regulation
6)Strict Carbon Regulation
7)High Renewable Penetration
8)Low Load (CWLP Load)
9)Seasonal Extremes
10)High Coal Price

Portfolio Options

- Retirements
- Natural Gas
- Wind
- Solar
- Storage
- Demand Side
- Etc.

Portfolio Results (x9)

- Optimal Portfolio
- 2nd Optimal Portfolio
- 3rd Optimal Portfolio
- 4th Optimal Portfolio
- Etc.

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