Transitioning from a Strategy, to a Plan, to a Decision – How Planning Under Uncertainty Builds Projects

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Increasing Market and Planning Efficiency through Improved Software

Session A – Current Approaches to Planning

Strategy Implementation

WHAT WE KNOW

- Where we currently are – existing loads, resources, transmission, and cost
- They will change (unless they don't)

WHAT WE DON'T KNOW (for sure)

- Load growth (when, where, how much, energy/demand – shape)
- Future resources (replacements – aging/technology/policy, new – fuel/etc.)
- Transmission – (when, where, required capacity, utilization)

DECISIONS AND IMPLEMENTATION

- Transmission – longest lead time, enabler or constraint (first/last choice?)
- Resources – policy and market risk (opportunity or solution?)
- Reliability leads economics (cost of not acting is unacceptable)

What We Have Learned

I HAVE BEEN INVOLVED IN PLANNING FOR A LONG TIME, AND HAVE SEEN ALL MY PLANS "EXECUTED" (but only parts of them implemented)

- A "plan" or strategy must foresee and respond to changes
- Scenarios and "possible futures" are always wrong, but the process of planning and developing strategies allows for managing uncertainty

SENSITIVITY ANALYSIS

- Three variables - LOAD, RESOURCES, TRANSMISSION
- Dependent or Independent? (every decision impacts other choices)
- Multiple attributes (time, location, cost, shape, etc.)

OBJECTIVE FUNCTION (OPTIMIZATION)

- Cost, subject to reliability and other environmental/policy constraints

TOOLS AND PROCESSES

ORDER No. 890 HAS OPENED AND EXPANDED PLANNING

- Created obligations to perform, allows flexibility to understand results
- Stakeholder involvement in the West at highest levels – pivotal

CHOOSING THE FUTURE

- Three variables - LOAD, RESOURCES, TRANSMISSION
- Can no longer allow single-dimension decisions
- *Every decision affects future alternatives. Incremental planning (next decision) limits ability to "see" the future – must expand horizon*

BUILDING THE PROJECTS

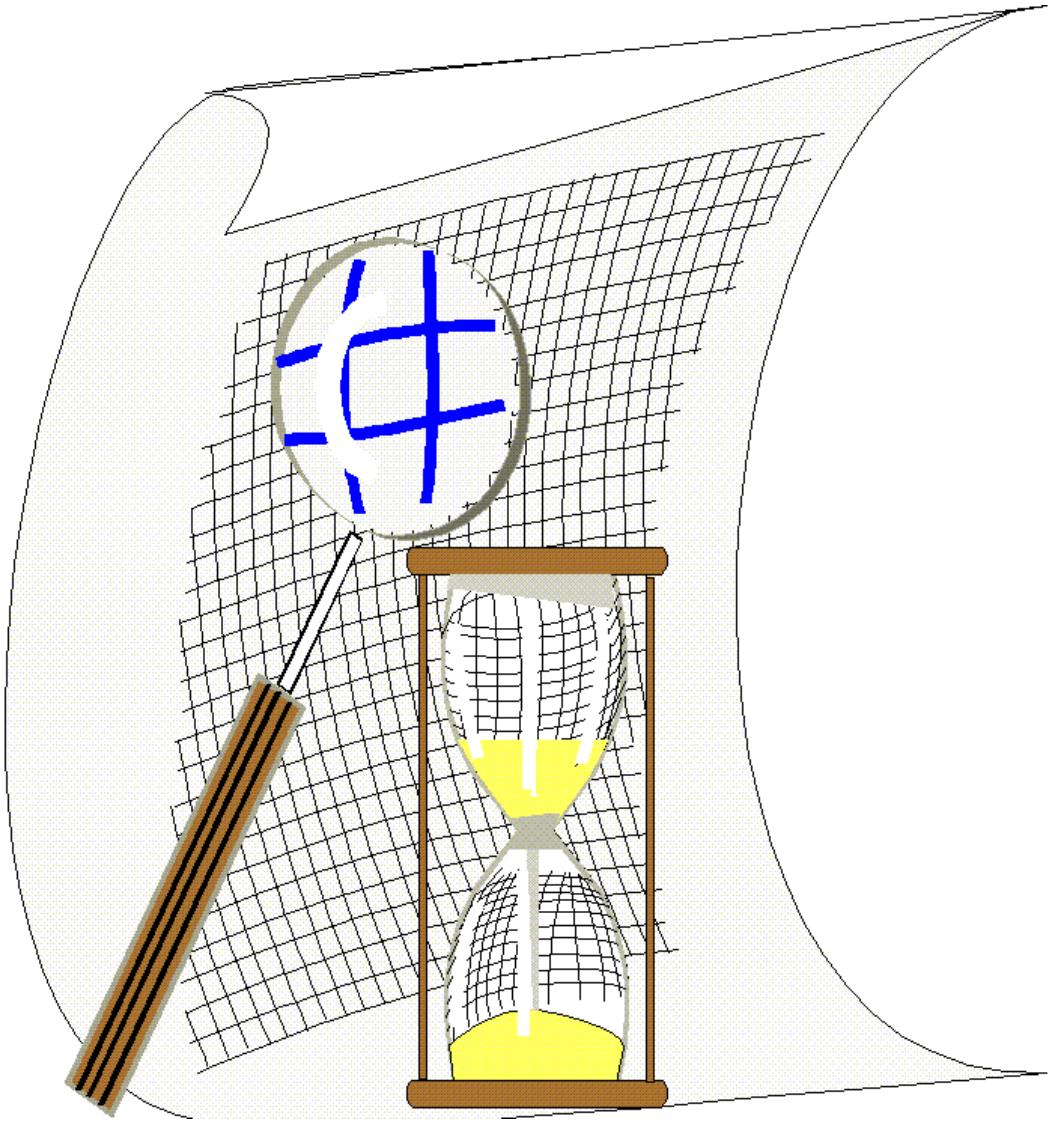
- No such thing as "perfect information", but land use based development and geographical/natural resources still best estimators
- Optionality, timing, sequence, commercial and regulatory, "no regrets"

Public Process Experience

- Don’t show up with “the solution” on the map
- Non-trivial steps/definitions
  - NEED – perceived or stated problem (FUTURE SCENARIOS)
  - SOLUTION – action(s) that satisfy or alter need(s)
  - RISK – inaction or over-reaction for need(s)
  - STRATEGIC PLAN – solution set with multiple alternatives to balance needs and risks based upon existing and changing information (dynamic)

What is long range planning?

