WINDPOWER-WATER EQUIVALENCY FOR THE WESTERN US REGION

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Facts to Maintain Perspective

- Water use, meaning evaporation or other loss from the consuming chain equals about \textit{3\% for electric generation}.
- Today, fossil fuel plants, on average, use less than \textit{0.5 gallons/kilowatt hour} generated.
- A 500 Megawatt (MW) coal-fired generating plant requires approximately \textit{1.8 billion gallons of water per year} to operate.
Regional Water-Energy Concerns…

“The NEXUS between energy production and water supplies adds a new and problematic facet to the ongoing debate of how to make the United States more energy independent.”
NEXUS 2007 Study

- **NEXUS** focused on identifying **water-sustainable energy generating resources** in the 14-state Western US region

- **Goal:** Assess the feasibility of managing water availability (especially in areas with water shortages); identify electric generation and transmission line strategies that allow "**virtual transfer**" of water

- **One option:** Increase wind farm generation to 25% energy generated target by 2025; transfer water saved to adjacent areas
Examples: Virtual Transfer of Water

- Electricity shipped into California from water-cooled plants across the Southwest represents a “virtual transfer of water”

- Food grown with irrigation represent ways of virtually moving water; relative to power, food shipped out of California equals much larger quantities of water

- The comparison is complex, because food requires water for growth, whereas water use for power generation can be cut to near-zero, at the expense of using more fuel and a higher capital cost
NEXUS Model and Process

**Integrated Energy Analysis** including Supply-Demand, Emissions, Delivery, Fuels/Water, and New technology

Process developed collaboratively by Los Alamos, Sandia and Argonne National Laboratories
Description of Scenarios

- **Scenario 1** – Baseline Case with electric demand growth, no water management consideration
- **Scenario 2** – New generation sited at existing nuclear power plant locations (all nuclear)
- **Scenario 3** – Wind generation added to meet 25% of energy consumed at sites with greatest wind generation potential (mix of conventional and wind)
- **Scenario 4** – Imports of low water usage power from outside the Western region
Where are Our Wind Resources?

Mainly four states, plus California

By 2025, new wind farms occupy nearly 20,000 mi²
Reduction in Water Usage

25% wind energy saves **68 billion gallons** of water per year by 2025
Effect on Western Grid in 2025

Blue: Transmission overloads

25% wind energy

No added wind energy
NEXUS Observations and Results

- Technology options or scenarios exist for reducing water intensity in the electric power sector in the Western US by 2025.

- Full realization of NEXUS water savings would require regulations, and will result in consumer electricity cost increases, *plants using less water cost more to build and will use more fuel*.

- In most locations, the value of water saved, at today’s contract prices, may not justify additional costs of dry cooling; water availability influences plant location.