

Unlocking Grid Analytics using AF, Maps and Rosetta Stones



**Using OSIsoft tools to manage
the Power Grid**



Presented by **Dayna Aronson**



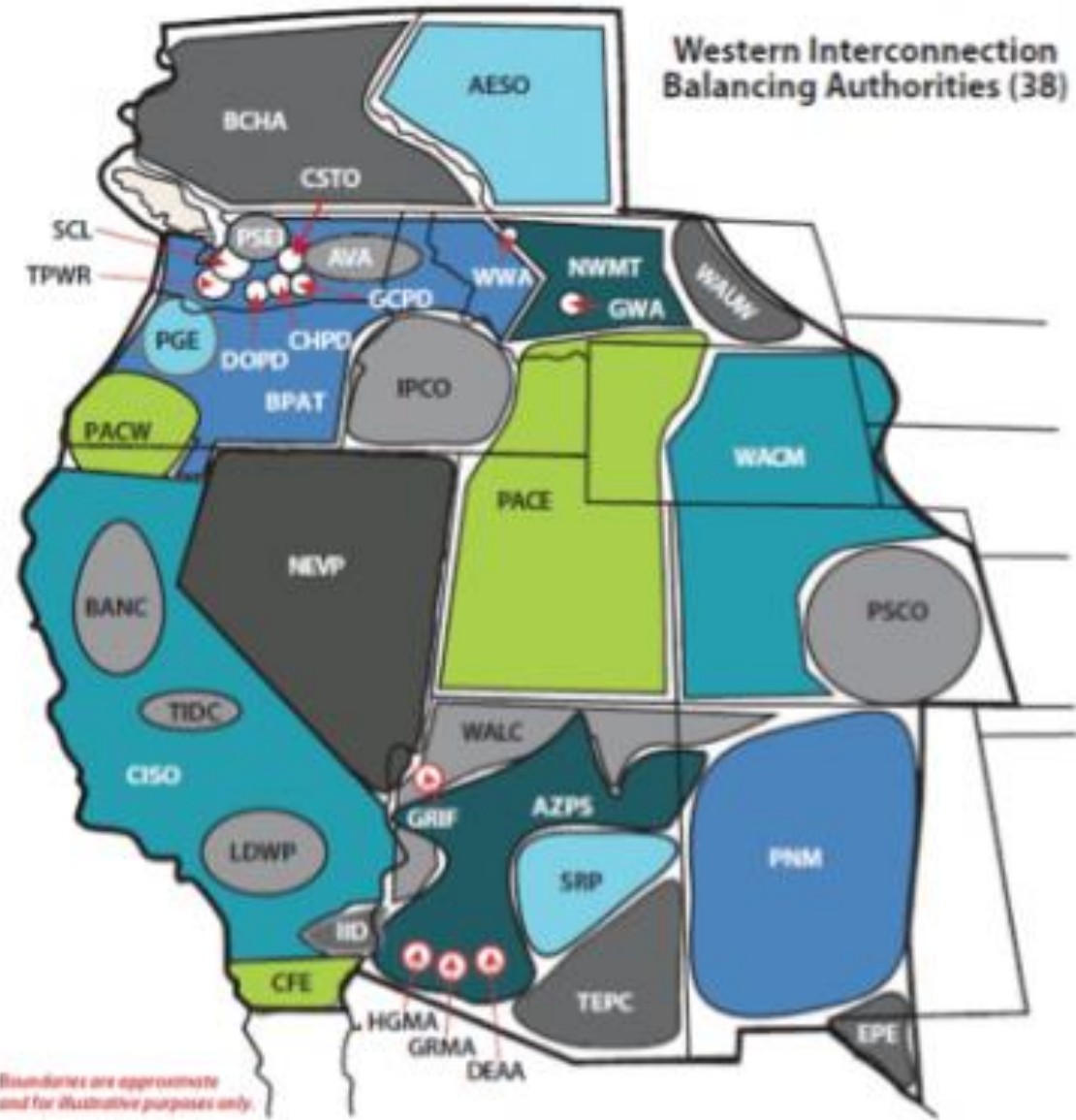
PEAKRELIABILITY
assuring the wide area view

Dayna Aronson



Enterprise Solution Architecture

Peak is registered in the NERC Compliance Registry to perform the Reliability Coordinator (RC) function as a statutory activity. Peak performs this function for most of the Balancing Authorities and Transmission Operators in the Western Interconnection which includes all or parts of 14 western states, British Columbia, and the northern portion of Baja California, Mexico.