- **Strategies** to respond to changing needs as uncertainties are resolved over time
- A plan is **<u>not</u>** a schedule
- Bottom-up details and top-down policy impacts
- "Build out" or end target with incremental implementation
- Key decisions – where, when, how much, and why (triggers)



NEEDS Tools – Load Forecasts

- **Raw growth – natural response**
  - **Absent demand response, energy efficiency, technology, and policy changes**
- Saturation – end point for planning horizon
- How get there – S curves

Pentonian Methodology
of
Geo-typical Growth Based Load Forecasting (GGLF)
By
Hilly S. Penton, Planning Engineer
B.A (1970 Boise State), B.S.E.E. (1984 U of Idaho)
May 6, 2004

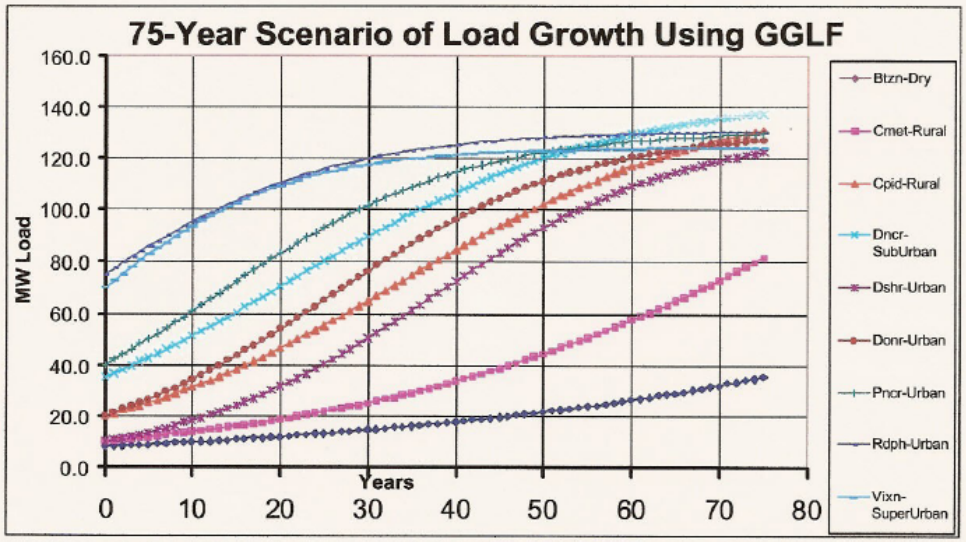


Figure 3 . Load Growth Curves of Substations using Pentonian GGLF Methodology

NEEDS Tools – Load Forecasts

- Why? – influences – economy, limited natural resources, local phenomena (spot growth), systemic/uniform growth.
- See policy changes, and influences on load/energy (demand/energy efficiency, etc.)
- Ability to recognize transitions
- Perspective – "eternity eyes"

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Discussion of the GGLF growth curves

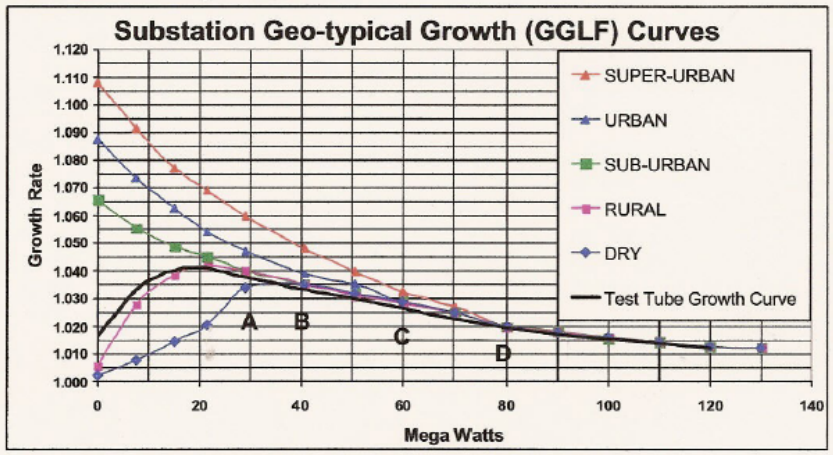


Figure 1. The Geo-typical Growth based Load Forecasting Curves

The five basic GGLF curves used here illustrate the application of load forecasting. They may be expanded into subclasses and variations as the need arises. Each growth curve is quantified by the load density or MW load usage per square mile. See Table 1

Needs – Resources

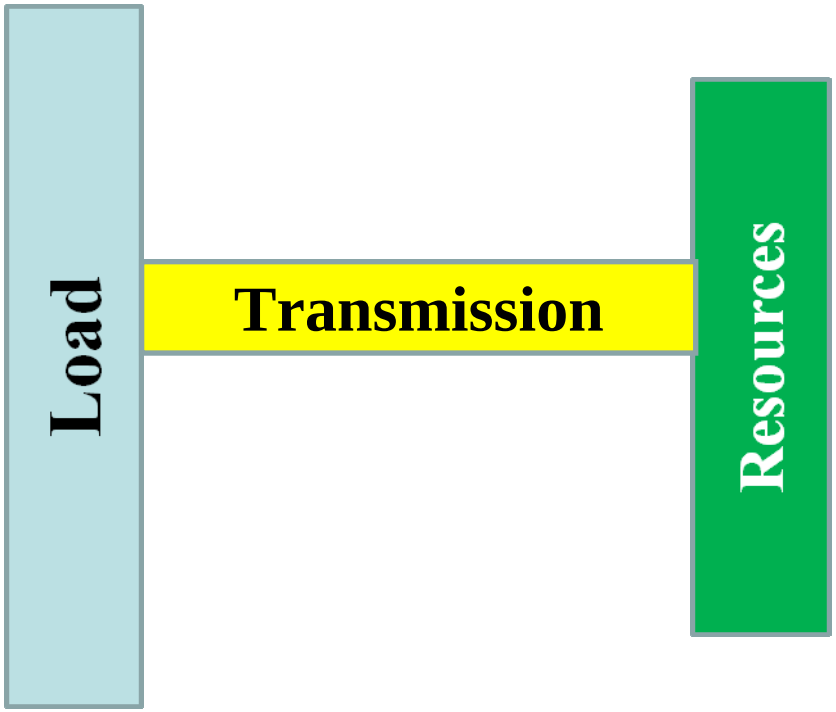
When are They Real?

