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APS

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May 23, 2008

Docket Control
Arizona Corporation Commission
1200 W. Washington Street
Phoenix, Arizona 85007

RE: Arizona Public Service Biennial Transmission Assessment Presentations
Docket No. E-00000D-07-0376

Attached please find copies of the presentations presented by Arizona Public Service Company (APS) at the fifth Biennial Transmission Assessment Workshop held on May 22nd and 23rd, 2008:

APS Ten-Year Plans 2008-2017
Arizona Extreme Contingency Analysis 2009 & 2016
Arizona Renewable Transmission Task Force
Reliability Must-Run Analysis 2008-2017
TransWest Express

If you have any questions pertaining to these presentations please contact Jeff Johnson at 602-250-2661.

Sincerely,

Barbara Klemstine

Barbara Klemstine

Attachments

CC: Terri Ford
Prem Bahl
Laurie Woodall @ K.R. Saline & Assoc.

Arizona Corporation Commission
DOCKETED
MAY 23 2008
DOCKETED BY nr

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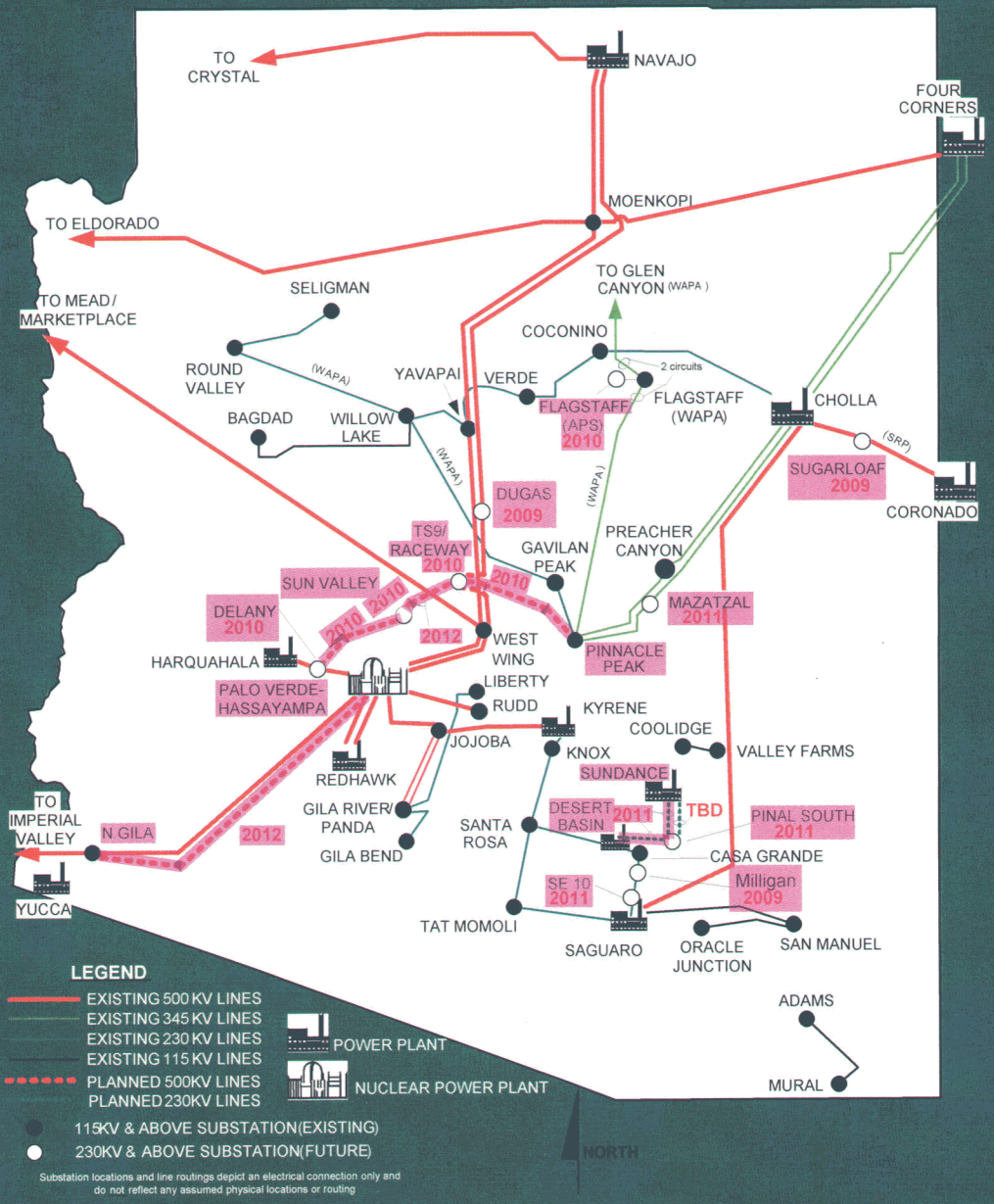
2008 MAY 23 P 4: 41
AZ CORP COMMISSION
DOCKET CONTROL

APS TEN-YEAR PLANS 2008-2017
5th BTA PRESENTATION

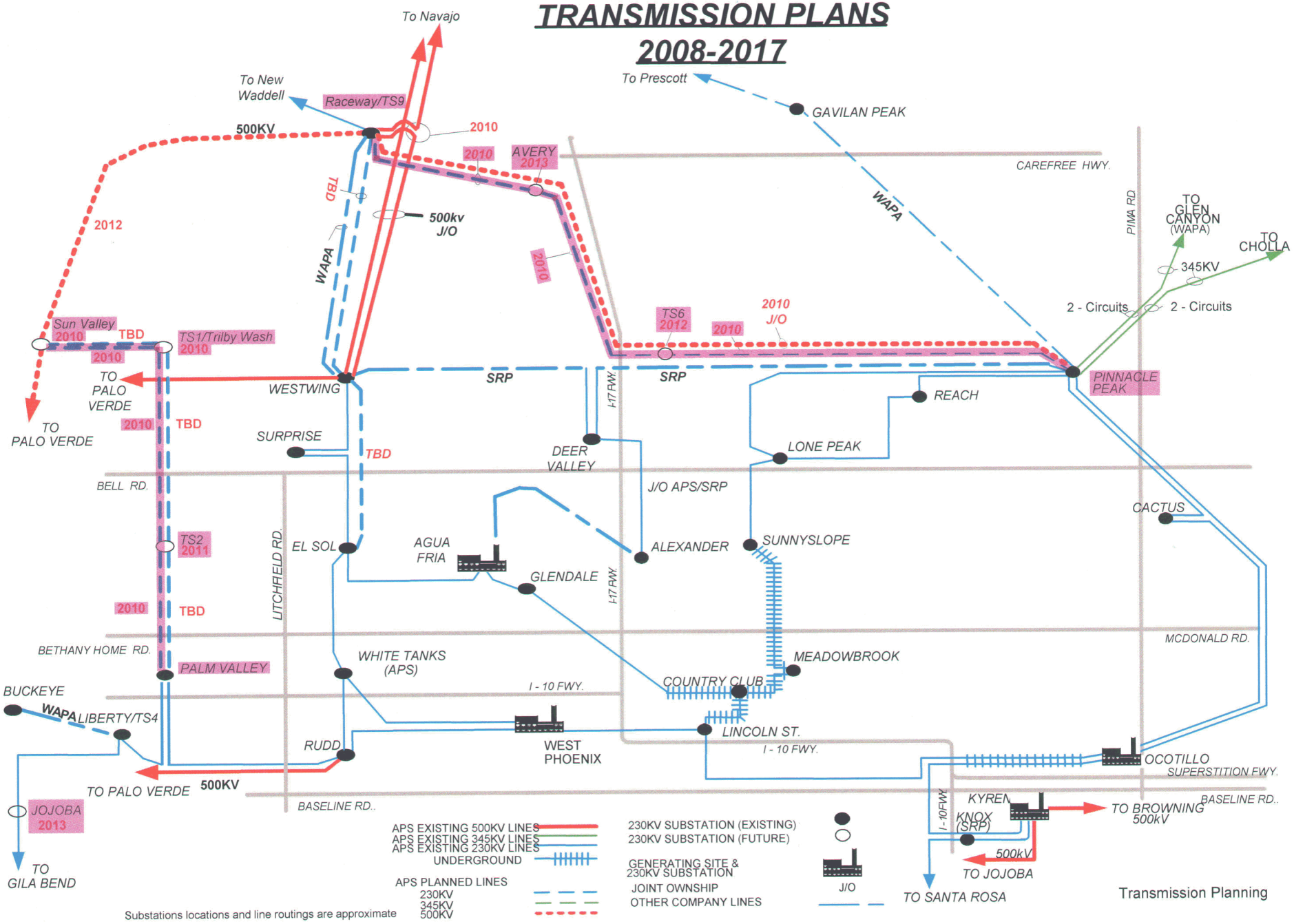
APS Ten-Year Plans 2008-2017 5th BTA Presentation

John Lucas
Manager Transmission Planning
May 22, 2008

APS EHV & OUTER DIVISION 115/230 KV TRANSMISSION PLANS 2008 - 2017



PHOENIX METROPOLITAN AREA TRANSMISSION PLANS 2008-2017



Changes from 2006 to 2008

Project	Status
Palm Valley 230/69KV Substation	Completed
Rudd-Palm Valley-TS4 230KV	Completed
Flagstaff 345/69kV interconnection	Changed to I/S date of 2010
Jojoba cut-in of TS4-Panda 230kV	Changed to I/S date of 2013
PV Hub-Sun Valley(TS5) 500kV	Changed to I/S date of 2010

Changes from 2006 to 2008

Project	Status
Sun Valley(TS5)- Trilby Wash(TS1) 230kV	Changed to I/S date of 2010
Trilby Wash(TS1)-TS2-Palm Valley 230kV w/TS2 I/S OF 2011	Changed to I/S date of 2010 w/TS2 I/S date of 2011
Pinnacle Peak-TS6-Avery-Raceway-TS9 230kV	Changed to I/S date of 2010
Milligan 230/69 kV Substation	New Project - 2009

Changes from 2006 to 2008

Sundance-Pinal South 230 kV	New Project - 2011
Desert Basin-Pinal South 230 kV	New Project - 2011
SE10 230/69 kV Sub	New Project - 2011
N.Gila-Yucca 230 kV	New Project - TBD
Sun Valley – TS9 230kV line	New Project - TBD
SunValley-TS11-Buckeye 230 kV	New Project - TBD
SunValley-TS10-TS11 230 kV	New Project - TBD

Technical Studies and Stakeholders

- All projects with in service dates have had technical studies and are included in the 10 Year Plan that has been filed:
  - Thermal and Post-Transient analysis (all 10 years)
  - Transient Stability analysis (2011 & 2016)
  - RMR Studies
  - SWAT studies (N-1-1 and Extreme Contingency)
- All transmission projects with an in-service date listed as To Be Determined have not had power flow studies performed

Technical Studies and Stakeholders

- All projects are included in common, jointly built base cases
- Plans are presented to SWAT and WestConnect
  - Participation in projects are open to all stakeholders
  - Project updates are regularly given at SWAT and WestConnect meetings
- WECC
  - Transmission projects seeking a WECC rating go through the WECC 3-phase rating process

Technical Studies and Stakeholders

- APS holds regular coordination meetings with SRP and WAPA
- Project(s) interconnecting into jointly owned facilities undergo interconnection process and review by appropriate technical review group; i.e. WATS
- Plans included in all WECC, WestConnect, and SWAT base cases

Questions ?

ARIZONA EXTREME CONTINGENCYANALYSIS
2009 & 2016
5TH BTA PRESENTATION

Arizona Extreme Contingency Analysis 2009 & 2016
5th BTA Presentation

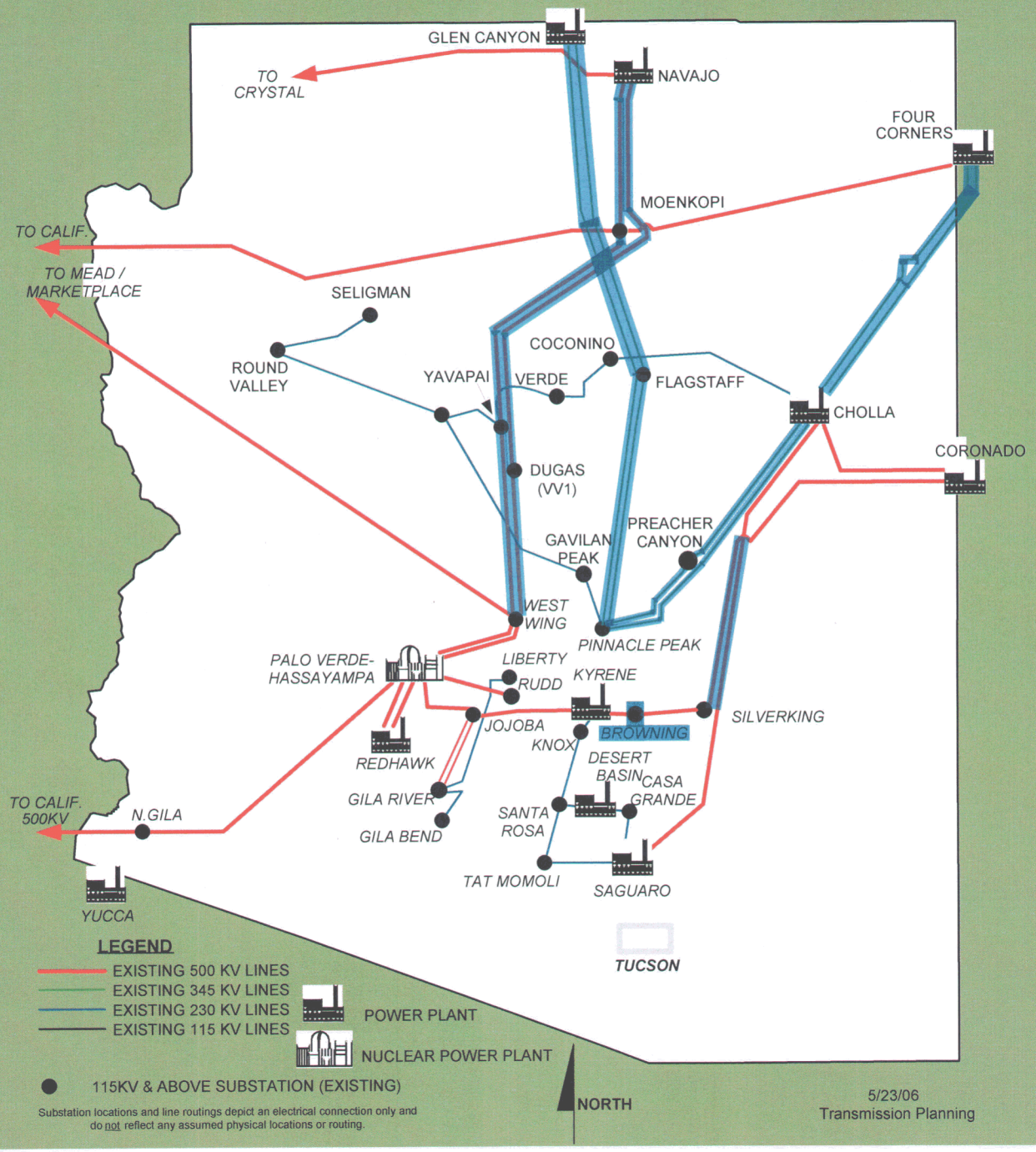
Jonathan Stahlhut, Ph.D.
Transmission Planning Engineer, APS