PI System Summary

- EA Customer since 2008
- Total number of tags in EMS PI: 1.1m
- Total number of SCADA tags we get via ICCP: 793k
Updating every 10 seconds
- Daily growth of archives in EMS PI: 5GB Daily
- Total number of tags in Phasor PI: 4k
Updating 30 times per second
- Daily growth of archives in Phasor PI: 64GB Daily
- AF 150k Elements



Peak Visualization Platform (PVP)

ProcessBook Display

Sum of ACEs

181.99

Areas

Filter

BC-HYD
Generation 9,103.96 (9,684.23)
Load 8,923.18 (8,923.18)

BPA
Generation 13,548.00 (13,400.78)
Load 7,428.00 (7,428.00)

LADWP

Areas Details

Operating_Areas: BC-HYD

agcdisplayurl http://vet-pc02-br.temsi...

requiredtotalreserves 955.00

requiredspinningreserves 0.00

IROLs

SDGE_Import_Non_Summer

SDGE_Import_Summer

NW_Wash_Load_Area

IROLs Details

IROLs-Dynamic: 1 of 3

SDGE_Import_Non_Summer

IROL_Status Normal

caliso_limit 3893

PVP - Overview

Legend

- Lines_500kV_OOS
 - OutofService
- Paths
 - Over 100
 - Over 95
 - Over 90
- Operating_Areas
- IROLS-Dynamic
 - Over 100
 - Over 95
 - Over 90
- Fires - Fire Point
- Fires - Fire Perimeter
- DB86_StaticLayers_Po

ZOOM - +

230kV and Over Selected	Under 230kV Selected
MW	MW
No Data	No Data
MVAR	MVAR
No Data	No Data
MVA	MVA
No Data	No Data
Substations Sel...	Substations Sel...
No Data	No Data

Paths
INTWMS - Normal
INTWMM - Normal
PATH18 - Normal
PATH19 - Normal
PATH16 - Normal
PATH17 - Normal

Paths Details
PathName: INTWMS
WSMPathName: INTWMS
scheduleflow: 0.00
percentageofflimit: 48.41
pathloading: 48.41
pathlimit2: 0.00
pathlimit1: 0.00
pathalarmstate: 0.00
pathalarmcalc: 0.00
actualflow: 968.12
retrievaltime: 3/7/2017

Substations Under...
106SOUTH - 106th South Street
118SOUTH - 118th South
119TH_ST - 119th Street

Substations Under...
106SOUTH
voltage: 0.0
unacknowledgealarm: false
totalofmx: 0.0
totalofmw: 0.0
totalofmva: 0.0
TOPOLOGY: PGAE.PGAE.2
Generation: 0.00
TOPOLOGY: AESO.AESO.2
Generation: 209.11
TOPOLOGY: AESO.AESO.2
Generation: 0.00
TOPOLOGY: AESO.AESO.2
Generation: 0.00

Substations 230 kV...
26R
voltage: 0.0
unacknowledgealarm: false
totalofmx: 0.0
totalofmw: 0.0
totalofmva: 0.0
TOPOLOGY: PGAE.PGAE.2
Generation: 0.00
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TOPOLOGY: AESO.AESO.2
Generation: 0.00
TOPOLOGY: AESO.AESO.2
Generation: 0.00

Substations 230 to 500 kV:
26R
voltage: 0.0
unacknowledgealarm: false
totalofmx: 0.0
totalofmw: 0.0
totalofmva: 0.0
TOPOLOGY: PGAE.PGAE.2
Generation: 0.00
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Generation: 0.00
TOPOLOGY: AESO.AESO.2
Generation: 0.00