Total Idaho Power Generation Interconnection Queue Applications

Sum of Max	Fuel Type																
County		Biogas	Biomass	CCCT	Coal	Cogen	CT	Diesel	Gas	Geothermal	Hydro	Landfill	Solar	Steam	Wind	Wood	Grand Total
															100		100
Ada		1				13	200	105	1,260		124	3					1,706
Baker											3				743		746
Bannock									0								0
Bingham															108		108
Blaine										50							50
Boise			13														13
Canyon	280		3			20			2,244		3						2,550
Canyon			5														5
Cassia								118							283		401
Elko										95							95
Elmore	206			1,312	1,500		340		6,702		15		10	125	237		10,447
Gem						15	340		975	4						18	1,351
Gooding	275		12			1		84			0						372
Harney						10											10
Jerome	6		6		725	1		62			0						801
Lemhi											1						1
Lincoln	275		5												9		289
Malheur									1,065				20		10		1,095
Malheur										36							36
Minidoka	215		0					115									330
Minidoka			3														3
Owyhee								3					10		251		264
Payette	875			1,606				28	6,500								9,009
Power	3,133														90		3,223
Twin Falls	18		3					28	100	100	133				524		907
Union															450		450
Union & Baker															401		401
Wallowa															252		252
Washington	275																275
White Pine					1,070												1,070
Grand Total	5,558	1	51	2,918	3,295	60	880	543	18,846	284	279	3	40	125	3,457	18	36,358

SOLUTIONS – Tools

- **Change load**
- **Add resources**
- **Add transmission**
- At what load level does the capability NEED to change? (Margin)
- What is the total NEEDed capability?



NOT INDEPENDENT!

RISK Analysis Tools

- **Define RISKS**
  - **Consequences of inaction, insufficient action, over-action**
  - **Implementation, permitting, equipment lead times, etc.**
  - **Reliability and sequencing for next project(s)**
  - **Constructability**

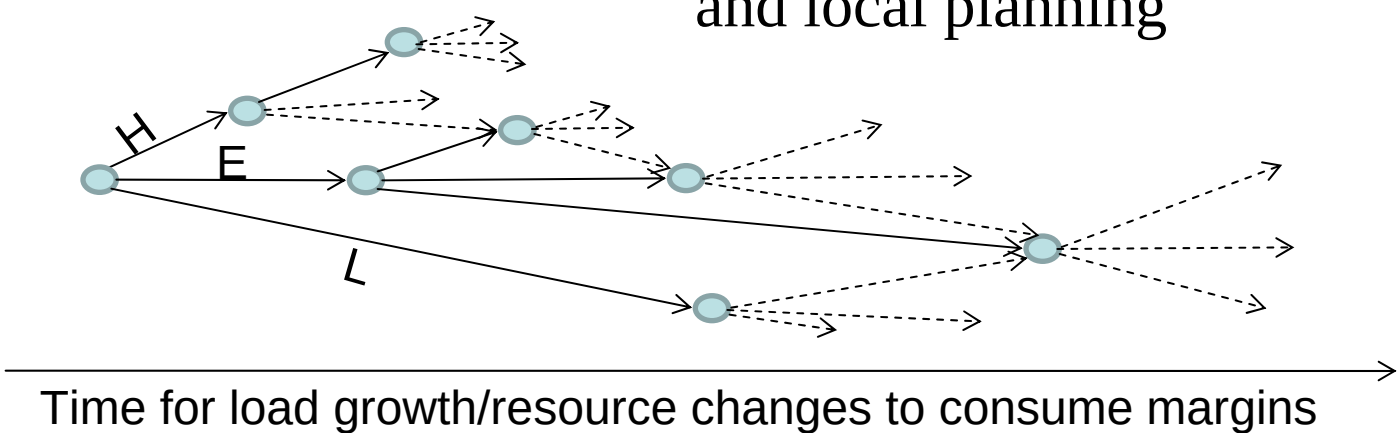
Decision tree – discrete outcome path analysis and identification of expected path.

– What to do when…

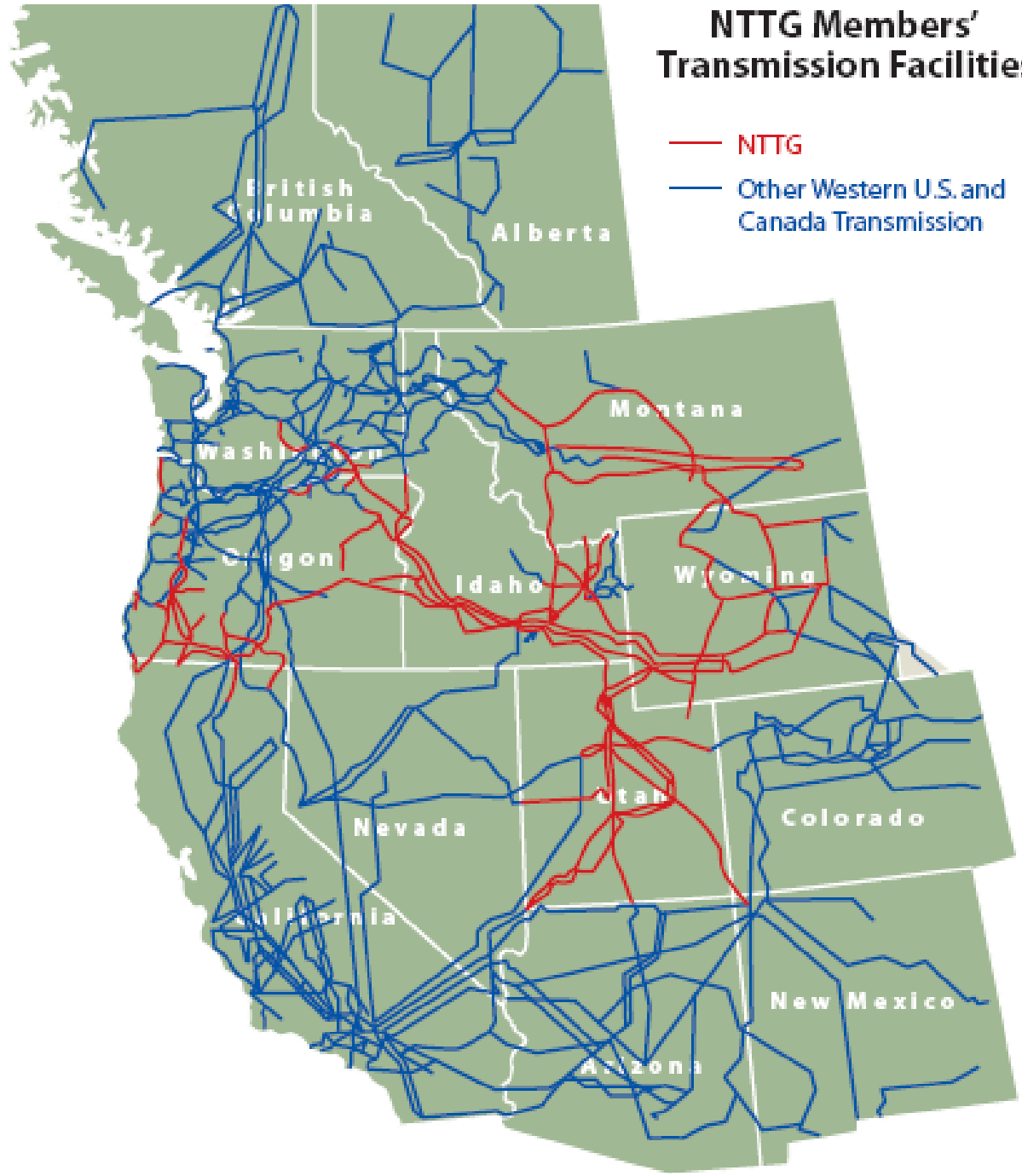
–Coalescence over time, converges to same "point"