May 22-23, 2008

Study Assumptions

- Utilize the 2009 and 2016 heavy summer power flow cases
- The integrated Arizona power system is represented
- Corridors are chosen based upon exposure to forest fires and other extreme events
  - Cholla-Saguaro and Coronado-Silverking 500kV lines
  - Navajo South 500kV lines
  - Four Corners-Cholla-Pinnacle Peak 345kV lines
  - Glen Canyon-Flagstaff-Pinnacle Peak 345kV lines

ARIZONA STATE EHV MAP



Study Assumptions

- Transformer banks studied
  - Browning 500/230kV
- Transformer banks not studied
  - Rudd 500/230kV transformer outage
    - Equivalent to single contingency of Palo Verde-Rudd 500kV line
    - This outage is studied under the 10 year plan
  - Pinnacle Peak 345/230kV transformer outage
    - Equivalent to outages of the 345kV lines into Pinnacle Peak
    - This is already studied with the 345 kV lines into Pinnacle Peak outage in the extreme contingency study

SUMMARY OF RESULTS (2009)

- For all outages studied, all load can be served & local Phoenix reserve requirements met
  - Some outages from remote generation would require redispatching from other available sources
    - Maximum redispatch requirement is ~800MW @ Navajo
    - Generation made up or purchased from available AZ and CA units
  - Some outages would require some system reconfiguration to alleviate overloads
  - Without system reconfiguration, load reduction is required for outages of corridors into Pinnacle Peak

SUMMARY OF RESULTS (2016)

- Outages of the Cholla-Saguaro and Coronado-Silverking lines causes a reduction of Phoenix import capability
- For all other outages studied, all load can be served & local Phoenix reserve requirements met
  - Some outages from remote generation would require redispatch from other available sources
    - Maximum redispatch requirement is ~800MW @ Navajo
    - Generation made up or purchased from available AZ and CA units
  - Some outages would require some system reconfiguration to alleviate overloads

Arizona Extreme Contingency Analysis 2009 & 2016
5th BTA Presentation

Jonathan Stahlhut, Ph.D.
Transmission Planning Engineer, APS

May 22-23, 2008

ARIZONA RENEWABLE TRANSMISSION TASK FORCE
BTA RESPONSE

Arizona Renewable Transmission Task Force BTA Response

Chairman of SWAT RTTF
Peter Krzykos
BTA Workshop
May 22-23 2008

BTA Order

"IT IS FURTHER ORDERED that in the next BTA, Commission regulated electric utilities, in consultation with the stakeholders, should prepare an assessment of ATC for renewable energy and prepare a plan, including a description of the location, amount and transmission needs of renewable resources in Arizona, to bring available renewable resources to load."

SWAT RTTF Phase #1
Integration of Renewable Resources into Arizona Transmission Network
BTA Response

- Three Parts to the BTA Response
  - Assessment of ATC in Arizona
  - Potential renewable resources in Arizona
  - Potential transmission configuration to deliver the renewable resources in Arizona

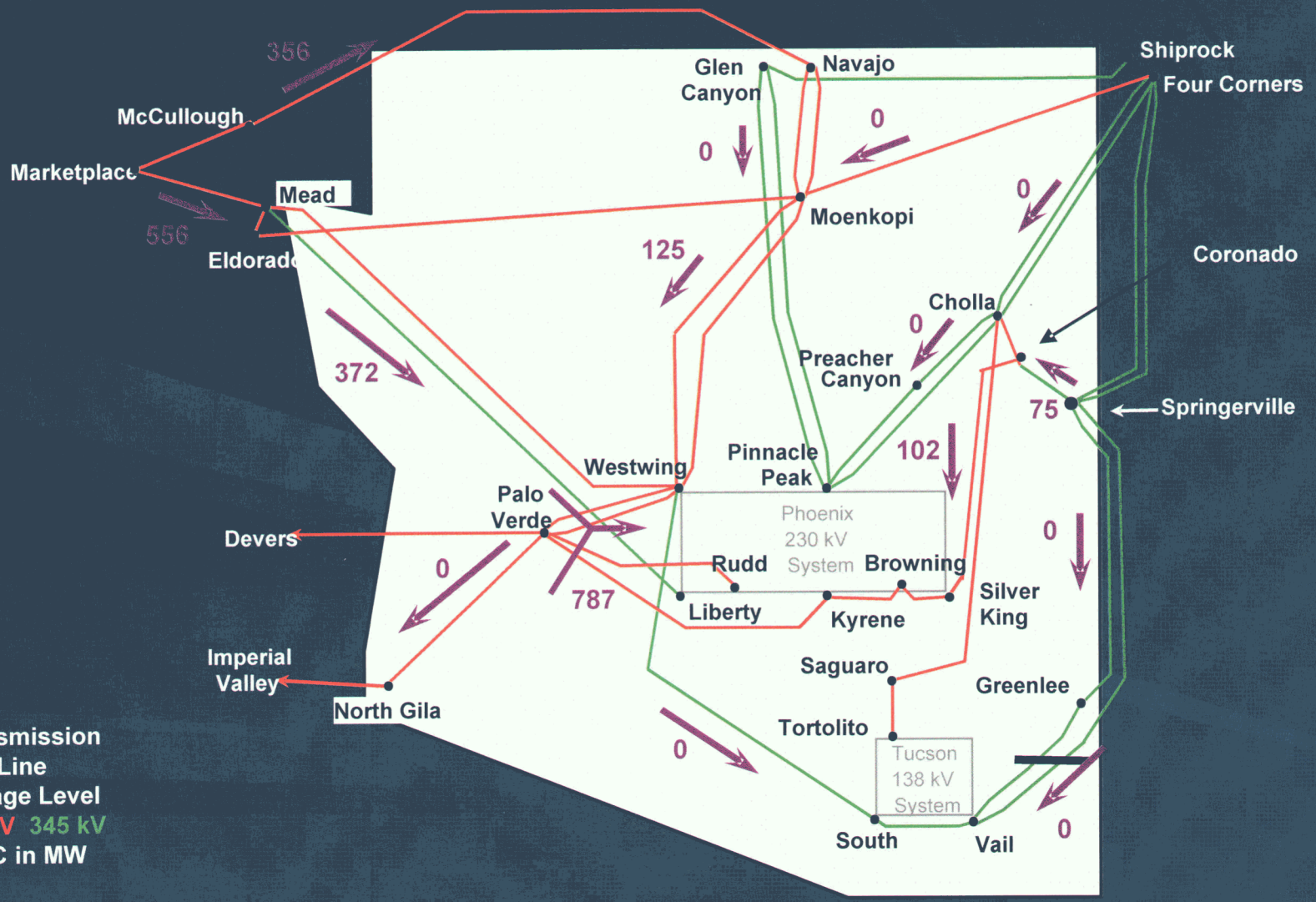
SWAT RTTF Phase #1
AZ BTA Order Response Task Force Meetings

- Two meetings(October 8th and November 16th 2007)
  - Stakeholders and utilities attended
    - Arizona Corporation Commission
    - Utilities
      - Arizona Public Service
      - Salt River Project
      - Tucson Electric Power
      - Southwest Transmission Corporative
      - Southern California Edison
    - Renewable Energy Companies
      - Sky fuel
      - BP Alternative Energy
      - Foresight Wind
      - West Wind Wires
      - Ausra
      - Solar Mission
      - Interwest Energy Alliance
    - Other Stakeholders
      - National Renewable Energy Laboratory
      - Genesee Consulting
      - PDS Consulting
      - K R Saline
      - Stanley Group
      - WSES Consulting
  - 20-30 people were at each meeting
  - Stakeholders and utilities participated in development of a resource map, transmission map, and assess the ATC in Arizona in an open forum to address the BTA

SWAT RTTF
Part 1 -ATC Assessment

- This information was developed during stakeholder workshops held October 8th and November 16th 2007 and includes utility (APS, SRP, SWTC, and TEP) ACC staff and stakeholder input.
- Available Transfer Capability (ATC) has been gathered for each utility in Arizona
- ATC is a dynamic number that can change from day to day. Values observed in June 2007 are used to illustrate the status of the ATC in the Arizona transmission system.

Arizona EHV Transmission ATC (as of June 2007)



SWAT RTTF
Part 2 - Resource Projection

- The renewable resource map was developed during workshop meetings on Oct 8th and Nov 16th 2007
- A renewable resource map displaying areas where resources development potentially could occur and was developed with input from three specific areas
  - The Arizona Renewable Energy Assessment recently prepared for APS, SRP and TEP by Black and Veatch (2007)
  - The queue for renewable resource in Arizona requesting potential interconnection (as of October 15th 2007)
  - Stakeholder/developer input on prospective development opportunities.
  - The # of MW display on the map is the highest out of the three inputs.

Black & Veatch Summary

Projected Resource Locations

1. Solar CSP/Yuma – 800MW
2. Solar CSP/Stoval – 1,900MW
3. Solar CSP/Phoenix – 800MW
4. Solar CSP/Tucson – 800MW
5. Wind/Project KS – 18MW
6. Wind/Project RS – 140MW
7. Wind/Project BR – 158MW
8. Wind/Project CV – 597MW
9. Wind/Project BH – 46MW
10. Wind/Project GP – 31MW
11. Biomass/Biogas – 60MW (22 sites)
12. Geothermal/Clifton – 35MW
13. Hydro – 82MW (7 sites, 90% @ GC)

September 21st 2007

B & V Summary Filters

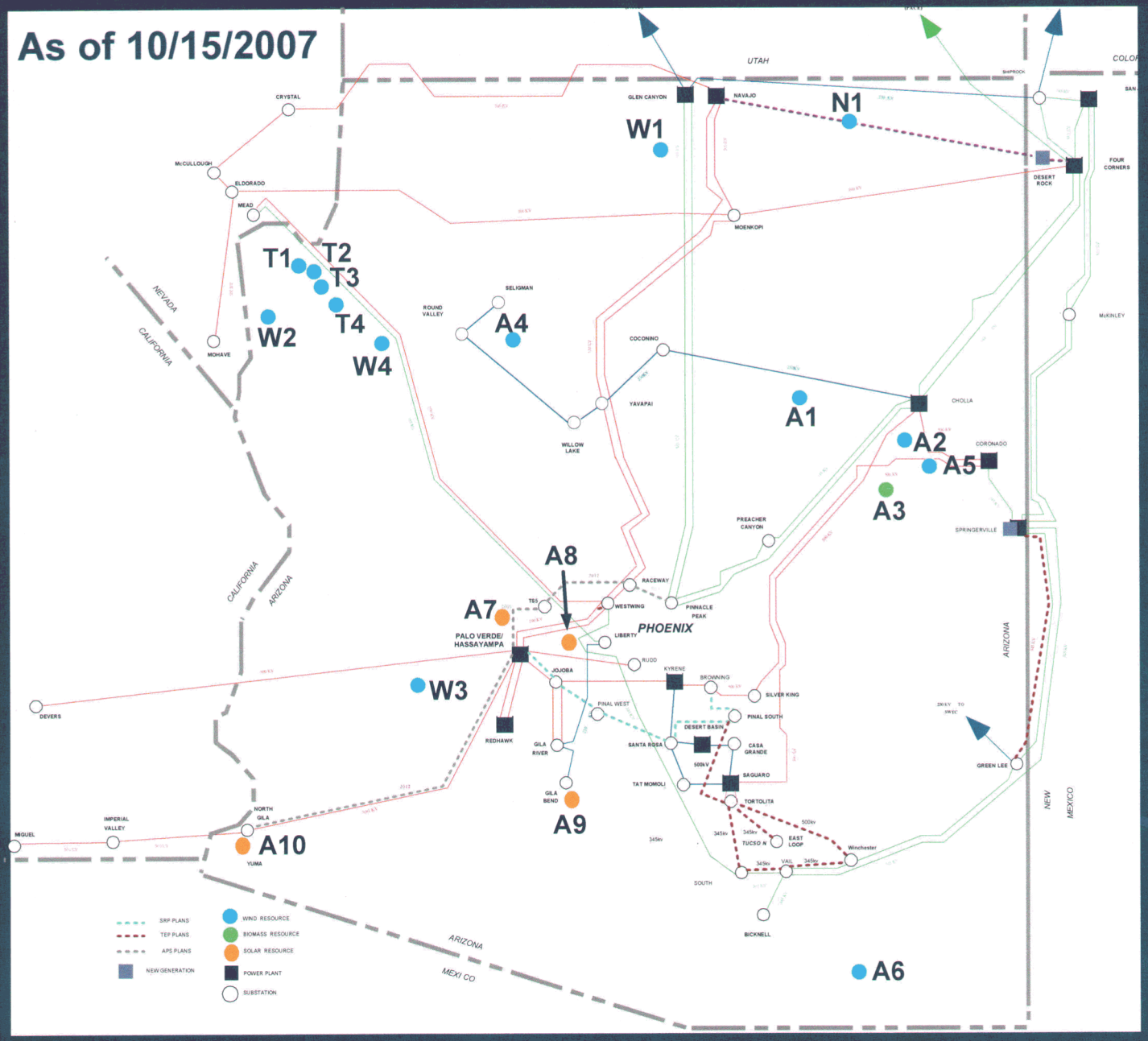
- Solar Thermal
  - Equipment availability/supply chain
  - Development timelines/engineering support
  - Project economics
  - Proximity to adequate transmission
  - Land availability/terrain slope/proximity to sensitive areas
- Wind
  - Equipment availability/supply chain
  - Class/Capacity factor
  - Project economics
  - Proximity to adequate transmission
  - Proximity to federal/environmental sensitive areas