Same Problem – Different Control Room

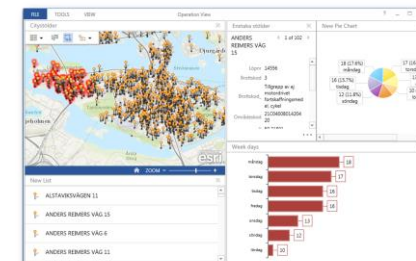
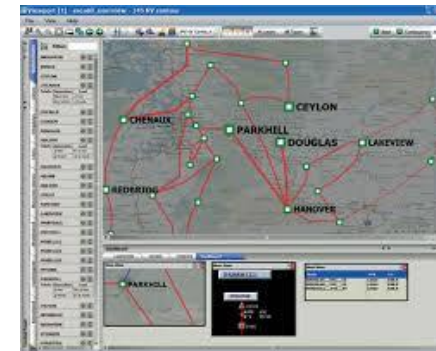
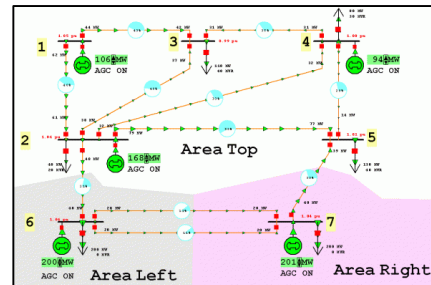
- More and more data coming into the control centers responsible for larger areas than ever before
 - Addition of PMU and other high definition data sources (even more data)
 - Need to make it comprehensible by humans – turning data into information
 - allow the most important data to rise to the top and be understood by operations staff
 - Show how one set of data impacts another
 - MUST be maintainable
- Alarms
 - IROL
 - Flow gate / Paths
 - ACE
 - PMU and wide area Voltage Angle
 - Load
 - Ace
 - AGC
 - RAS
 - Systems / IT



Options Evaluated

- eTV
- WAV
- STI
- Macomber Map
- PowerWorld
- ESRI

Lots of solutions available
– about best match



“...Failure to Communicate”

- Systems that need to communicate with each other about the same Equipment / Grid speak different languages. They have different models, units, nomenclature, process and terminology.



