Oversupply Recommendations

Wind Integration Forum
Oversupply Technical Oversight Committee

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Background

- Council was requested at the June 6, 2011 Steering Committee meeting to develop recommendations for power system changes to address oversupply.
- Oversupply Technical Oversight Committee (WIF OTOC) members were appointed by the Steering Committee members.
- Technical workgroups were organized around categories with region-wide stakeholder participation.
- Operating through consensus, WIF OTOC developed recommendations for further study.

Solution Set Limited by Cost

- BPA estimates average of 300,000 MWh per year.
- Equivalent cost of displacing wind resources (no legislative changes) $12 million per year.
- Largest displacement in 2011 was 1,500 MW.
- Implies competitive solution costs < $8/kW-yr.
  - Compare, e.g., Sixth Plan Pump Storage levelized cost of $324/kW-yr.
- Solutions have to be cheap!

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Recommendations for Study

- The list of recommendations is not prioritized.
  - All merit attention now.
- Recommendations are for further study.
  - Detailed economic analyses, institutional constraints, and environmental review were not performed.
- Some recommendations are being handled by existing groups, others may need additional focus.
  - E.g., market efficiency recommendations naturally fall under the new Market Assessment and Coordination Committee.

High Potential and Feasibility

1. Shifting load to Light Load Hours
2. Increased Power System Coordination
3. Resistive Loads

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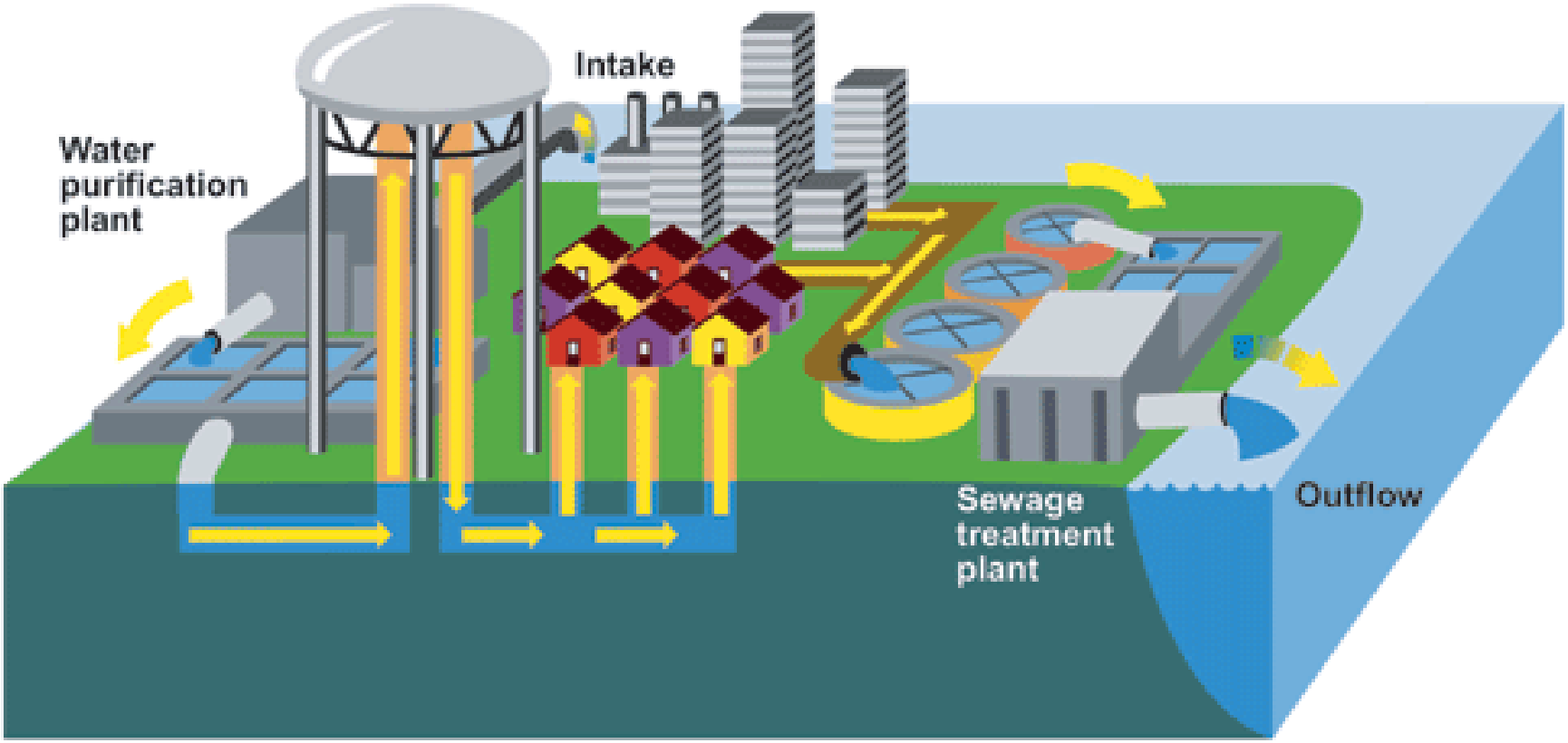
Load Shifting