Arizona Renewable Resource Queue

Code	Company	COD	MW Size	POI	County	Type
T1	TEP	2005	80	Dolan Springs Sub	Mohave	Wind
T2	TEP	2008	15	Dolan Springs Sub	Mohave	Wind
T3	TEP	2005	15	Dolan Springs Sub	Mohave	Wind
T4	TEP	2007	95	Co-Spr	St Johns	Wind
A1	APS	2008	60	Cholla - Coconino	Coconino	Wind
A2	APS	2008	128	Cholla Show	Coconino	Wind
A3	APS	2007	22	Cholla zeniff	Coconino	Biomass
A4	APS	2008	270	Ashofork - Pollock	Coconino	Wind
A5	APS	2009	250.5	cholla - show	Coconino	Wind
A6	APS	2010	100	Adams - Mural	Cochise	Wind
A7	APS	2011	110	Harquahala Jnc	Maricopa	Solar
A8	APS	2011	110	Panda Liberty line	Maricopa	Solar
A9	APS	2010	300	Gila Bend	Maricopa	Solar
A10	APS	2010	400	North Gila Sub	Yuma	Solar
W1	WAPA	2008	500	Tap on 345kV Glen Canyon-Pinnacle Peak	Coconino	Wind
W2	WAPA	2008	300	Mead - Davis 230 kV Line	Mohave	Wind
W3	WAPA	2008	65.1	Goldmine Tap Substation	Imperial	Wind
W4	WAPA	2008	500	Peacock Substation	Mohave	Wind
N1	Navajo Nation		100			Wind
Total			3420.6	As of 10/15/2007		

Arizona Renewable Resource Queue

Code	MW Size
T1	80
T2	15
T3	15
T4	95
A1	60
A2	128
A3	22
A4	270
A5	250.5
A6	100
A7	110
A8	110
A9	300
A10	400
W1	500
W2	300
W3	65.1
W4	500
N1	100

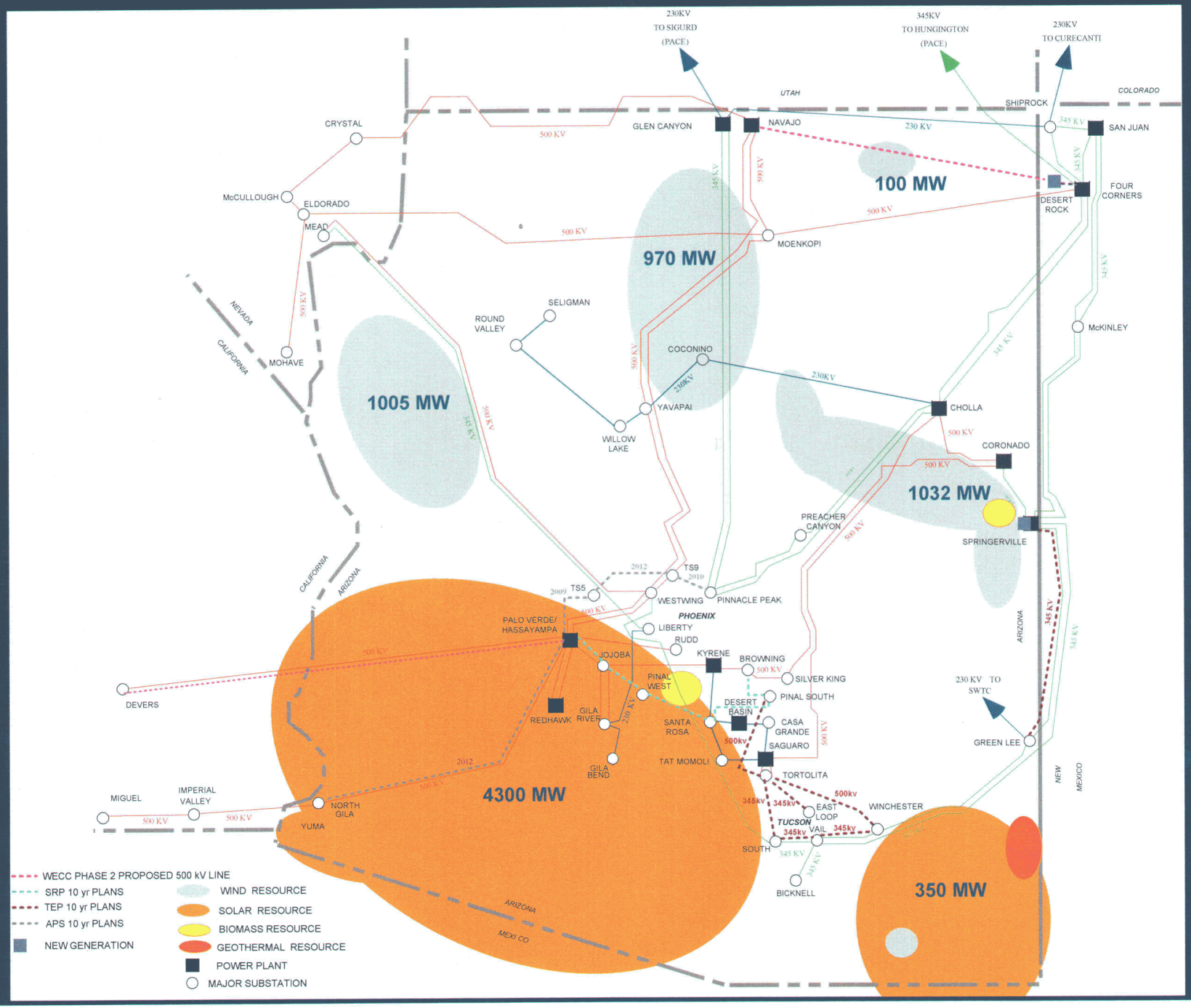


SWAT RTTF

Part 2 - Resource Projection

- The map is intended to provide an overview of the potential, renewable resources within Arizona, which include wind, solar, biomass, hydro and/or geothermal and identifies those resources as clusters.
- Since both geothermal and biomass/biogas opportunities are small relative to both solar and wind opportunities, they have been included within the total which is described as generally wind and solar clusters.

Potential Arizona Renewable Resources



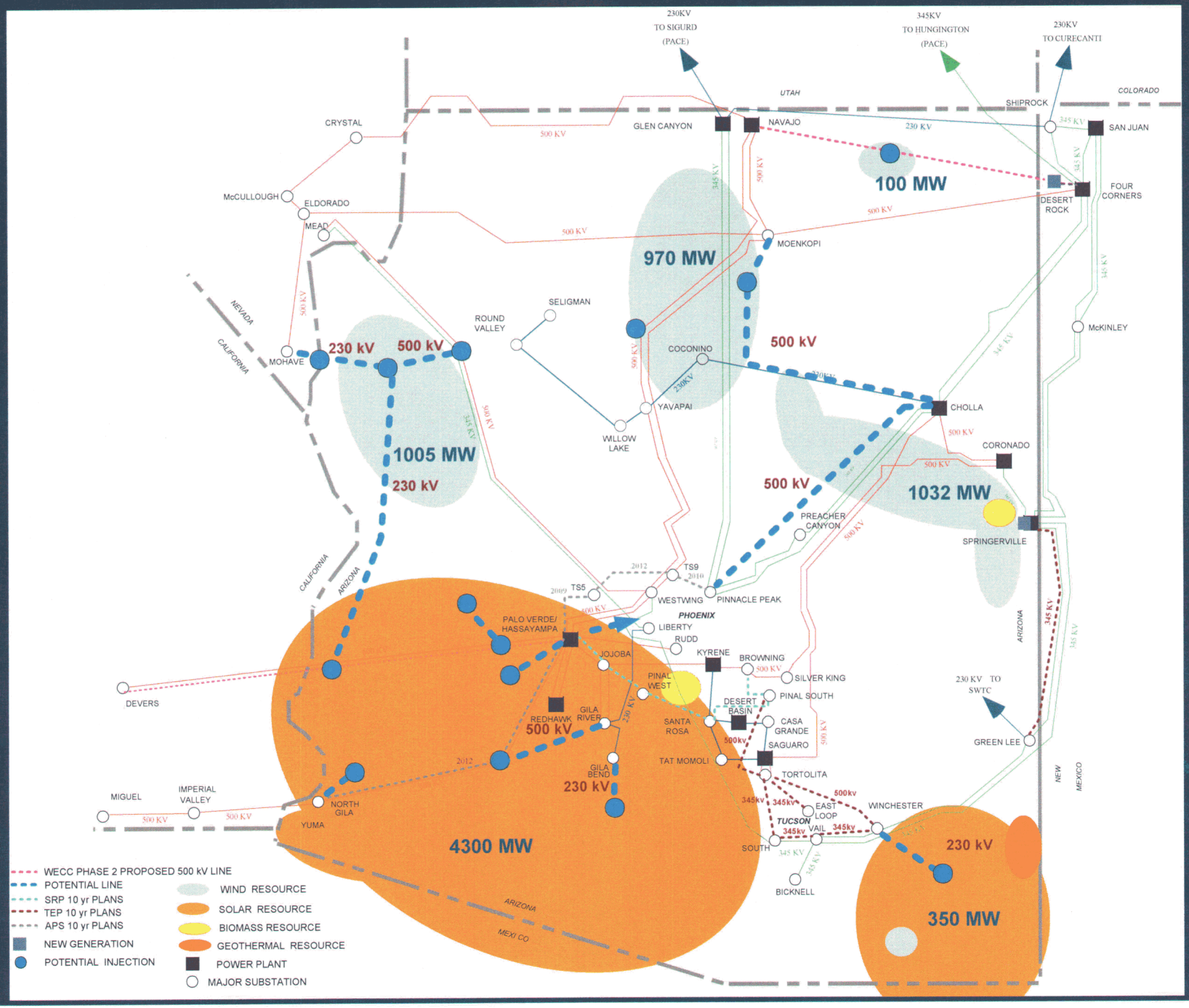
SWAT RTTF
Part 3 - Transmission System

- During the October 8th and November 16th 2007 meetings, transmission alternatives for bringing the renewable energy resources to load were discussed.
- Mapping was developed which represents the potential transmission lines that would be necessary if *all* of the renewable resources were to be developed in Arizona.

SWAT RTTF
Part 3 - Transmission System

- Included in the map are:
  - existing transmission lines
  - APS, SRP and TEP 10 year plans
  - other WECC Projects in Phase II process
  - potential transmission lines

Potential Configuration for Transmission to Serve All Available Renewable Resources in Arizona