– Examine independence

–Works well for single variable and local planning



NTTG Members' Transmission Facilities



Participating Utilities

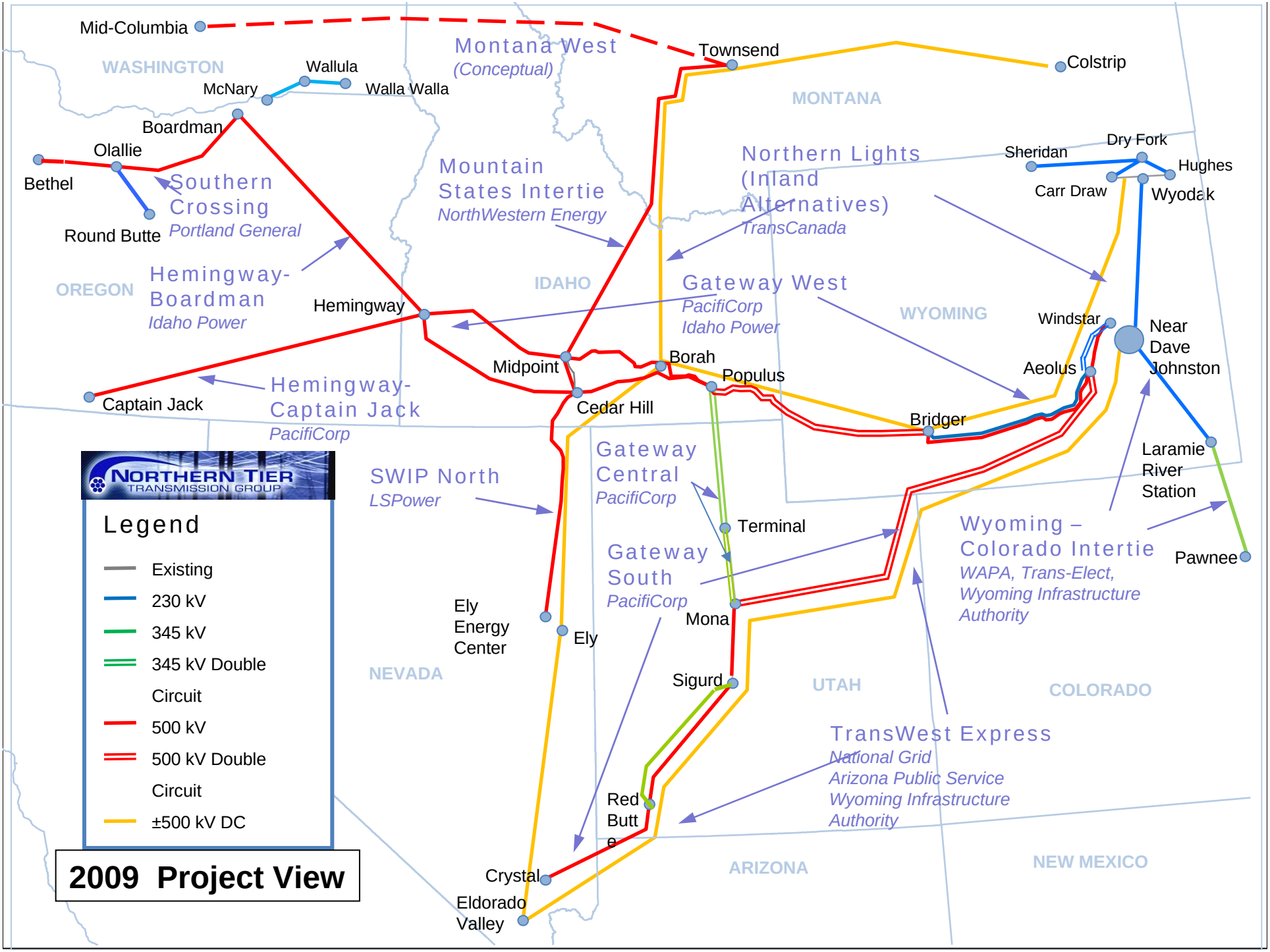
Deseret Power Electric Cooperative
Idaho Power
NorthWestern Energy
PacifiCorp
Portland General Electric
Utah Associated Municipal Power Systems

NTTG Footprint
+4 million customers

30,000 miles of HV transmission

+1,000 MW/yr growth

Over 6,500 miles proposed transmission, +25,000 MW capacity


Mid-Columbia
WASHINGTON
Wallula
McNary
Walla Walla
Montana West
(Conceptual)
Townsend
Colstrip
MONTANA
Boardman
Olallie
Bethel
Round Butte
Southern Crossing
Portland General
Mountain States Intertie
NorthWestern Energy
Northern Lights (Inland Alternatives)
TransCanada
Sheridan
Dry Fork
Hughes
Carr Draw
Wyodak
OREGON
Hemingway-Boardman
Idaho Power
Hemingway
IDAHO
Gateway West
PacifiCorp
Idaho Power
WYOMING
Windstar
Near Dave Johnston
Aeolus
Midpoint
Borah
Populus
Cedar Hill
Bridger
Captain Jack
Hemingway-Captain Jack
PacifiCorp
Gateway Central
PacifiCorp
Laramie River Station
SWIP North
LSPower
Terminal
Gateway South
PacifiCorp
Wyoming – Colorado Intertie
WAPA, Trans-Elect, Wyoming Infrastructure Authority
Pawnee
Ely Energy Center
Ely
Mona
NEVADA
Sigurd
UTAH
COLORADO
TransWest Express
National Grid
Arizona Public Service
Wyoming Infrastructure Authority
Red Butte
Crystal
Eldorado Valley
ARIZONA
NEW MEXICO
NORTHERN TIER TRANSMISSION GROUP
Legend
Existing
230 kV
345 kV
345 kV Double Circuit
500 kV
500 kV Double Circuit
±500 kV DC
2009 Project View