Model Consolidation & Normalization

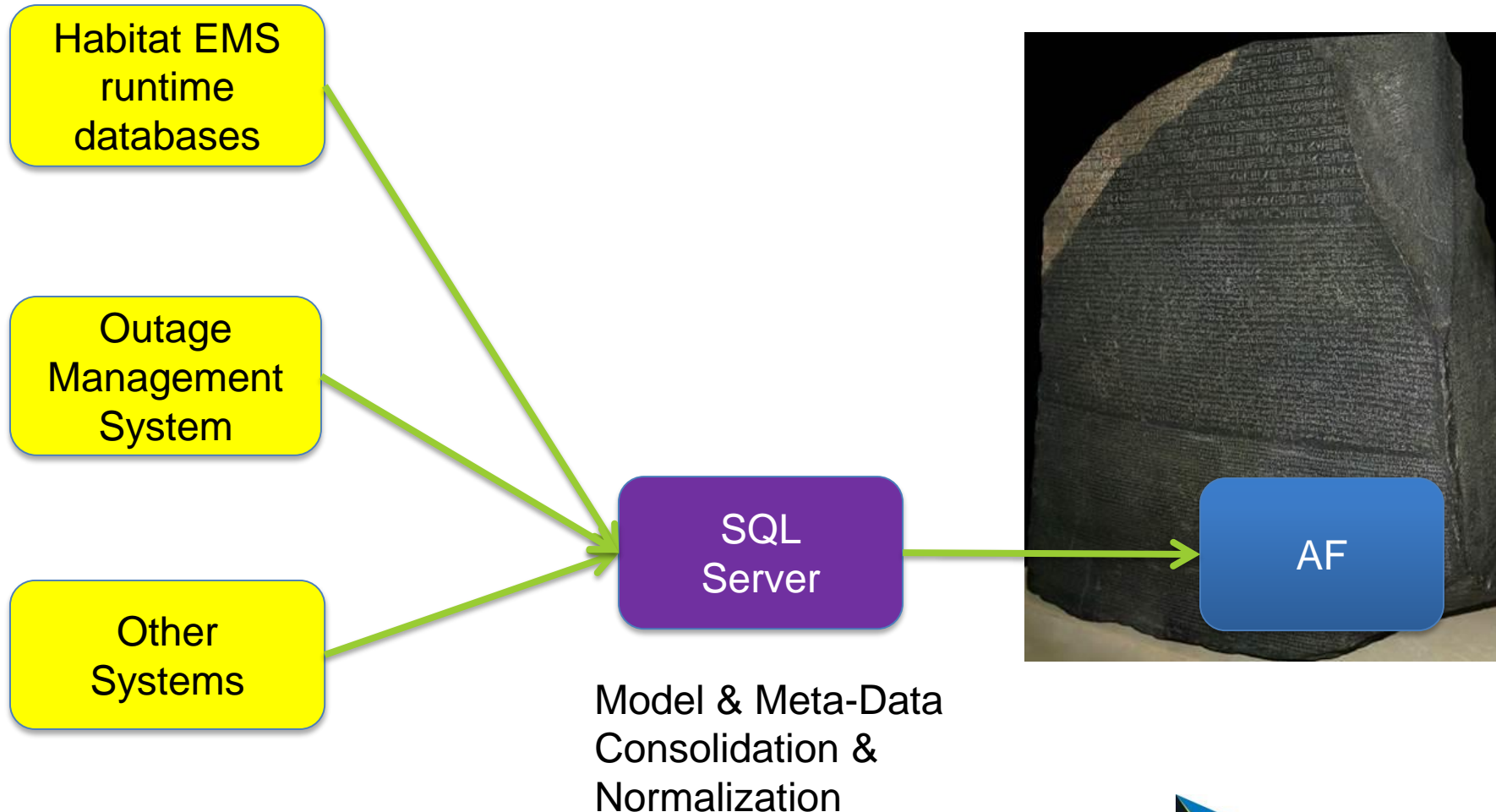
Performed every five weeks

- Physical network topology: ETS (EMS vendor Tool)
- SCADA: In-house databases and scripts
- ICCP: In-house databases and scripts
- RTCA Contingencies: Home-grown CSV file and scripts
- Alarms: EMS vendor UI and scripts
- RAS: In-house databases and scripts
- Outages: 3rd party proprietary software

Peak RC spends significant resources to maintain models (meta-data)



Building the Rosetta Stone



Collaboration Kudos

- Three versions over two years of development, with at least 4-5 days/month dedicated to it.
- Over 15,000 lines of code

- Jeffrey Parker
- Tim Van Prooyen
- Cody Parker
- Brian Caserta
- Ryan Schoppe
- Michael Nuget
- Todd Chumley



Grid Reliability

- Reducing the amount of time it takes an RC to comprehend actionable information.