Estimated Construction Costs

Substation Additions	
Voltage (kV)	# of Substations Added
500	11
230	3

Transmission Circuits	
Voltage (kV)	Miles
500	445
230	247

Totals	
	Cost (Million)
Substations	$130
Lines	$1,500
Total	$1,630

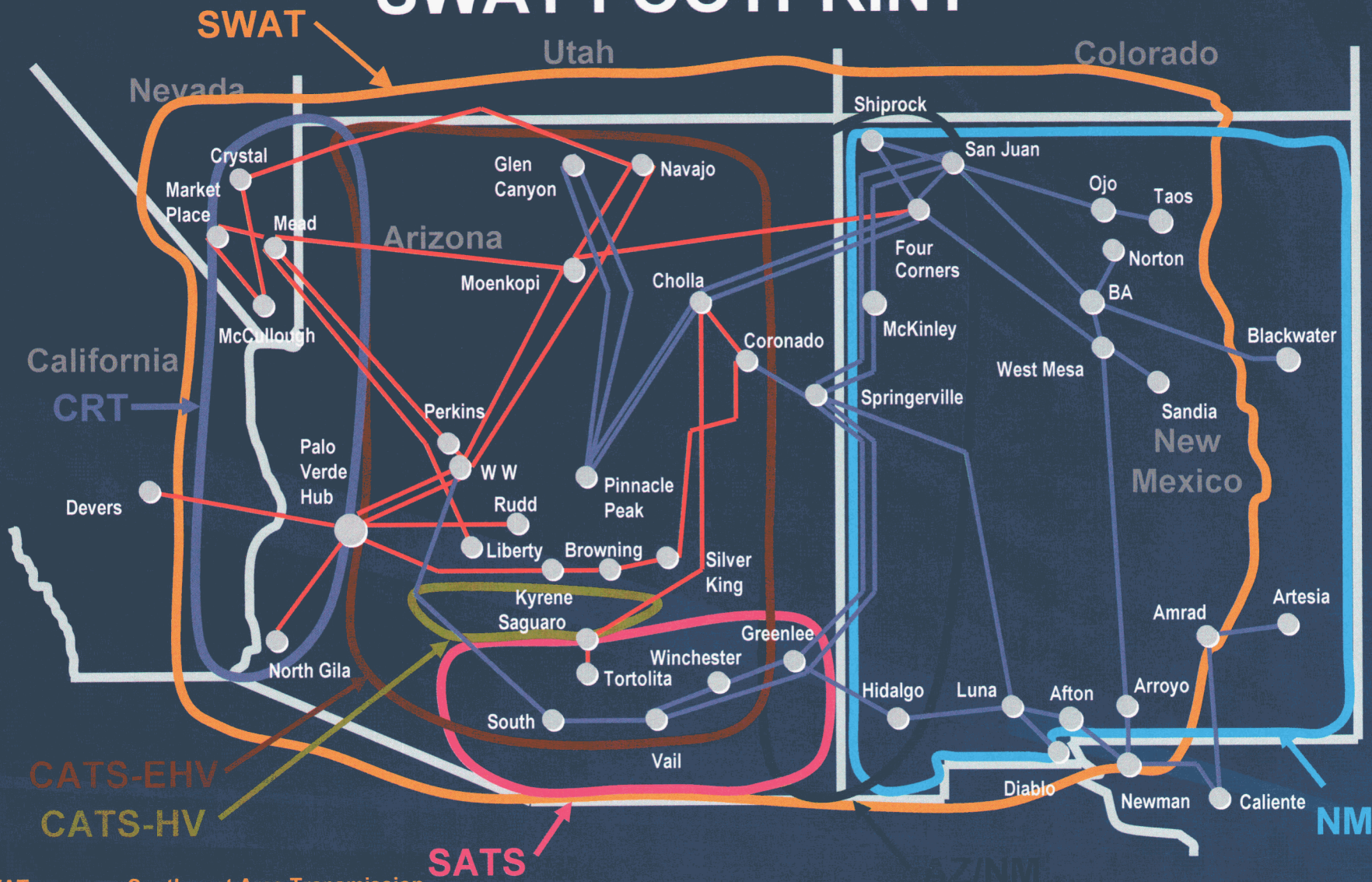
SWAT RTTF
Phase #2 – Evaluation and Integration of Renewable Resources into the Southwest Transmission Network

- Workshop Meetings held on April 7th and May 19th 2008
  - Renewable resource projection development
  - Potential transmission additions are in development for the entire SWAT area
- Renewable Taskforce has been extended to the entire SWAT area and includes Arizona, New Mexico, Nevada and Eastern California
- <u>Power flow studies will be developed based on the transmission alternatives</u>

SWAT Footprint
One of the WestConnect Sub-Regional Planning Groups

http://www.westconnect.com

SWAT FOOTPRINT



SWAT	Southwest Area Transmission
CRT	Colorado River Transmission
CATS – EHV	Central Arizona Transmission Study Extra High Voltage
CATS – HV	Central Arizona Transmission Study High Voltage
SATS	Southeast Arizona Transmission Study
AZ/NM	Arizona New Mexico Region of Transmission
NM	New Mexico Transmission

500kV
345kV

Web Sites

WestConnect: http://www.westconnect.com/init_swat.php

Arizona Renewable Transmission Task Force BTA Response

Chairman of SWAT RTTF
Peter Krzykos
BTA Workshop
May 22-23 2008

RELIABILITY MUST-RUN ANALYSIS 2008-2017
5th BTA WORKSHOP

Reliability Must-Run Analysis 2008 – 2017 BTA Workshop

Paul Smith
APS Resource Planning
May 22, 2008

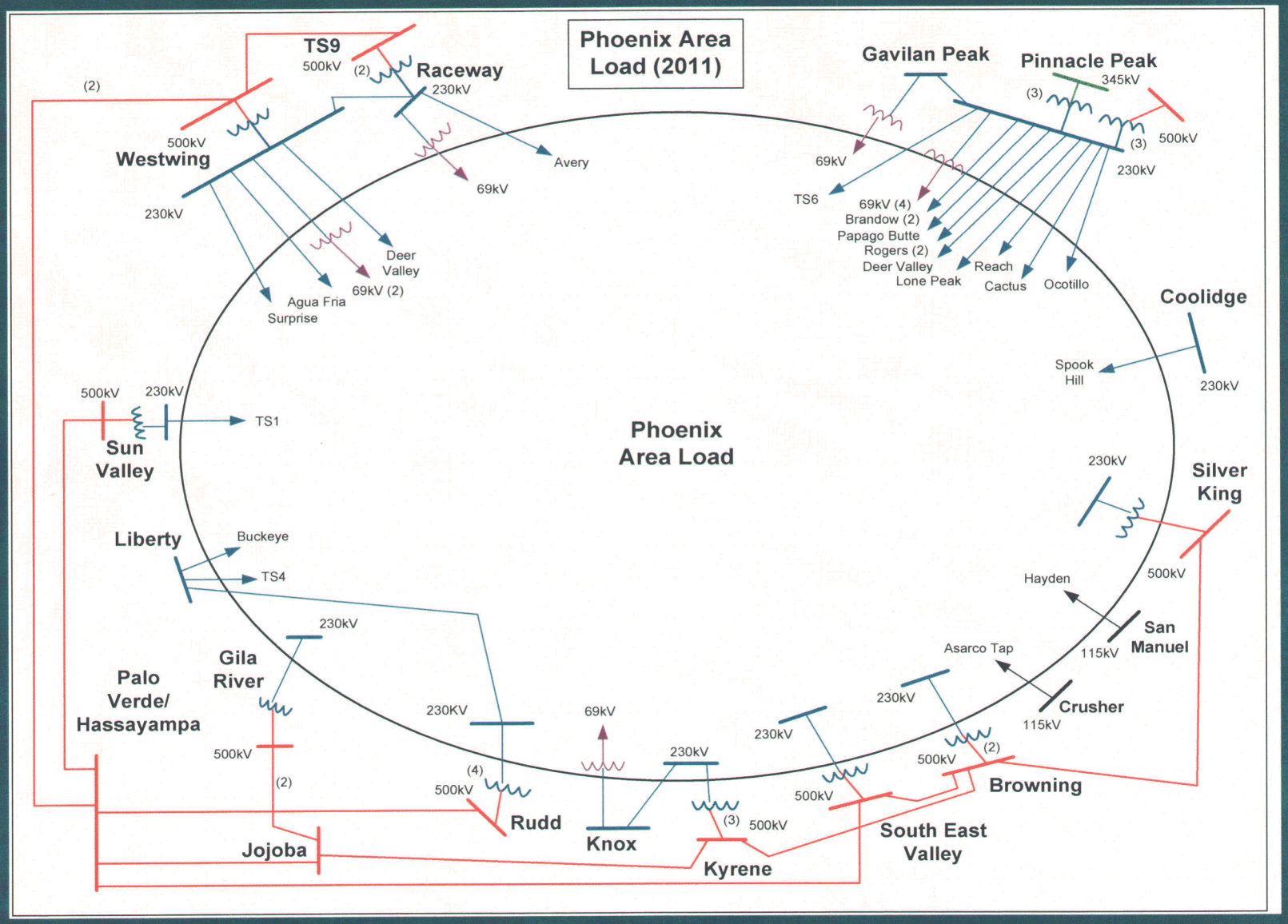
Outline of Presentation

- 2008 RMR Study Process
- Description of network.
- Phoenix load serving capability & Transmission limits .
- RMR - demand, energy and duration
- Economic impact of transmission constraint
- Observations

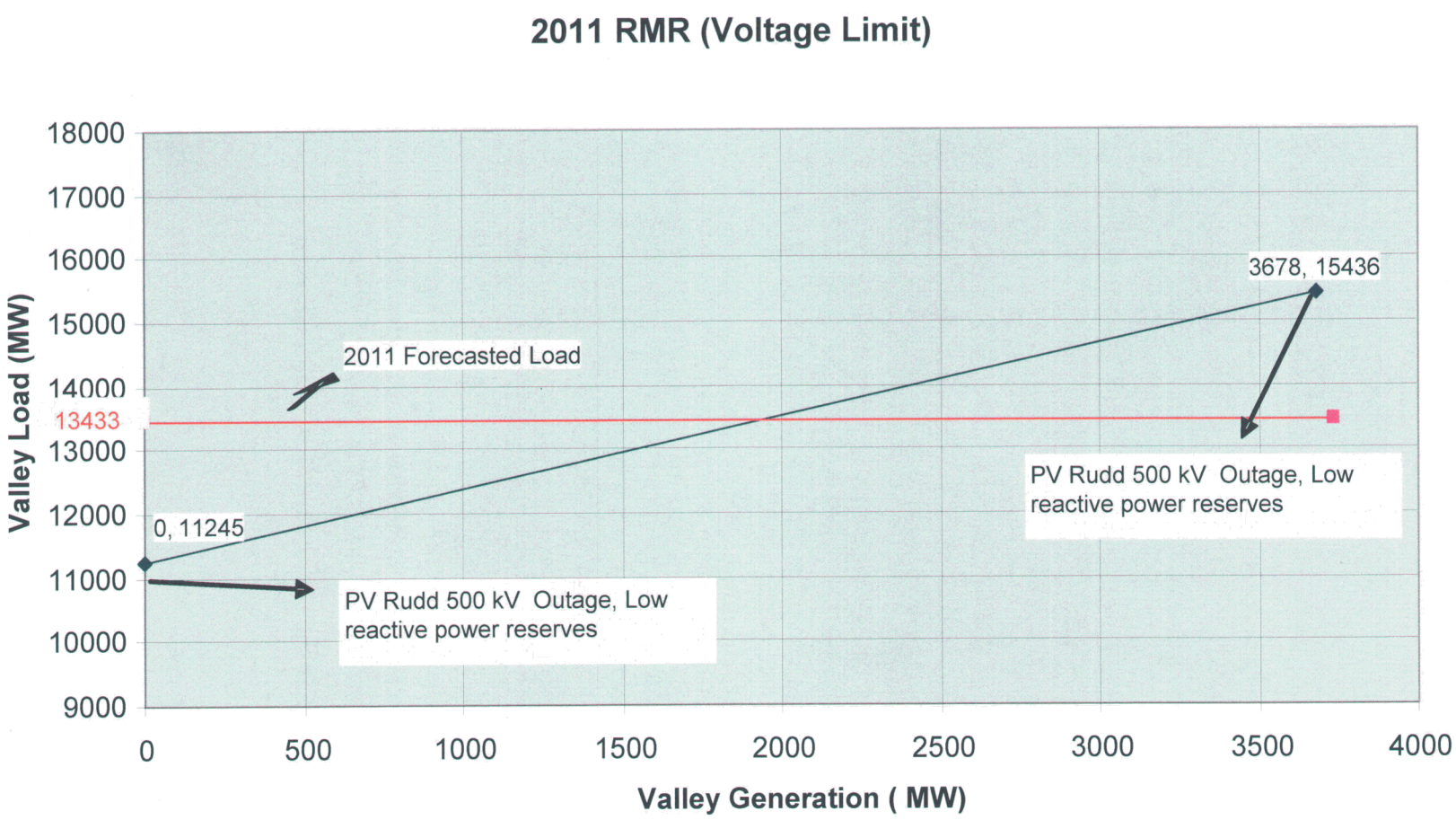
RMR Economic Analysis

- New Energy PROMOD production-cost simulator
- SRP and APS control areas modeled
- Hourly least cost dispatch with transmission constraints
- Annual cost to serve area load determined
- Study repeated ignoring local import limit
- Difference is the RMR cost