NTTG Planning Process

Figure 1: NTTG Study Cycles

NTTG Biennial Transmission Planning Cycle

	Quarter	Activity
Year 1	Qtr 1	Information Gathering *
	Qtr 2	Study Plan and Assumptions *
	Qtr 3	Draft Plan Analysis *
	Qtr 4	
Year 2	Qtr 5	Draft Study Results and Review *
	Qtr 6	Economic Studies and Cost Allocation Process
	Qtr 7	Final Plan Report and Review *
	Qtr 8	Final Plan Approval

* Stakeholder and public participation required

NTTG Economic Planning Studies

	Quarter	Activity
Year 1	Qtr 1	Receive and Prioritize Requests *
	Qtr 2	Study
	Qtr 3	Report/Review Results *
	Qtr 4	
Year 2	Qtr 1	Receive and Prioritize Requests *
	Qtr 2	Study
	Qtr 3	Report/Review Results *
	Qtr 4	

NTTG Planning Process

- A **"study" constitutes a body of analysis** that results in a report of findings related to one or more questions or issues. It **may contain multiple "cases" or "scenarios"** to address specific modeling requirements or sensitivity analyses.
- **Economic Study Request –** request to model the ability of specific upgrades/investments to transmission, resources, or demand response to reduce the cost of reliably serving forecasted customer needs.
- **Clustering –** geographically and electrically similar, and can be feasibly and meaningfully studied as a group.

2017 Forecasted "Incremental" Loads and Potential Resources with Transmission Hubs and Candidate Transmission Additions

This information is still being updated. Additions or modifications are welcome.
Please use Potential versus Fast Track to indicate your preferences.
Missing data may be updated from the SSG-WI data base