Municipal water supply and sewage treatment



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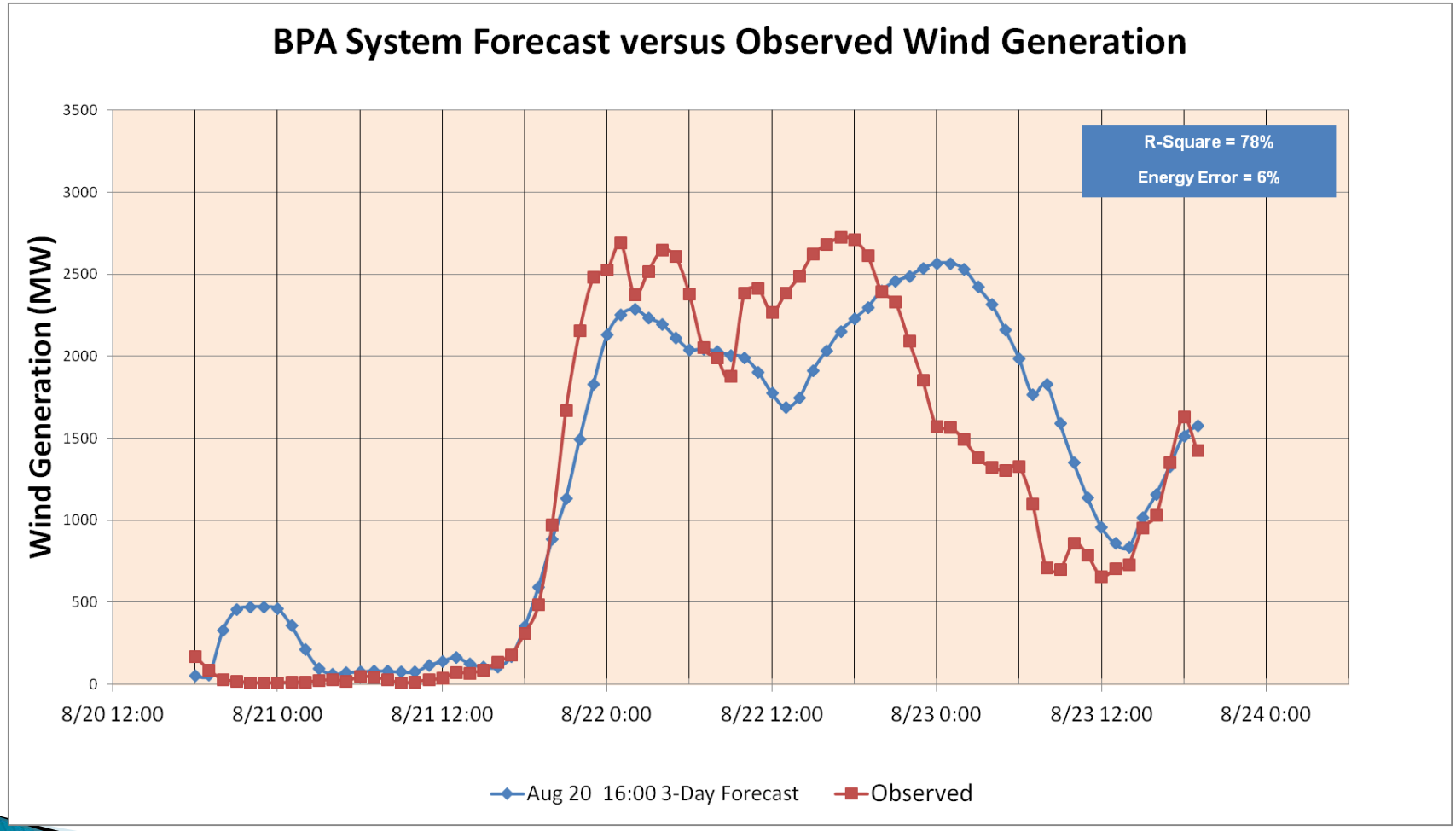
Load Shifting