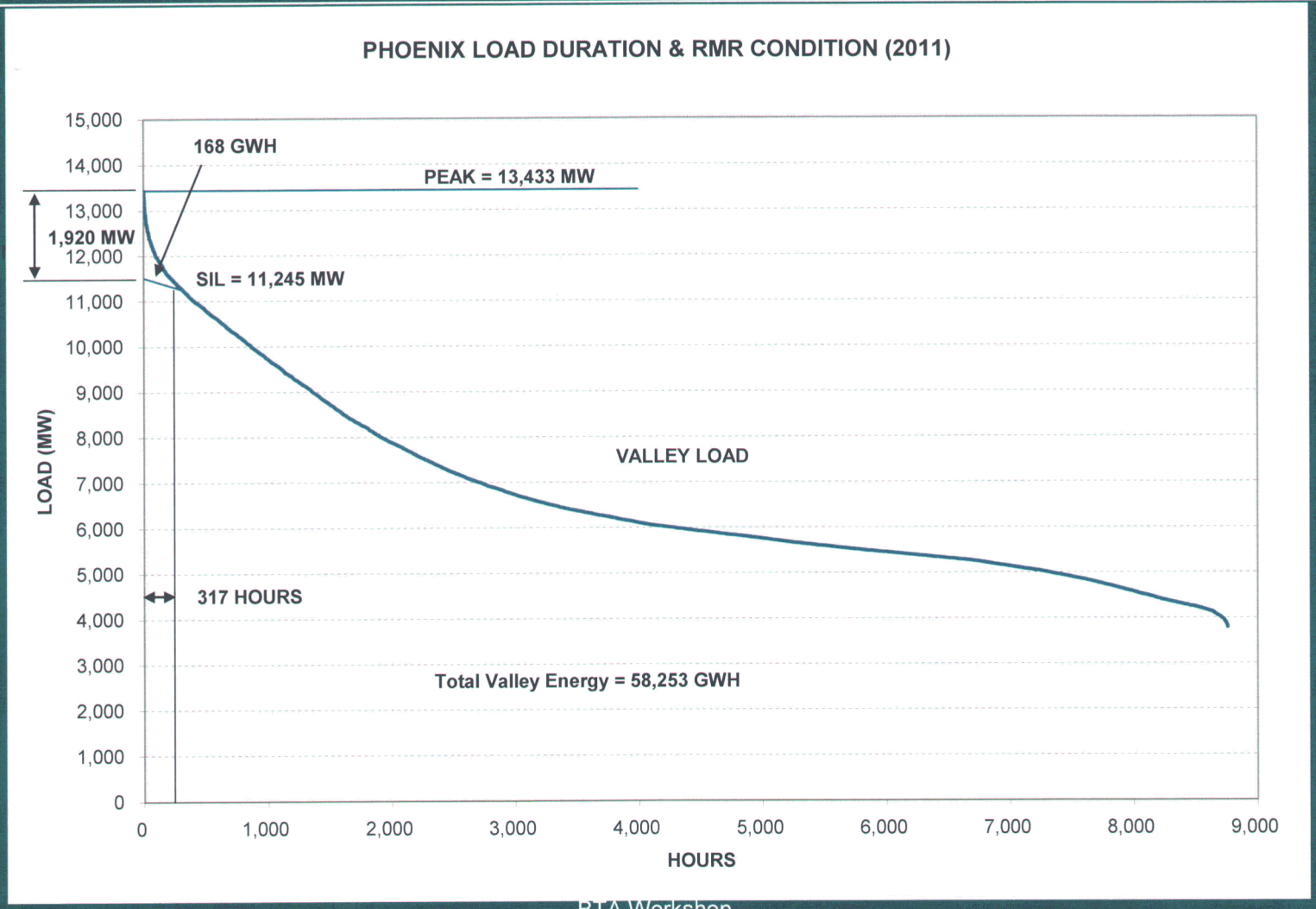
Phoenix Area Load 2011



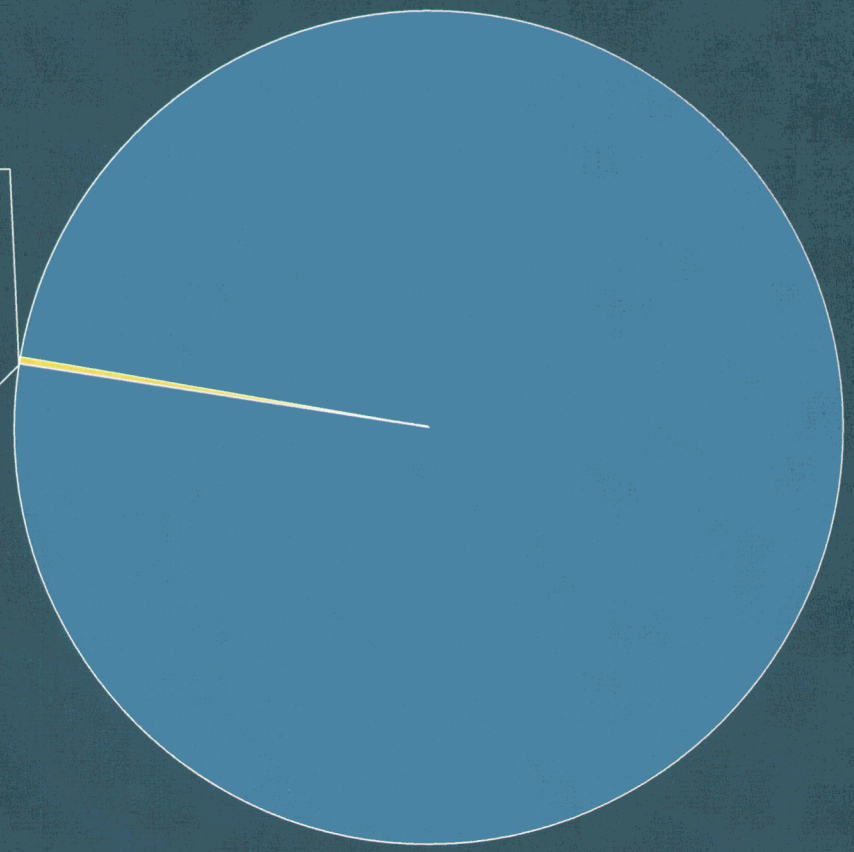
2011 Phoenix Load Serving Capability



2011 Phoenix Load Duration and RMR Conditions



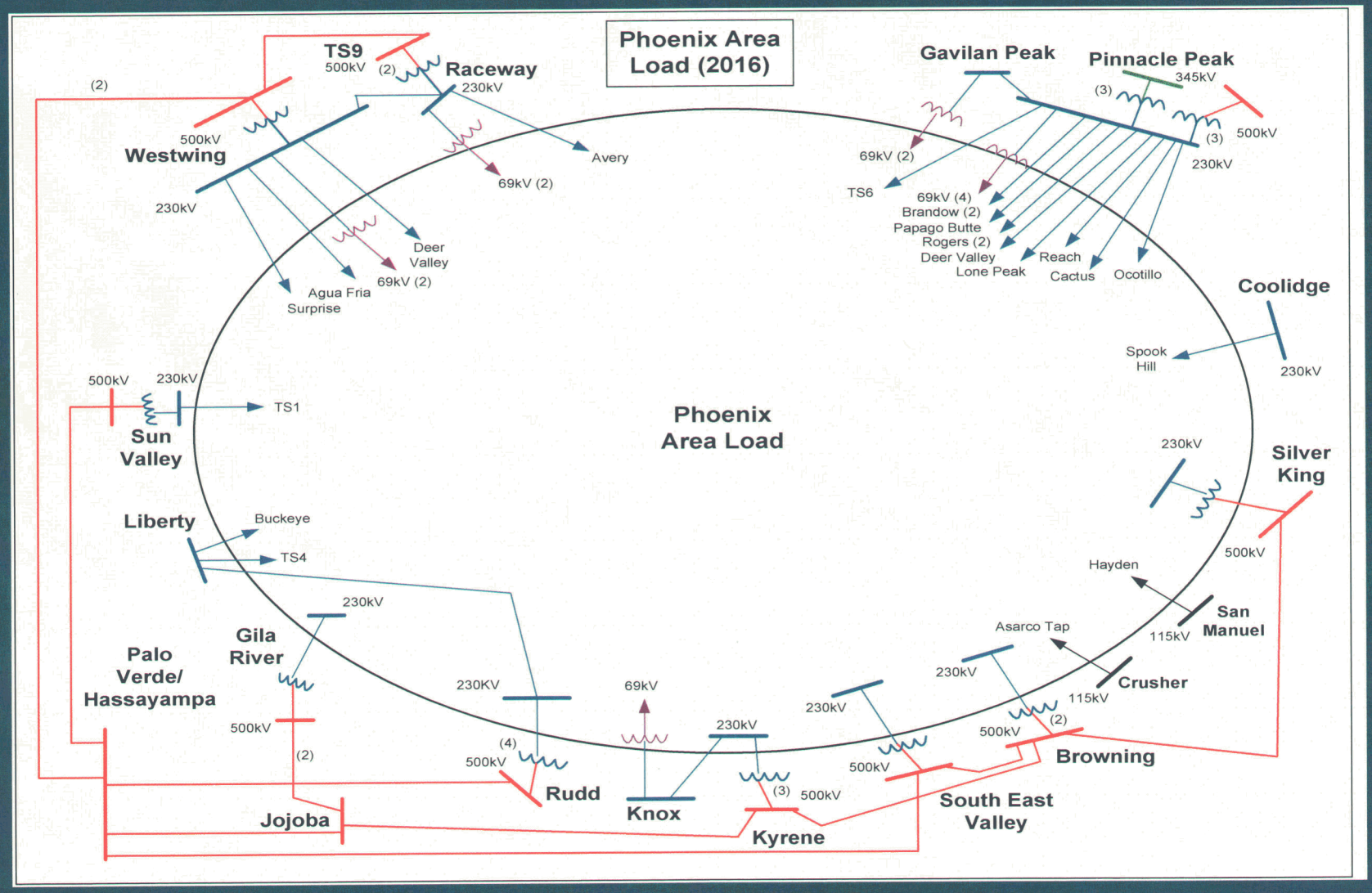
2011 Phoenix Area Energy



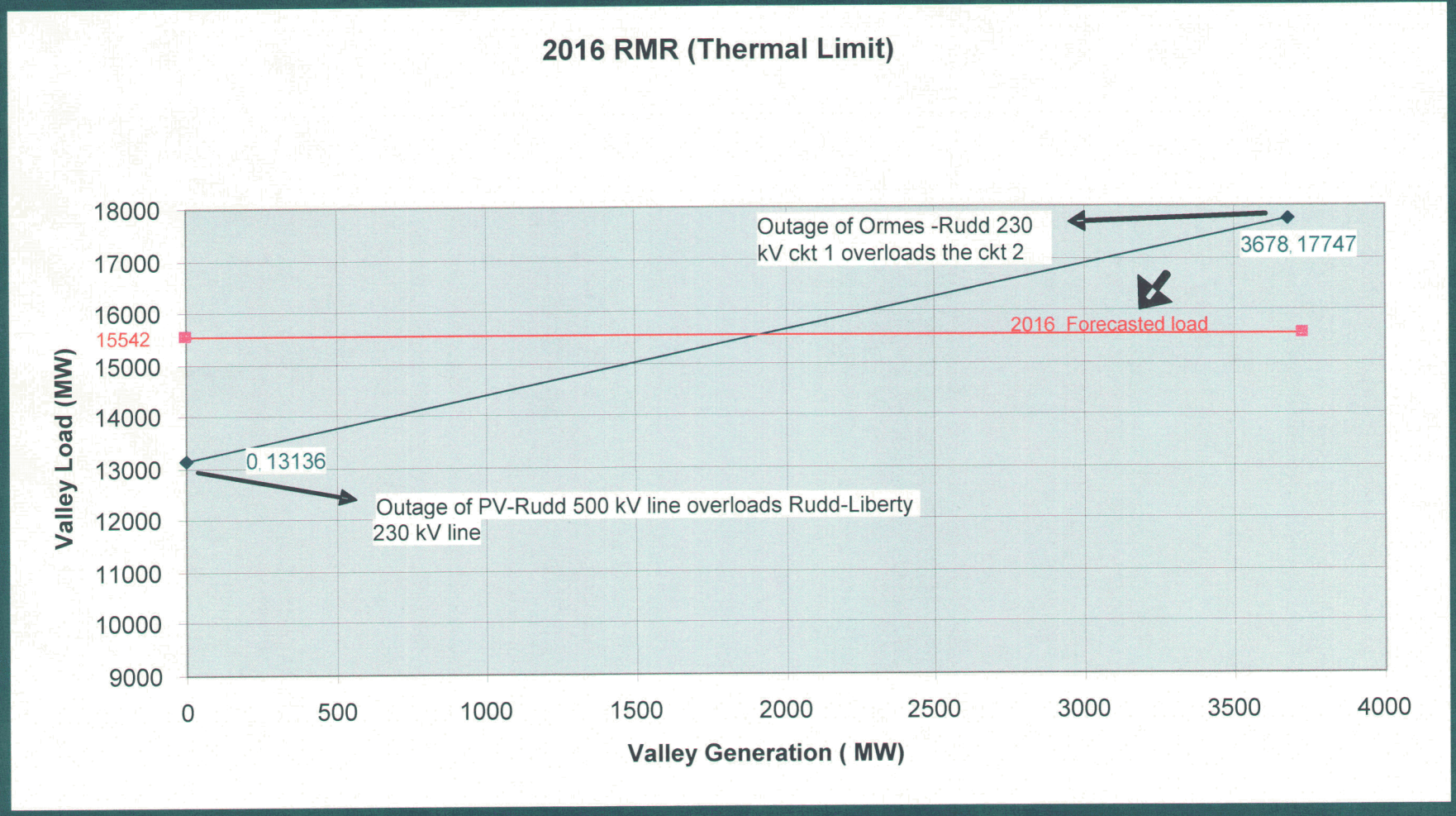
Phoenix Area Total Load = 58,253 GWh

$0M incremental cost

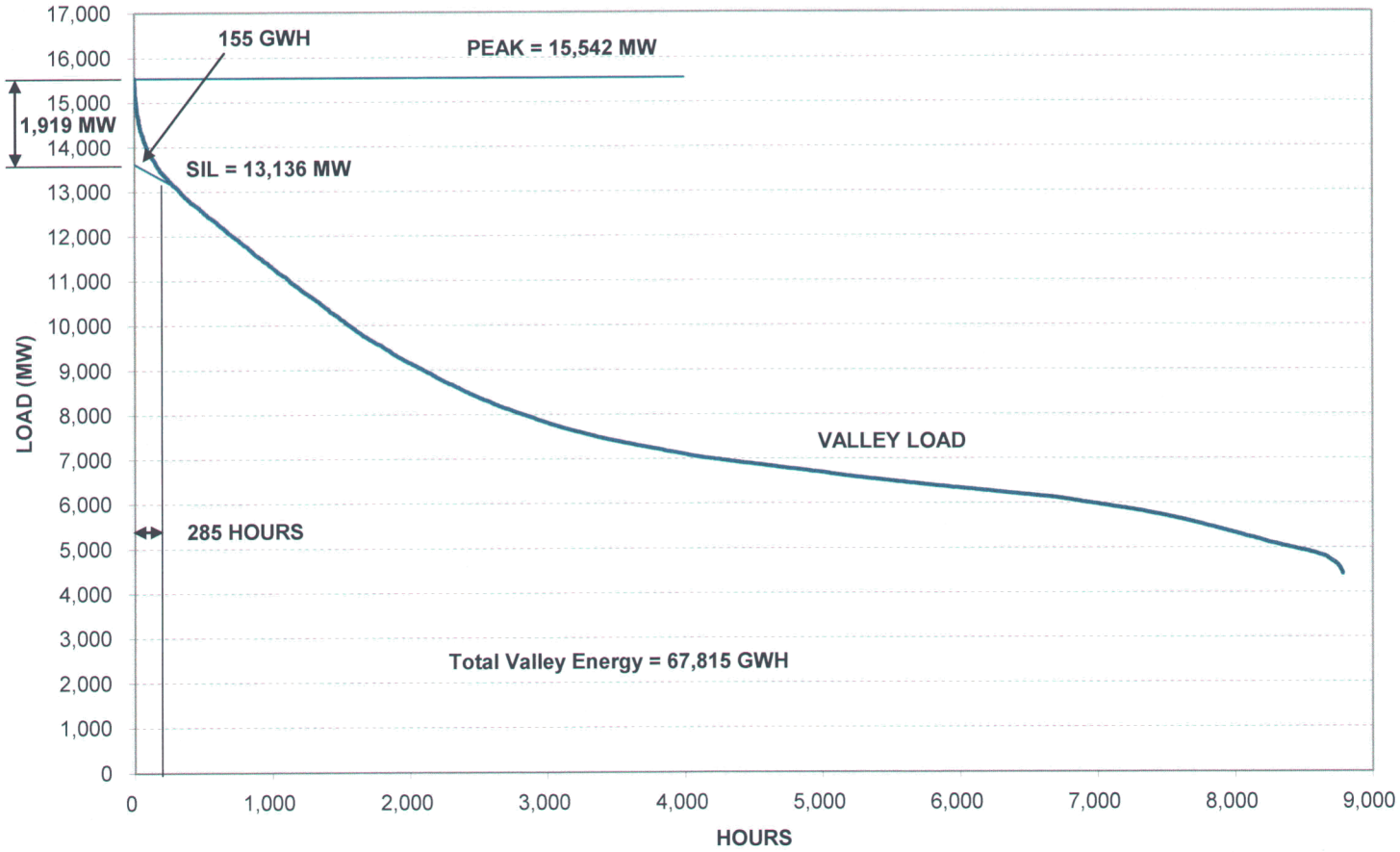
Phoenix Area Load 2016



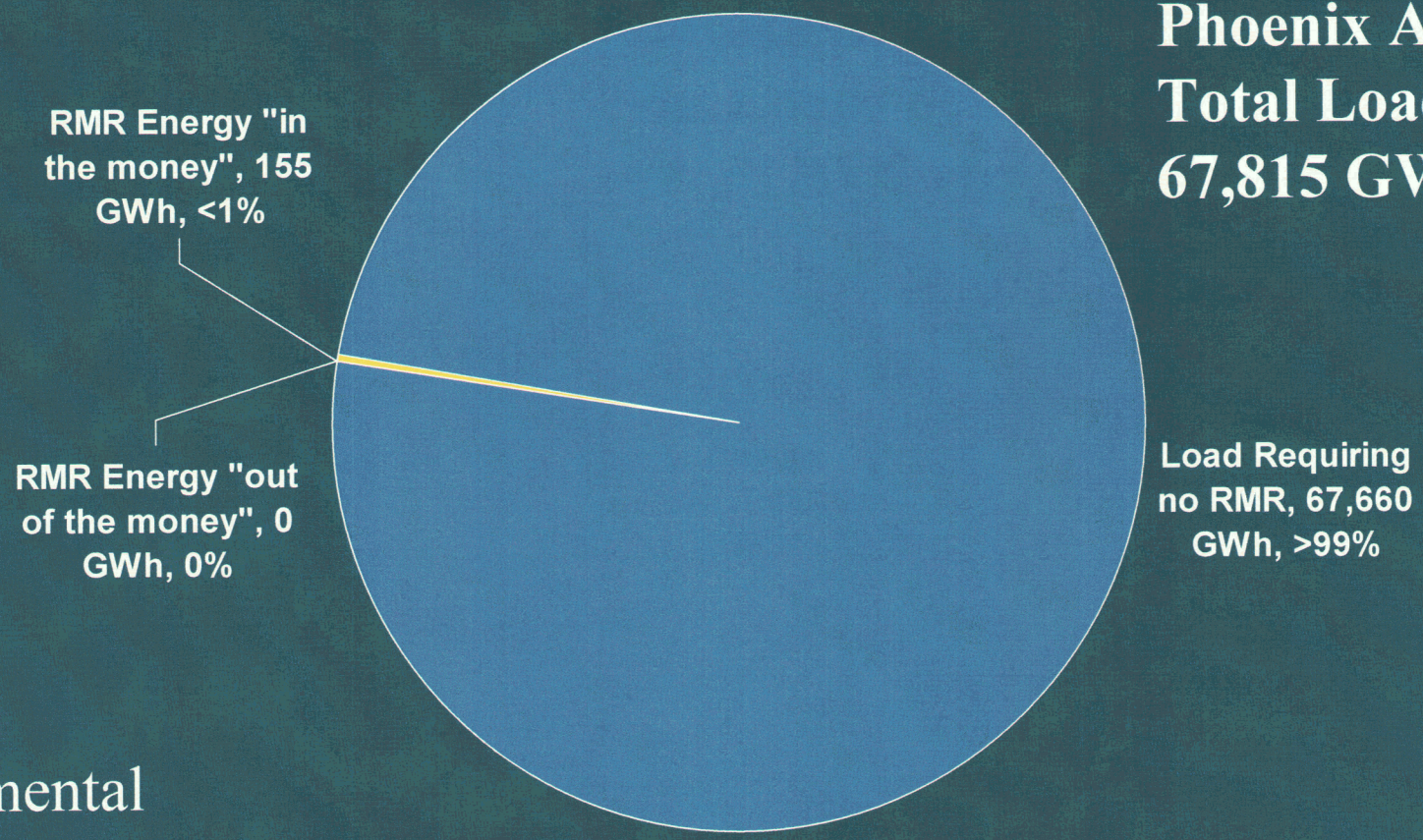
2016 Phoenix Load Serving Capability



