Civilization, renewable energy, WAPA and the grid

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What is WAPA?

One of four power marketing administrations within the U.S. Department of Energy whose role is to market and transmit wholesale electricity from multi-use water projects.

- **Our mission**: Market and deliver clean, renewable, reliable, cost-based federal hydroelectric power and related services.

- **Our vision**: Continue to provide premier power marketing and transmission services to our customers, as well as contribute to enhancing America's energy security and sustaining our nation's economic vitality.
WAPA’s Three Lines of Business

Federal Hydropower
- Markets 10,505 MW of power from 56 dams
- Buy and sell power to provide firm electric service

Transmission System & Service
- 17,000 miles of transmission lines
- Operate 4 balancing areas
- 15-state operating region

Transmission Infrastructure Program
- Independent $3.25 B borrowing authority
- Projects must facilitate renewables
- Projects must have a nexus in Western’s footprint
WAPA’s distributed organization

- Distributed organization
- Multiple systems
- Competing demands
My perspective

• 30 years in electric industry (plus gas, oil and water)
• Eight years at Electric Power Research Institute
• Certified technology nerd
• Utility, venture capital, private equity and consulting background

• A DOUG:
  ✓ Dumb
  ✓ Old
  ✓ Utility
  ✓ Guy
Untangling the giant hairball of electricity
The vast networks of electrification are the greatest engineering achievement of the 20th century
– U.S. National Academy of Engineering
Dot Com circa 1880: Electricity

1882 First electric station built by Edison on Pearl Street
Dot Com circa 1880: Electricity

- Industry began in support of other enterprises
  - Industrial
  - Telegraph, telephone
  - Street Cars
- Wild West of the east coast
  - 20 companies providing service in NYC
  - 18 deaths in 1889
Basic rules of electricity

• Electrons are governed by the laws of physics
  – Flows to the point of least resistance
  – Always must be in supply and demand balance
  – No storage outside of fossil fuel, water and some chemical reactions
• Electricity is governed by the laws of politics
The U.S. power supply network is the largest most complex machine ever created

- Engages the most complex enterprise involving:
  - 5000 corporate entities
  - Several forms of ownership and levels of regulatory oversight
  - Some 100 million customers
- Attempts to satisfy conflicting economic, social political, and environmental objectives
- Complexity is increasing driving need for more system intelligence
Challenges in the Energy Frontier

- Aging Infrastructure
- Increased regulation
- Intermittent resources
- Decreased hydro production
- More customer-side resources
- Changing markets
- Security
Industry Changes

I WELCOME CHANGE
as long as nothing is altered or different
Who won the movie format battle: Betamax or VHS?
Neither!

Apple redefined market:
Identified megatrend:
personalized entertainment
The Janus Conundrum: Looking Back or Looking Forward

Choice of Capital Investment

**Reliance on the Past**
- Repair, replace, rebuild
- Status quo, current opportunity optimized
- System limited to yesterday’s technology
- Reduced returns, limited upside, exposure to competition

**Reliance on the Future**
- Invest in new generation of technology
- New business opportunities
- System expansion
- Competitive advantage

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The Solar/Peak Conundrum: 
Even in Arizona...

253 MW Peak Reduction

Hourly Electric System Demand (MW)

Hourly Solar DE Production (MW)

Demand After St
763 MW Solar

Hour Ending
MegaTrend: Carbon/Capacity Conflict

We’re on track for the “t***n w***k” of regulations vs. carbon et al
The Destiny of Carbon Constraints/Capacity Conflict

- Demand for new power sources will outstrip capacity
- Demand for clean energy will outstrip the capacity
- Public perception contrasts with the reality of the system
- Renewables are being promoted as the only answer
- Cost of renewables creates financial challenges

Developed world demand dead? Developing world demand galloping
Contrasting world views

- Reality of system operations is generally ignored
- Sky is falling?
- Sky is not falling?
- Reliability hangs in the balance
- Surge in demand, hot summer or cold winter may lead to significant shortages
- Timing of regulations impact different regions differently
- Belief, not engineering, leads the way
The tug of war over what the new rules really mean

- Supreme Court stays Clean Power Plan
- NERC: EPA Rules Could Stress the Nation's Grid
- DOE: EPA rules will create no resource adequacy issues
- World Resources Institute: Cost predictions of EPA rules are overstated
The Destiny of Intelligent Infrastructure

• $50 Billion* will be spent in next 5 years in T&D

• How SG will change load profile is critical

• The enabler for energy efficiency and demand response

• How customers interact with the system is key
My unpopular theory on smart grid

- 80% of the benefits of intelligent infrastructure will initially accrue to the utility
  - This is opposite of the majority of business cases
- Consumer participation will be initially low
  - This will change as automation takes hold
- Hype will hurt the efforts
  - We are building unrealistic expectations
- Utilities will move to smart grid because it makes sense
  - Workforce, environment and overheads will be the drivers
- Utilities will not get significant benefits unless they make major process changes
Customers want choice but not risk; customers do not necessarily make economic choices.
Home technologies will drive smart grid benefits

- As of December, 2015 there are 378 million wireless devices in the U.S. up from 285 million in 2009
Water energy nexus

• Genesis Solar Project needs 536 million gallons of water every year
• Mojave Solar Project needs 705 million gallons per year
Wildcards

**ECONOMIC CONDITIONS**
Resurgence of economy increases demand at a time when coal plants are being shut down and/or retrofitted

**NATURAL GAS**
Prices spike due to weather, increased industrial demand, pipeline congestion and/or other competing uses

**WATER**
Regulations and aging infrastructure

**POLITICS**
10 myths about energy

1. U.S. has a 3rd world Grid
2. Hydrogen is the answer
3. Electricity is expensive
4. Renewables and energy efficiency are the only answer
5. Natural gas is the answer to global warming
6. Demand has disappeared and will not return
7. The Dakotas/Nevada are the answer
8. PHEVs will make a difference in the next 10 years
9. The cap and trade bill will pass this year
10. Storage and advanced batteries are the answer
10 truths about energy

1. All the energy that there ever will be exists today
2. Demand is increasing across the globe
3. Technology will make a difference
4. Electric and gas rates will rise significantly
5. Transmission must be expanded
6. We need new base-load capacity
7. There will be generation shortages across the U.S.
8. Business will adapt to these new realities
9. Renewables create significant opportunities and challenges
10. The inconvenient truth: we need all forms of energy in the fuel mix
WAPA’s Interest

• WAPA’s significant transmission system
  ▪ More than 17,000 circuit miles
  ▪ 15 states
  ▪ Among top 10 in the country

• Expanding geographic scope of markets

• Expanding number of participants

• Increasingly limited trading partners
WAPA’s Concerns

- Statutory requirements
- Each region has unique legislation and needs that must be addressed on case-by-case basis
- Cost
Joining Southwest Power Pool

- Joined SPP October 1, 2015
- SPP provides greater flexibility
  Creates more options for buying and selling
- Reduces constraints in delivering power
- Helps keep costs low for customers
- Alternate Operations Study $11.5 M
  net benefits predicted initial year
  savings/cost avoidance
- Savings estimated to be greater than the AOS
MWTG

- Goal – Create a single multi-company transmission tariff and explore “Day 2” market alternatives
- MWTG TSPs include: two IOUs, two municipals; two REA G&Ts; two Federal PMA projects
- MWTG members are a sub-set of the WestConnect planning region members and are members of the Colorado Coordinated Planning Group (CCPG)
- Currently includes seven parties with nine transmission tariffs
Key Take Away

Each region has unique legislation and needs that must be addressed on case-by-case basis.

Customer engagement is critical.
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