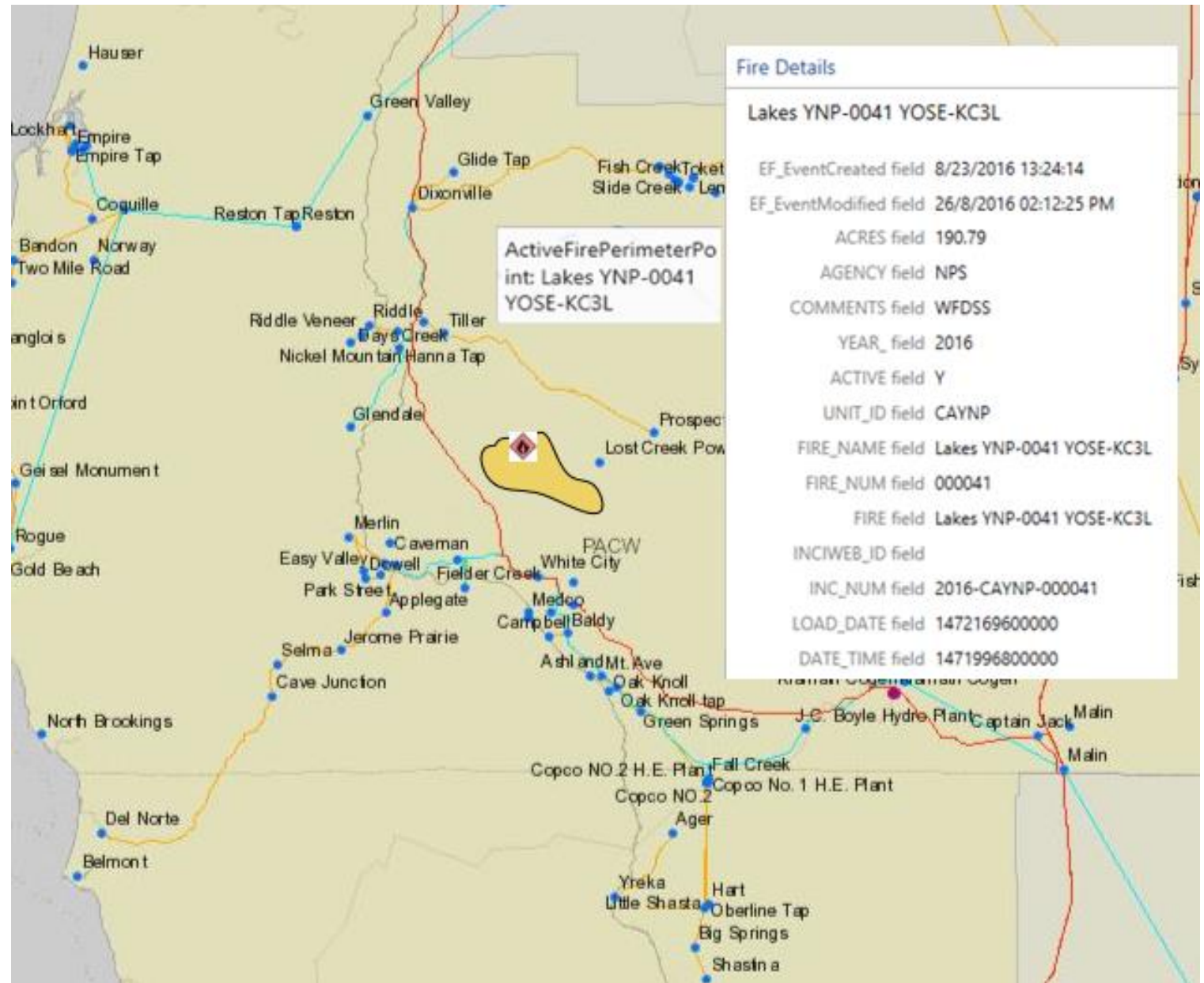


- 11:44 Loss of first 500kV line
- Over next 4 hours additional facilities are impacted as fire grows
- RC calls fire bosses to try and determine location and direction of fire growth and what additional facilities are about to be impacted
- It takes up to 1 hour for this information to get back to the RC
- No current method for analytic tools to geographically map
- Sub optimal gen dispatch
- Extended load shed exposure



Real-time Fire Visualization

Fire location, size and spatial geometry boundaries updating every 5 minutes from USGS along side of transmission assets

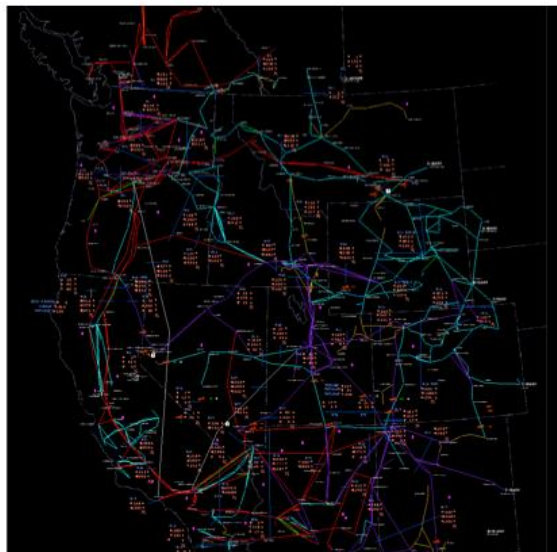


IT & Systems

ICCP Link Status

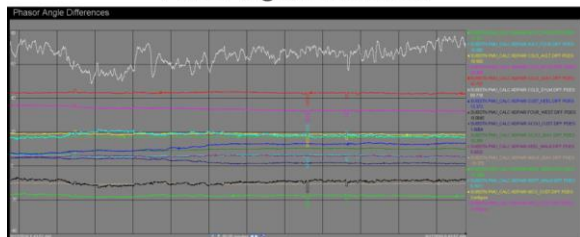
AESO	AVA	AZPS	BCTC	BHPL	BPA60	CAISO	CECD	CEN
CHPD	CSU	DOFD	EHV	EPE	EWER	FEUS	GCPD	HDWP
ID60	IPC	LDWP	NVE	NWE	PACR	PACW	PG&E	PG&E
PNM	POPD	PRPA	PSCO	PSK	SCE	SCL	SCPD	SDGE