2016 Phoenix Load Duration and RMR Conditions



2016 Phoenix Area Energy



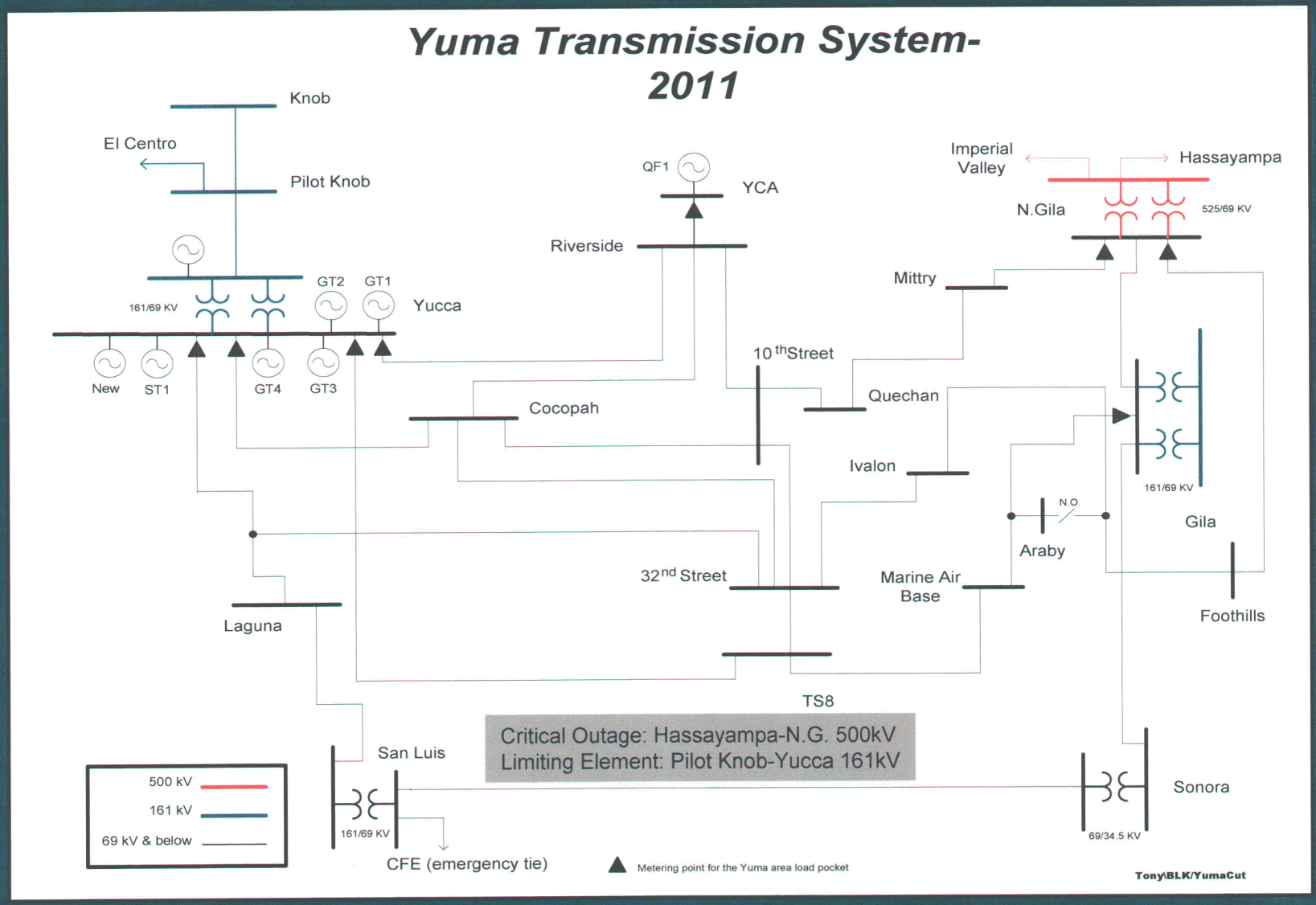
Phoenix Area Total Load = 67,815 GWh

$0M incremental cost

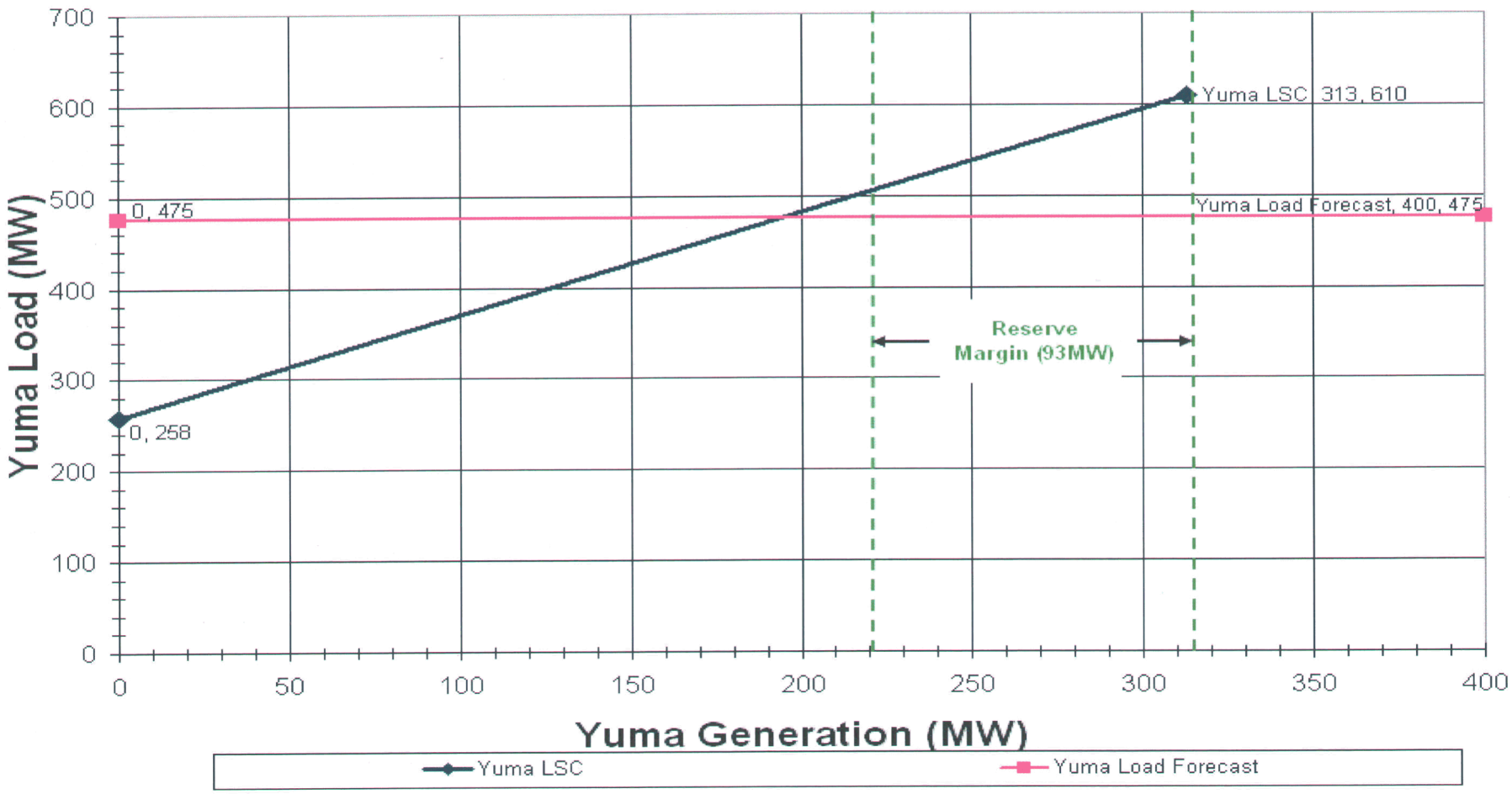
Phoenix RMR Observations

- APS load is expected to exceed import capability for 317 hours in 2011, and 285 hours in 2016. RMR energy represents less than 1% of the total energy.
- All the RMR hours are dispatched "in the money" in both 2011 and 2016. No additional cost to run local generation.