How we got there-2007

Candidate Transmission

Fast_Track Projects

FAST TRACK

Potential

2017 Load Forecast

MW Load

Potential Resources

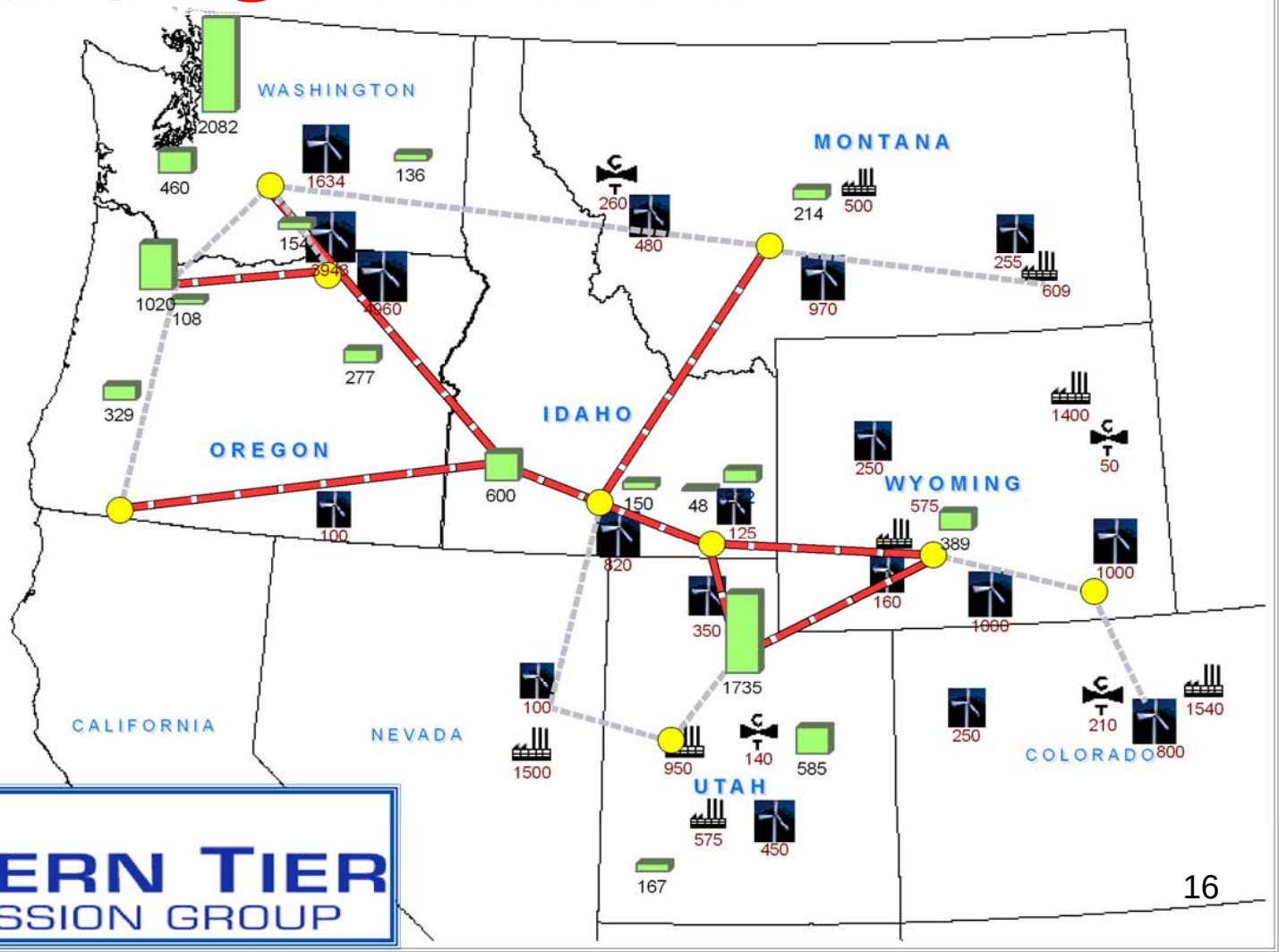
Type

Coal

Gas

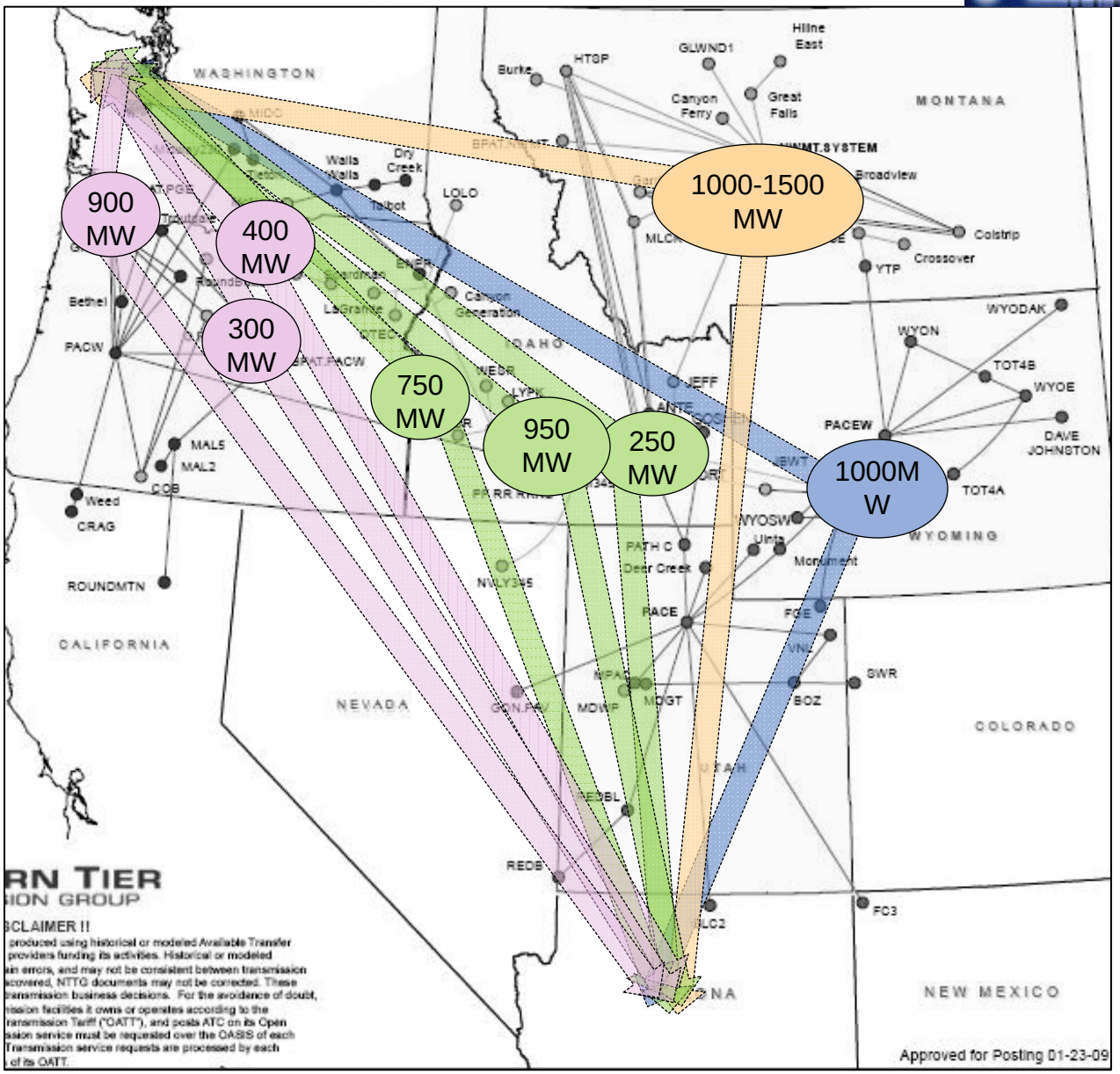
Wind

Transmission Hubs



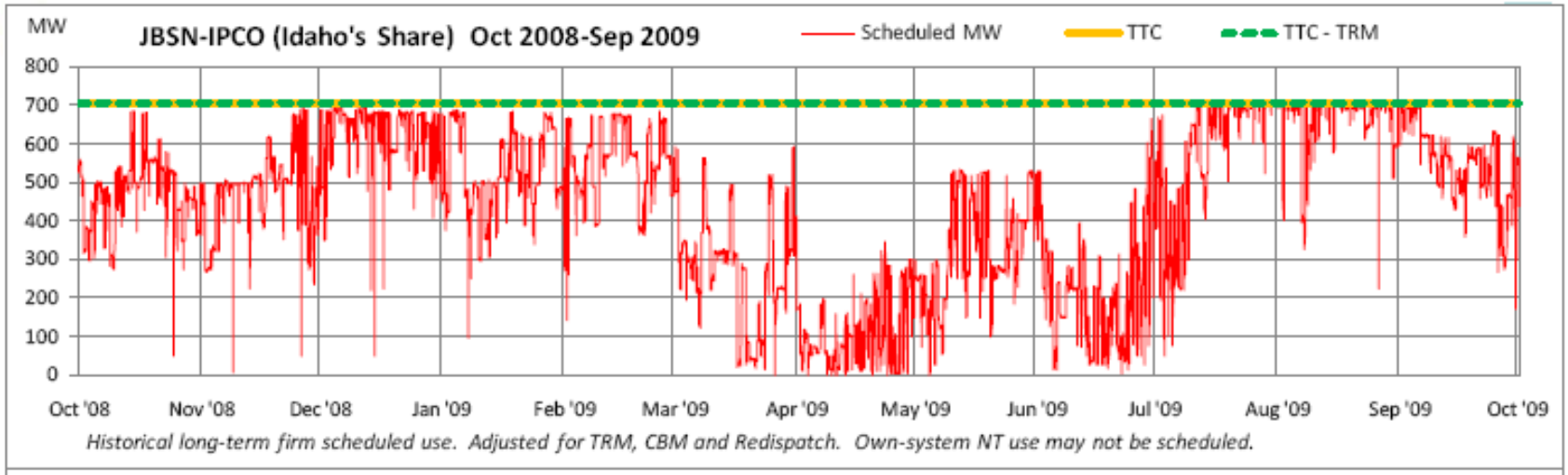
NORTHERN TIER TRANSMISSION GROUP

NTTG Study – Export Matrix

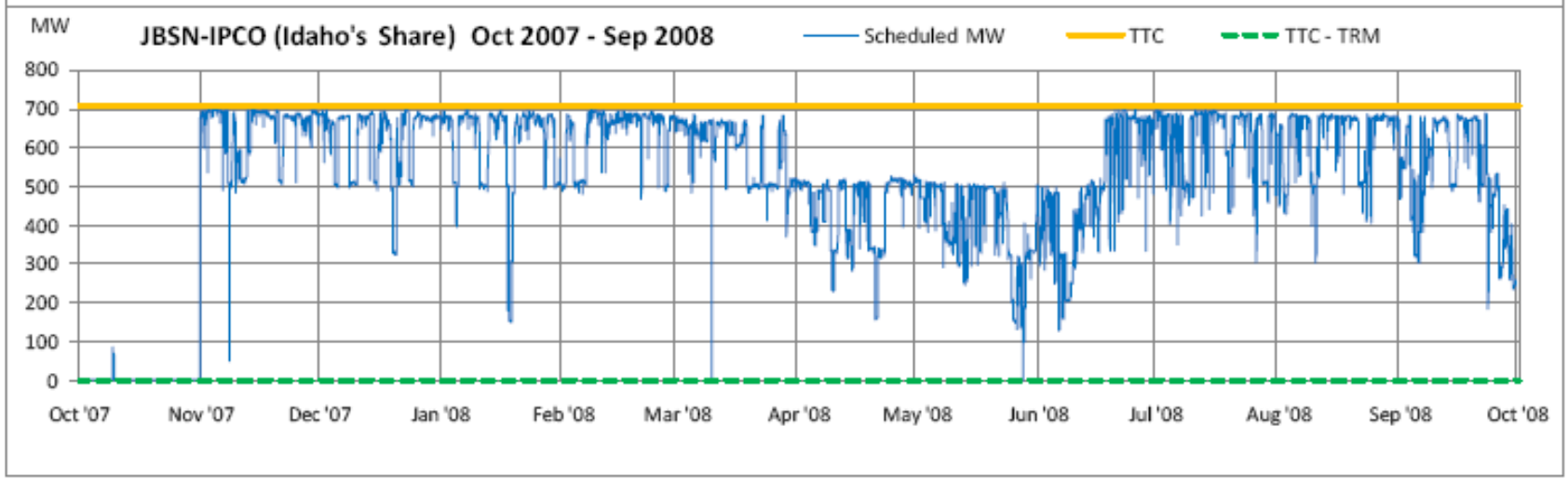