Transmission Overview



Interface	I/F Name	SOL Value (MW)	IROL Value (MW)	Current MW	IROL in Effect	SOL Margin	T. (mins)	IROL Margin	% SOL	% IROL
San Diego Imports (SDIE)	SDGIES	3800	3000	1185	NO	2615	30	2815		
	SDGIE1									
	SDGIE2									
San Diego/CFE Imports (SDGICFE)	SDGIC1	9499	9999	1232	NO	No Sample	No	No Sample		
	SDGIC2									
	SDGIC3									

PMU Angle Difference



RAS Status

Western Interconnection RAS

PATH 15 RAS

LOAD GRP MW AVAIL ARMED LBS MWN

HELMES 0 0 0 0 0

PATH FLOWS

P-45 TEL 1 1879 MW
P-46 TEL 1 2180 MW
P-28 TEL 2 606 MW

BORAH WEST (P17) 764 MW

TOTAL RAS

AVAIL MW ARMED MW

LBS 3338 0
LBS 3338 0
MWN 3338 0

MIDWAY GENERATION

GEN. GROUP MW	MW AVAIL	ARMED	LBS	LBS	MWN
GEN. GROUP 1 (QF & MIDWAY-SUNSET)	116	0	0	0	0
GEN. GROUP 2 (EAK HILLS)	490	0	0	0	0
GEN. GROUP 4 (LA PALOMA)	479	0	0	0	0
GEN. GROUP 4 (SERRISE)	543	0	0	0	0
GEN. GROUP 5 (LA PALOMA)	453	0	0	0	0

DIABLO CANYON PF

UNIT 1 276 MW
UNIT 2 1114 MW
TOTAL 1390 MW

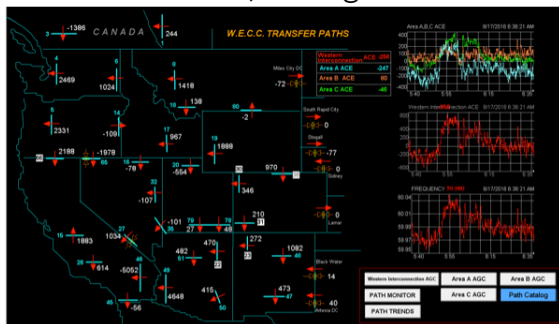
Midway Area Total Generation 479 MW

Phase - Summer (Apr - Oct) LBS 3200 MWN 3000
Phase - Winter (Nov - Mar) LBS 4200 MWN 3200

Path 15 Limit

- Lower of either LBS or MWN when flowing S-N
- 3000 MWN when flowing N-S regardless of season

Paths / Flowgates



IROL

SDGE & CFE AREA

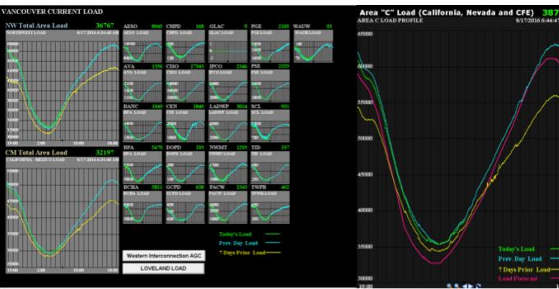
Interface	I/F Name	SOL Value (MW)	IROL Value (MW)	Current MW	IROL in Effect	SOL Margin	T. (mins)	IROL Margin	% SOL	% IROL
San Diego Imports (SDIE)	SDGIES	3800	3000	1185	NO	2615	30	2815		
	SDGIE1									
	SDGIE2									
San Diego/CFE Imports (SDGICFE)	SDGIC1	9499	9999	1232	NO	No Sample	No	No Sample		
	SDGIC2									
	SDGIC3									