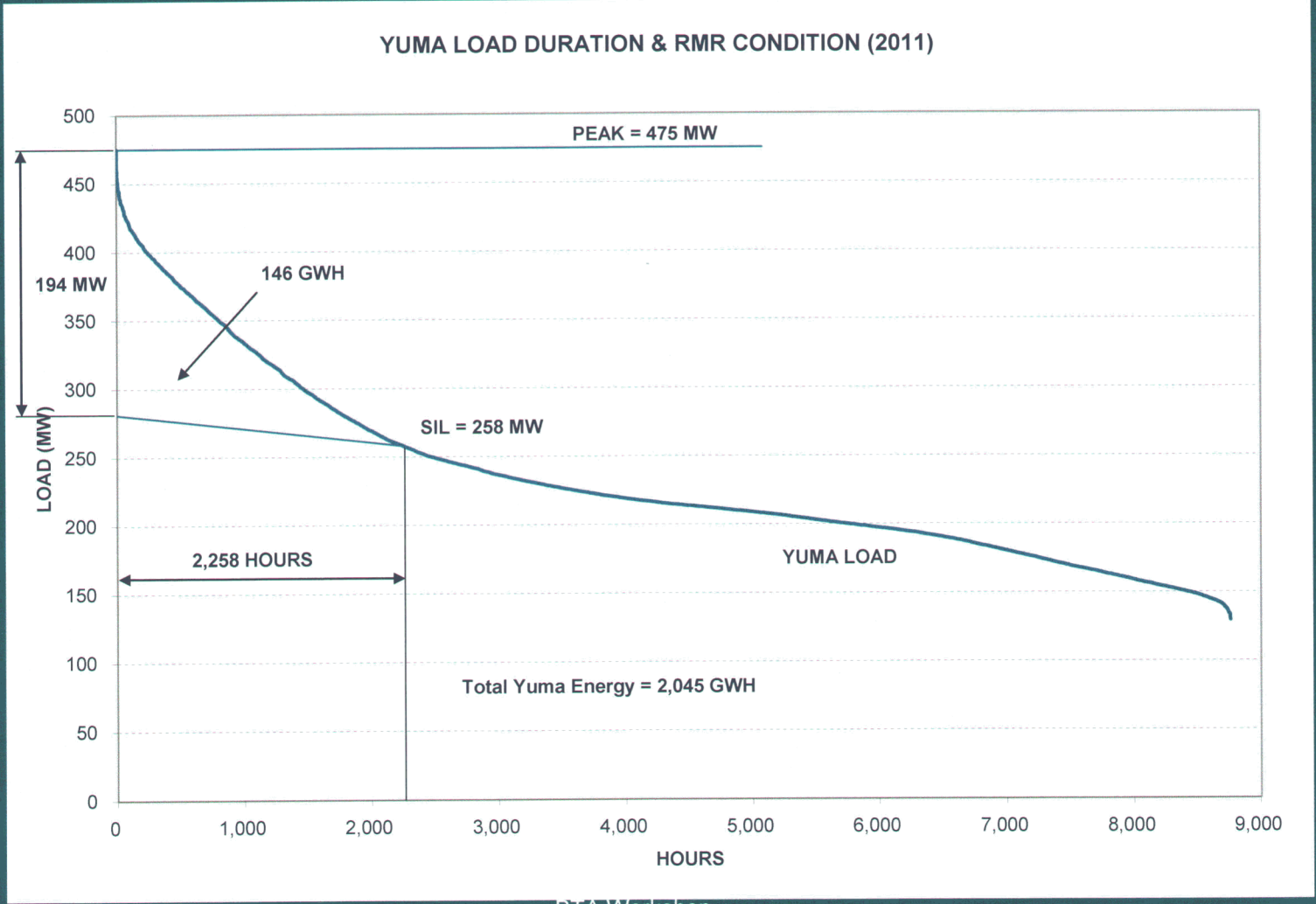
2011 Yuma Transmission System



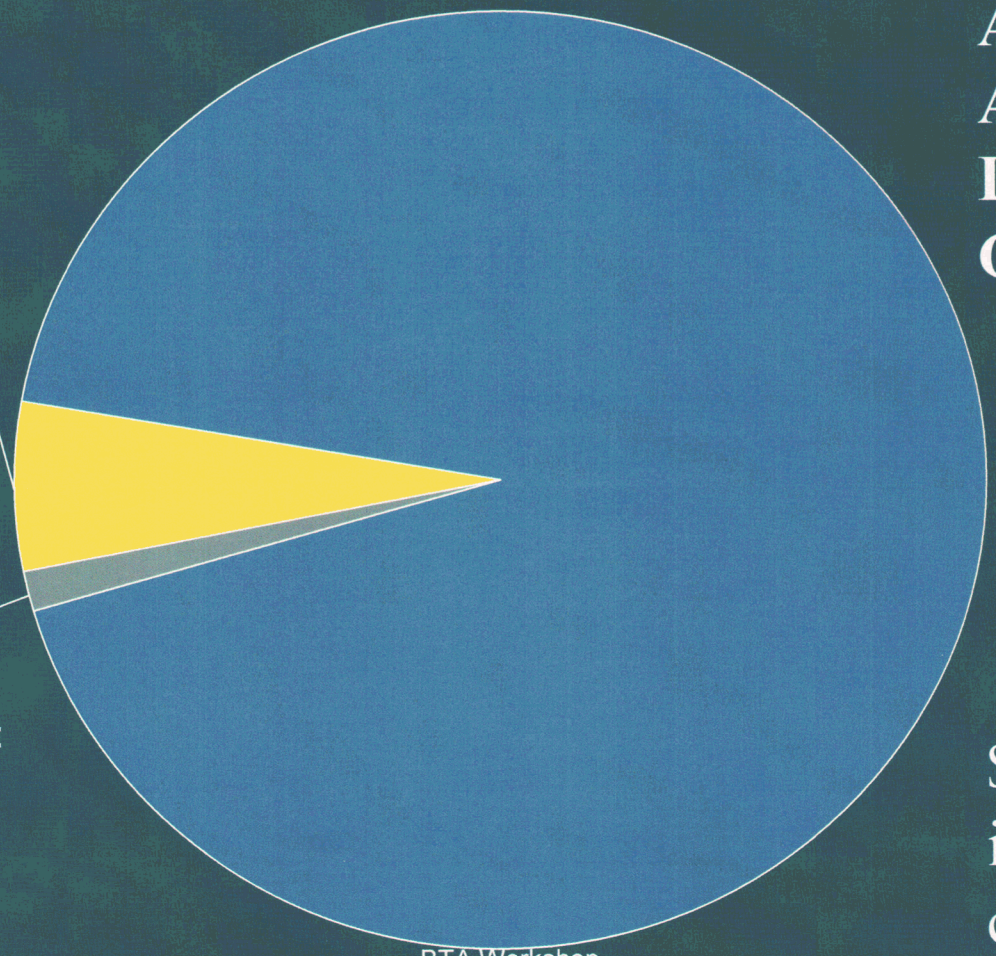
2011 Yuma Load Serving Capability



2011 Yuma Load Duration and RMR Conditions



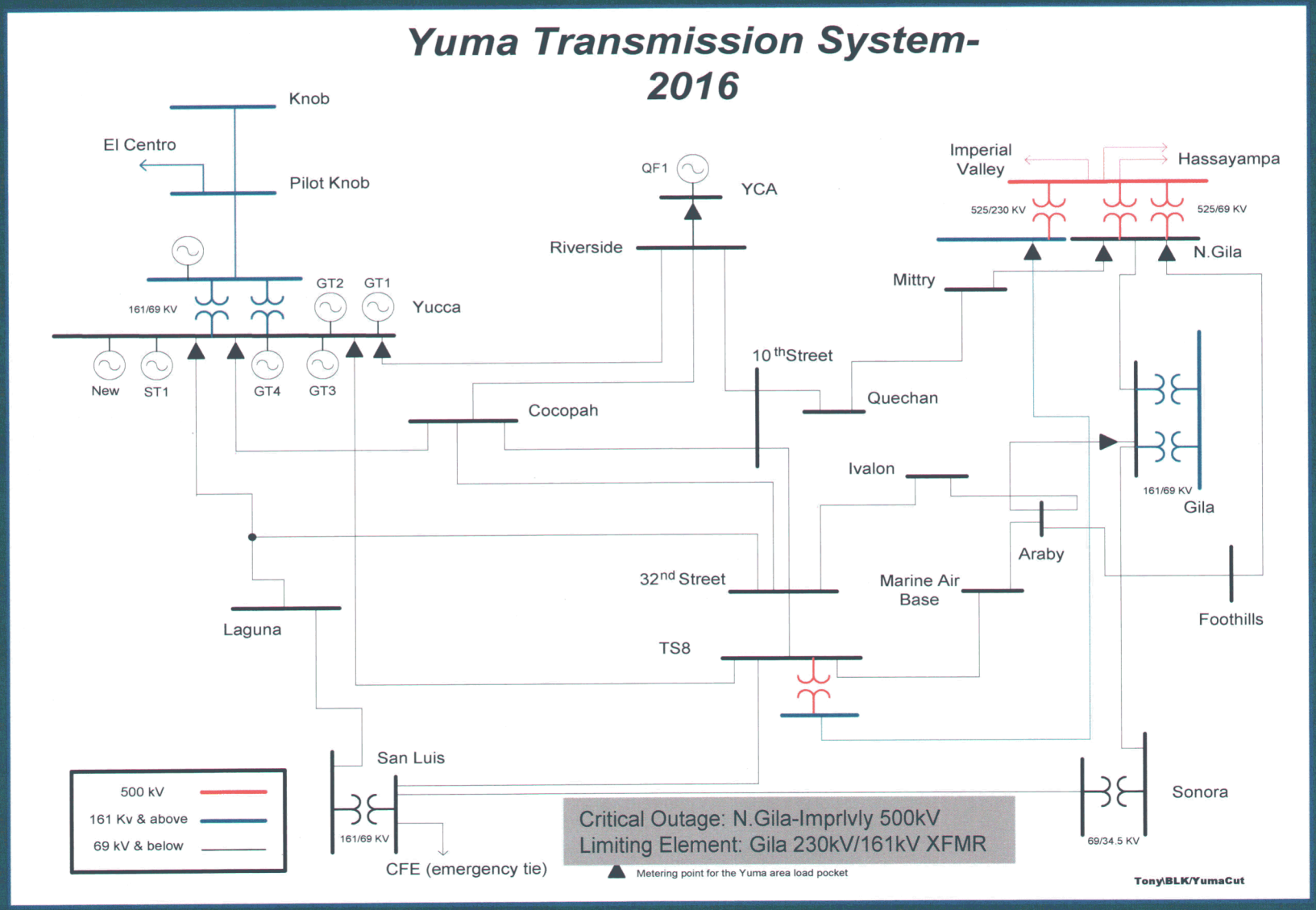
2011 APS Yuma Energy



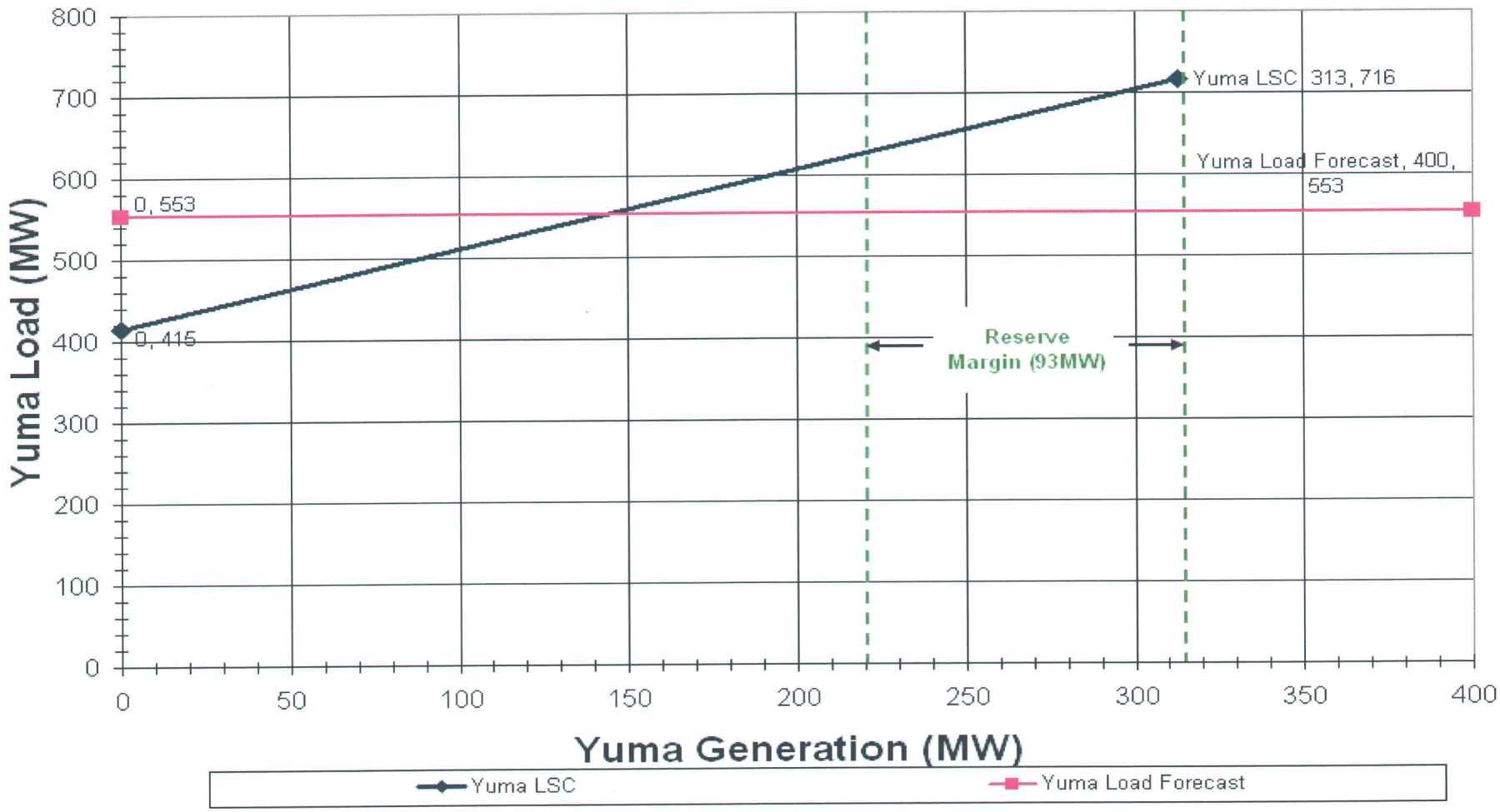
APS Yuma Area Total Load = 2,045 GWh

$1M incremental cost

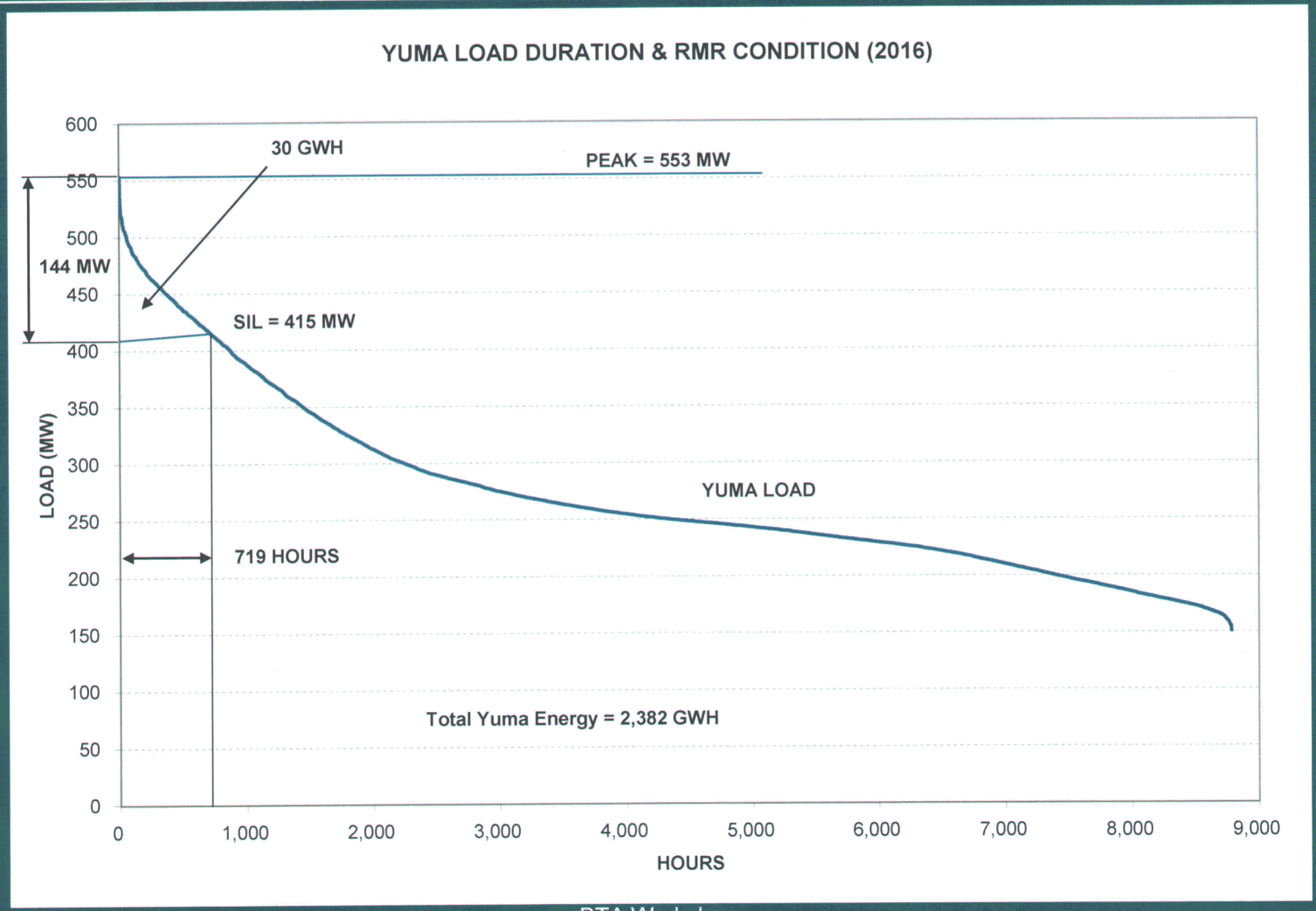
2016 Yuma Transmission System



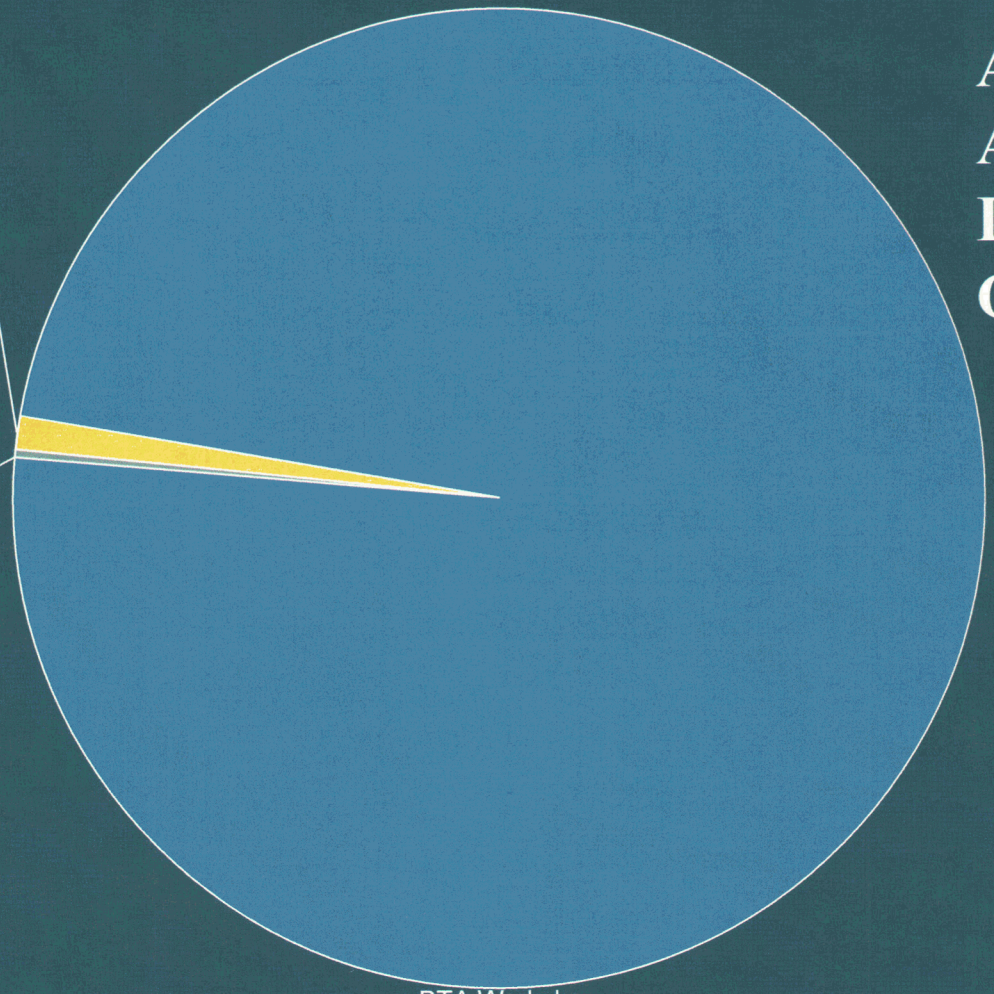
2016 Yuma Load Serving Capability



2016Yuma Load Duration and RMR Conditions



2016 APS Yuma Energy



APS Yuma Area Total Load = 2,382 GWh

$0M incremental cost

Yuma RMR Observations

- Yuma load is expected to exceed import capability for 2,258 hours in 2011, and 719 hours in 2016.
- Cost to run local generation outside of economic dispatch is $1M in 2011 and $0M in 2016.
- Addition of 96mw of generation in Yuma in 2008 and a new 500kV line from the PV area to North Gila and a 230kV line from North Gila into the Yuma load area effectively manage RMR conditions.

Overall RMR Observations

- Benefits of local generation
  - Increase reliability
    - Local voltage support
    - Contingency response
    - Operating flexibility
  - Reduced losses
  - Lower transmission investment

TRANSWEST EXPRESS
5TH BTA PRESENTATION

TransWest Express

Co-developed with Gateway South by four leading entities:

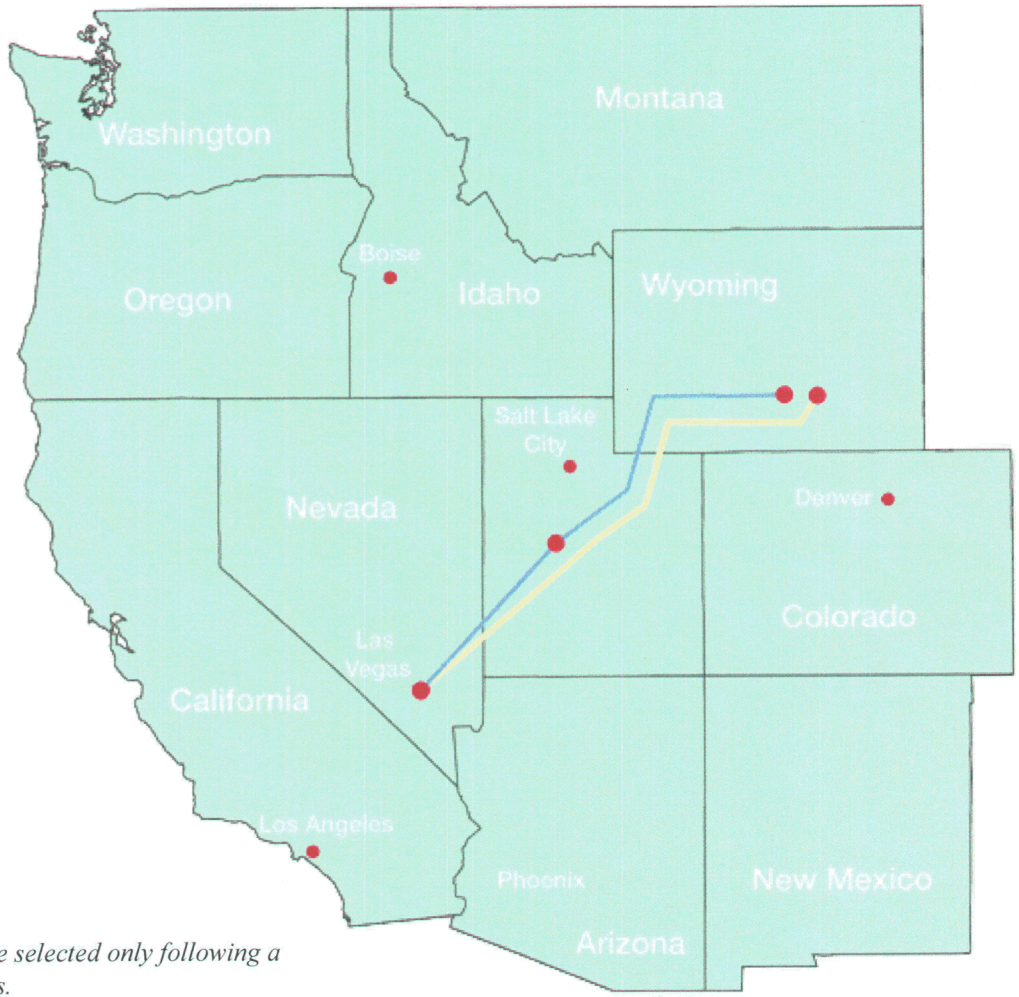
- **Arizona Public Service**
- **PacifiCorp**
- **National Grid**
- **Wyoming Infrastructure Authority**

Arizona Corporation Commission
Biennial Transmission Assessment Workshop