- Oversupply mainly occurs during light load hours.
- Shifting demand to light load hours can help.
- Many commercial and industrial loads can shift demand into light load hours.
  - E.g.: Pulp mills, municipal water pumping systems, irrigation pumps, server farms, water treatment plants, refrigerated warehouses, and possibly many commercial building cooling systems… others?
- Many peak demand charges don't distinguish between peak demands on heavy or light load hours.
  - Provides incentive to even out demand, or conversely, discourages increasing nighttime demand.
- May relieve oversupply and reduce regional cost of service by more than the projected cost of BPA Oversupply Management Protocol.
- Need to better understand the feasibility of implementation.
  - How much load is flexible?
  - How many utilities structure tariffs in this way, and are they willing/able to change?

Power System Coordination



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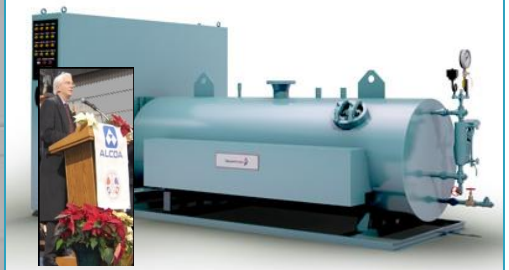
Power System Coordination

- BPA is doing a lot in this area.
  - Coordinating Canadian reservoirs, Willamette project spill, spill agreements, recallable sales, participation in half-hour scheduling, etc.
- Additional opportunities may exist.
  - Improved river/runoff forecasting.
  - Improved wind forecasting.
  - More dynamic flood control rule curve development procedures.
  - Increased incentives for entities outside BPA BA for displacing generation.
  - Spill at upstream, or off-mainstem projects.

Resistive Loads

3 MW Electric Boiler



3 MW Commercial Resistive Load Bank

1,200 MW Chief Joseph Dynamic Brake

Resistive Loads

- Resistive load banks provide alternative to spilling hydro energy without dissolved gas effects.
- Relatively inexpensive
  - ~5 year simple payback at BPA's expected $12 million annual OMP cost.
- More productive resistive loads also exist.
  - Commercial/Industrial electric boilers, domestic electric water heaters.
- Provide market depth around zero market price.

Moderate Potential and Feasibility

1. Efficient Generation Displacement
2. Reduce Total Dissolved Gas Levels
3. Transmission Trading Enhancements
4. Mini Energy Imbalance Market