JBSN-IPCO System (Idaho's Share)

Chronological Graph



Historical long-term firm scheduled use. Adjusted for TRM, CBM and Redispatch. Own-system NT use may not be scheduled.



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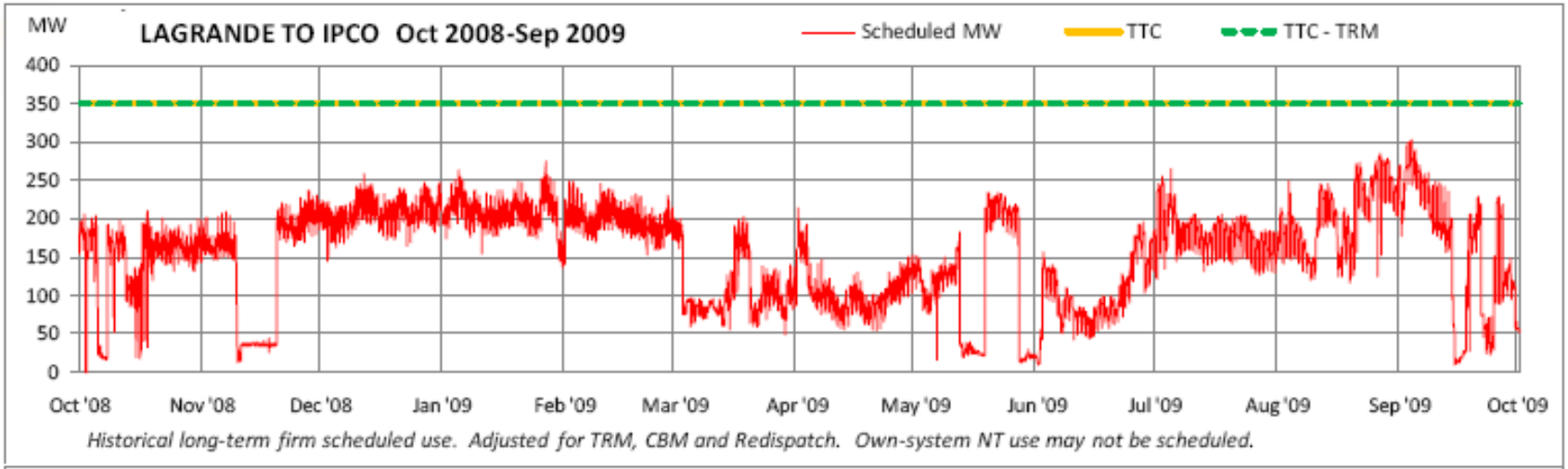
LaGrande-IPCO System

Chronological Graph



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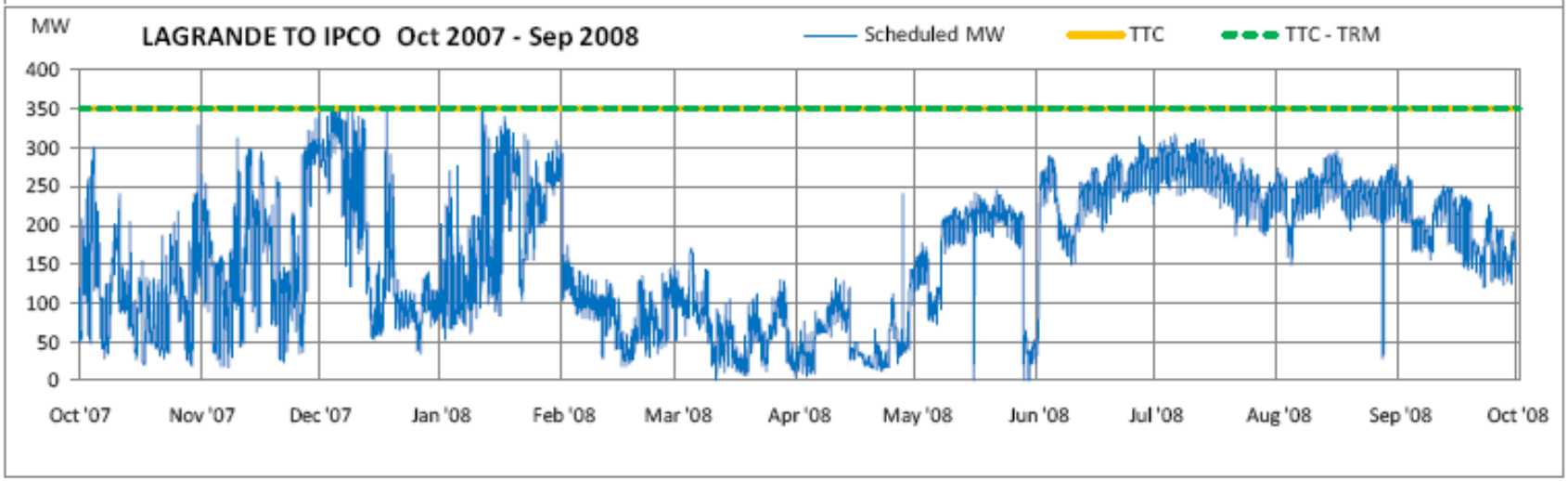