May 22-23, 2008
Phoenix, Arizona

APS PACIFICORP A MIDAMERICAN ENERGY HOLDINGS COMPANY nationalgrid WYOMING INFRASTRUCTURE AUTHORITY

Joint Stakeholder Process for TransWest Express and Gateway South

APS, PacifiCorp, National Grid, and the WIA in accordance with the WECC Regional Planning Review Process, the NTTG and SWAT planning processes, and FERC Order 890, have held four stakeholder meetings to obtain feedback on the TransWest Express and Gateway South projects



Projects

Gateway South

TransWest Express

Routes shown are illustrative only and will be selected only following a comprehensive environmental review process.

TransWest Express Current Configuration

Wyoming - Nevada

- APS, WIA, & National Grid
- 3,000 MW
- 500kV bi-pole HVDC
- 850 miles
- 2013 - 15 in-service date
- CAPEX $3.08 Bn
- Focused on regional needs – Access to AZ, NV & CA

Current Status of TransWest Express

Significant Progress made in past Year

- Right of way applications filed with BLM
- Conceptual design report completed
- WECC Regional Planning Project Review Completed
- Project Reconfigured based on Stakeholder Input – resource market changes
- Initiated WECC Rating Process (Phase 1)

Next Steps

- Attempts to secure participation by other utilities were not successful
- National Grid and APS are not prepared to continue co-development with PacifiCorp at this time due to resource uncertainty and the planned increase in development activities and cost
- TransWest Express Partners are re-assessing options to move the project forward

Further Information

- https://transwest.azpsoasis.com/