No. of Huntington Beach Units online

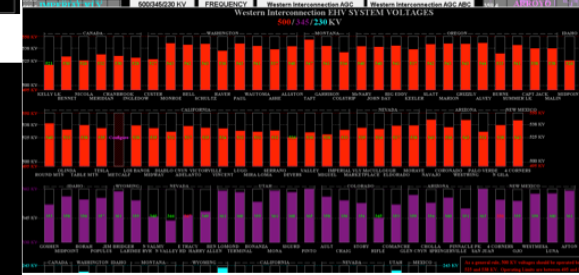
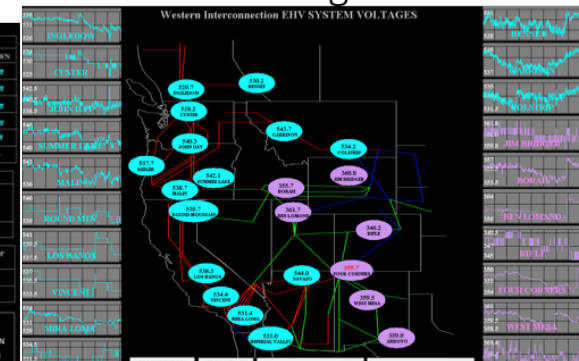
GENERATOR	STATUS	MW	MW
GEN1	Level 1	20	0
GEN2	Level 2	22	14
GEN3	Level 3	0	0
GEN4	Level 3	0	0

CFE RAS trips Tijuana - Otay Mesa 230 kV line YES
CFE RAS trips Imperial Valley - La Romita 230 kV line NO (Automatic, updated via ICCP)

Load



Voltage



AGC

Western Interconnection AGC Totals - Area A

CONTROL	ACTUAL REFERENCE	ACTUAL RESPONSE	TOTAL	TOTAL	NET	ACTUAL	ACTUAL	NET	BASE	BASE	BASE	
AGC	554	208	505	415	9135	8933	230	270	-24	-370	-462	5670
AGC	40	28	78	70	1007	1240	320	260	-2	-210	-270	2140
AGC	1125	905	4446	921	4940	5001	1170	1074	70	981	1217	5240
AGC	1409	205	4012	409	11109	5449	5628	8777	-110	-902	1127	5948
AGC	155	11	251	21	433	449	345	306	2	-124	-147	2514
AGC	152	9	204	17	507	0	507	500	0	-140	-200	1145
AGC	9	5	109	12	213	191	93	93	4	-48	40	1111
AGC	207	15	1011	30	269	606	240	240	-5	-215	-240	2140
AGC	3	3	5	0	194	0	140	142	1	46	83	330
AGC	461	65	712	130	2010	2243	-207	-209	0	-260	-336	2924
AGC	100	48	374	73	2091	1294	-30	-24	0	-484	-437	1181
AGC	403	73	480	145	2524	2338	190	158	-3	-810	-1012	2949
AGC	205	69	430	85	1408	1089	-548	-543	-1	-380	-486	2778
AGC	402	41	902	122	1770	2310	906	-601	0	-154	-182	2846
AGC	169	45	244	89	211	921	-708	-706	-35	-49	-41	2756
AGC	42	19	464	38	136	408	-222	-220	-2	-36	-40	1618
AGC	80	2	82	0	42	122	-216	-2	-26	-45	846	90
AGC	3	3	18	0	161	0	157	152	1	-120	-141	341

ACE

Western Interconnection TOTALS

POWER PEG	ACTUAL PEG	GENERATION	ACE	LOAD	ACT OPER BIAS	ACT OPER BIAS	REFD OPER BIAS	REFD OPER BIAS	FREQUENCY
93	220	102036	220	100256	28823	11913	7159	3666	60.012
Area A	517	5119	31881	-42	35501	1833	4702	2008	60.012
Area B	4046	4307	31753	215	27574	6740	1948	959	60.012
Area C	43300	43375	39265	110	39209	3007	3319	3634	60.012

Dashboard

ProcessBook Display

Sum of ACEs

181.99

Areas

Filter

BC-HYD
Generation 9,103.96 (9,684.23)
Load 8,923.18 (8,923.18)

BPA
Generation 13,548.00 (13,400.78)
Load 7,428.00 (7,428.00)

LADWP

Areas Details

Operating_Areas: BC-HYD

agcdisplayurl http://vet-pc02-br.temis.i...