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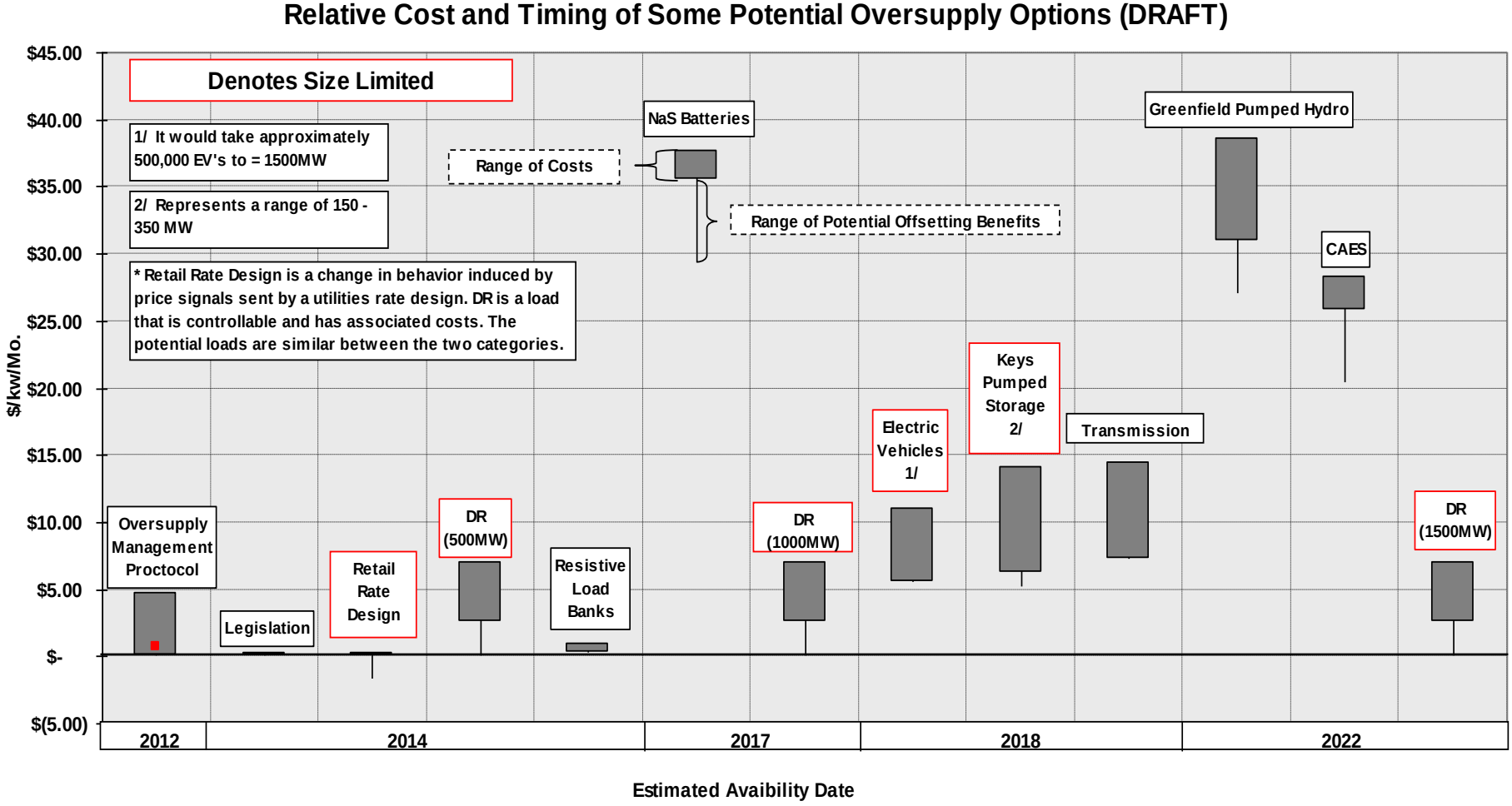
Longer-Term Efforts

- Cross-Balancing Area Exchanges
- Aquifer Recharge
- Electric Vehicle Charging Coordination
- John W. Keys III Pump-Generating Plant Improvements

Other Ideas Considered

- Conventional and Advanced Storage Technologies
- Increasing Transmission Intertie Capability
- Passing Water Through Unloaded Turbines
- Passing Water Through Locks
- Refrigeration loads for cooling river water
- Lower John Day Reservoir level
- Encouraging Increased Retail Demand
- Hydrogen Production and Storage
- Special Industrial Production Incentives
- Relaxing Dissolved Gas Caps

Preliminary Analysis
(Provided by BPA)



Possible Next Steps

- Costs and feasibility of the recommended measures need to be more fully explored.
- Some recommended measures need additional resources behind them:
  - Load Shaping
  - Power System Coordination
  - Efficient Generation Displacement
  - Reducing TDG levels

Questions and Discussion

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