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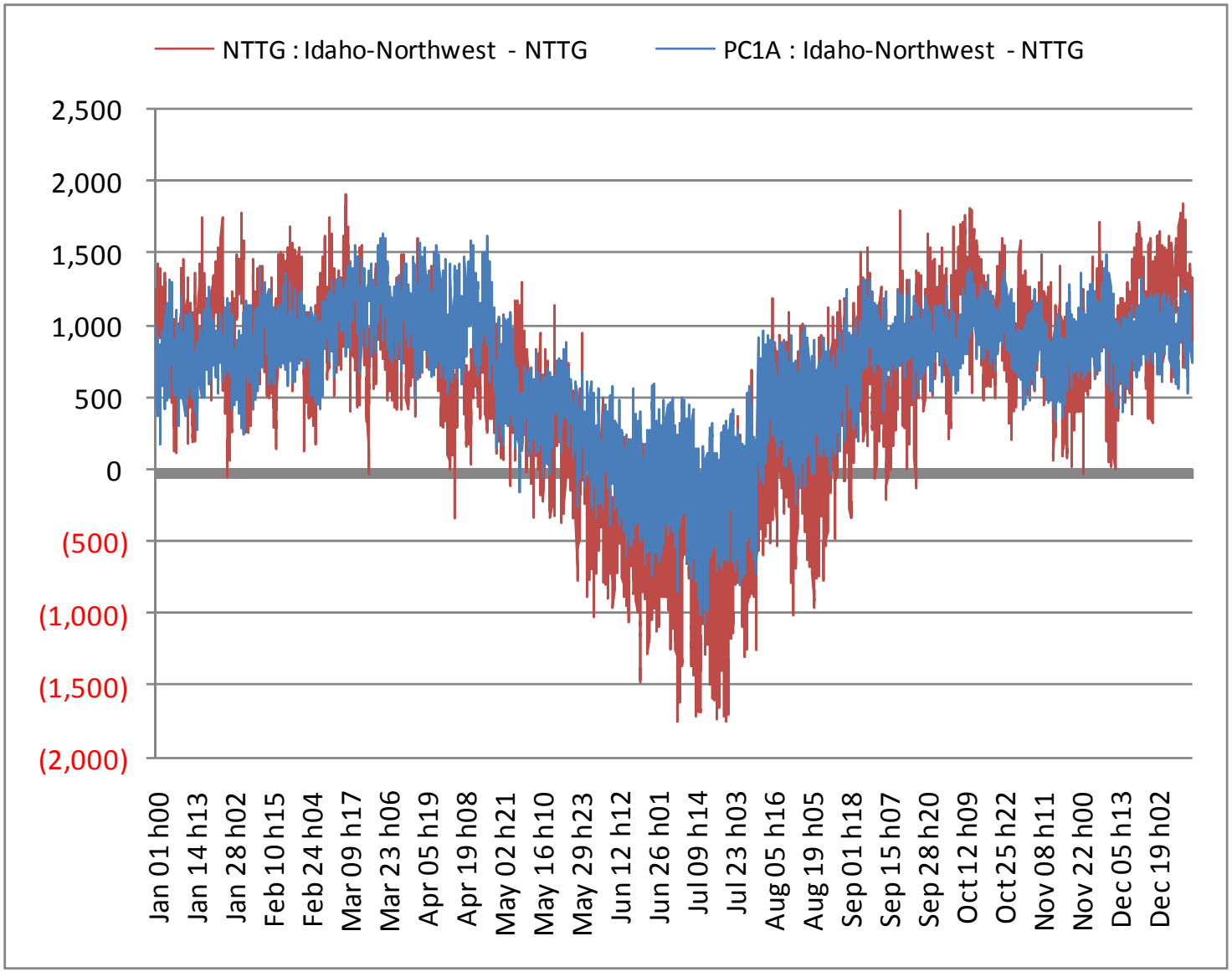
NTTG 2009 Economic Study



Production Cost Simulations

These tools produce a lot of data, and some useful information.

These studies did not demonstrate projects pay for congestion relief – they are being constructed to meet load service obligations

Limitations –

- Exclusion of capital costs
- Dispatch assumes "perfect market knowledge"
- Must pre-select loads, resources, and transmission to study
- Simulations "use" the transmission system, not design it
- VER integration and reserves
- Reliability and contingency analysis

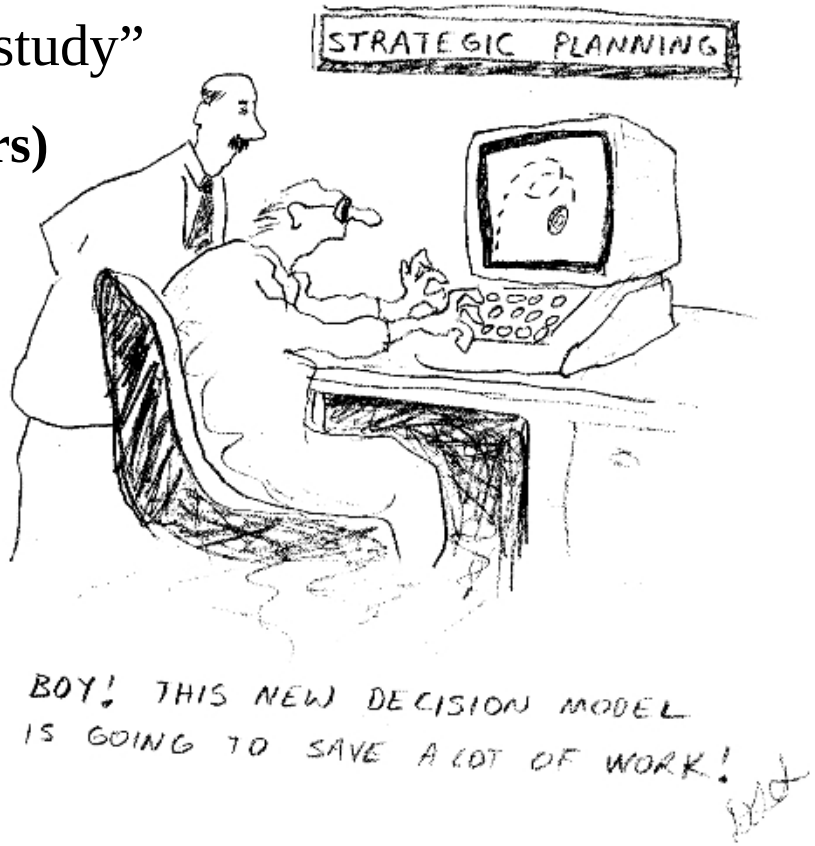
Advantages –

- Results relative to base assumptions
- "see" differently for broad changes in futures

NTTG is working to export L&R from production cost simulation models to simple DC power flow models to develop transmission alternatives, and will then use full AC solutions for reliability

Now What?

Still need to make decisions

"no regrets" – what choices provide for most future scenarios with the fewest bad outcomes?

- These programs are not "decision tools", provide analytics and data
- Managing risks drives decisions, not a "study"
  - **Investment recovery (willing customers)**
  - **Implementation delays and risks**
    - **Permitting**
    - **Equipment lead times, etc.**
  - **Reliability and project sequencing**
  - **Constructability**