requiredtotalreserves 955.00

requiredspinningreserves 0.00

IROLs

SDGE_Import_Non_Summer

SDGE_Import_Summer

NW_Wash_Load_Area

IROLs Details

IROLs-Dynamic: < 1 of 3 >

SDGE_Import_Non_Summer

IROL_Status Normal

caliso_limit 3893

PVP - Overview

esri

ZOOM - +

Legend

- Lines_500kV_OOS
 - OutofService
- Paths
 - Over 100
 - Over 95
 - Over 90
- Operating_Areas
- IROLS-Dynamic
 - Over 100
 - Over 95
 - Over 90
- Fires - Fire Point
- Fires - Fire Perimeter
- DB86_StaticLayers_Po

230kV and Over Selected	Under 230kV Selected
MW	MW
No Data	No Data
MVAR	MVAR
No Data	No Data
MVA	MVA
No Data	No Data
Substations Sel...	Substations Sel...
No Data	No Data

Filter

INTWMS - Normal

INTWMM - Normal

PATH18 - Normal

PATH19 - Normal

PATH16 - Normal

PATH17 - Normal

Paths Details

Paths: INTWMS

WSMPathName	INTWMS
scheduleflow	0.00
percentageofflimit	48.41
pathloading	48.41
pathlimit2	0.00
pathlimit1	0.00
pathalarmstate	0.00
pathalarmcalc	0.00
actualflow	968.12
retrievaltime	3/7/201 7

Substations Under...

Filter

106SOUTH - 106th South Street
TOPOLOGY.PACE.PACE.1
06SOUTH
Generation: 0.00

118SOUTH - 118th South
TOPOLOGY.PACE.PACE.1
18SOUTH
Generation: 0.00

119TH_ST - 119th Street
TOPOLOGY.BPA.CLK.119TH_ST

Substations Under...

Substations 0 to 229 kV: 106SOUTH

voltage	0.0
unacknowledgealarm	false
totalofmx	0.0
totalofmw	0.0
totalofmva	0.0
TO	LO
PO	LO
GY.	GY.

Substations 230 kV...

Filter

26R
TOPOLOGY.PGAE.PGAE.2
6R
Generation: 0.00

29EDD3
TOPOLOGY.AESO.AESO.2
9EDD3
Generation: 209.11

29EDD34
TOPOLOGY.AESO.AESO.2
9EDD34
Generation: 0.00

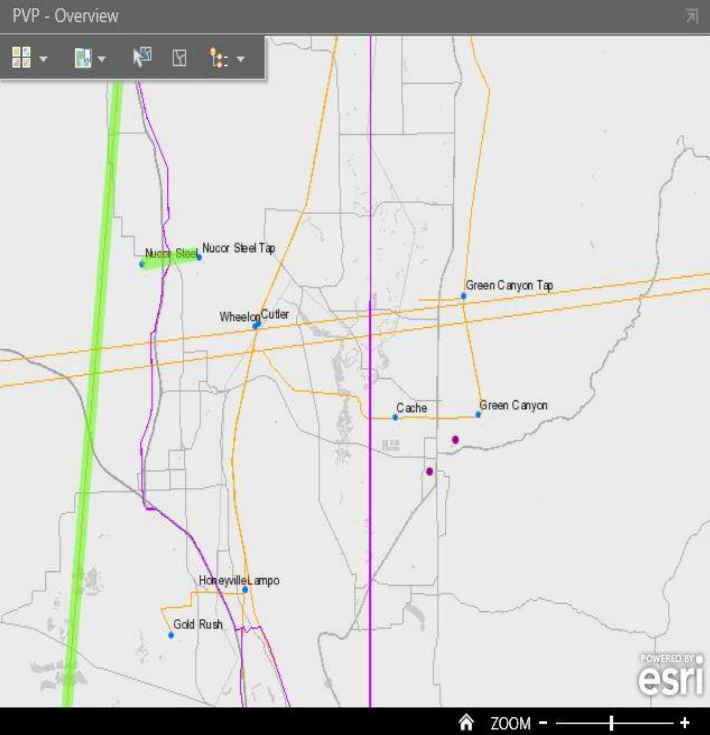
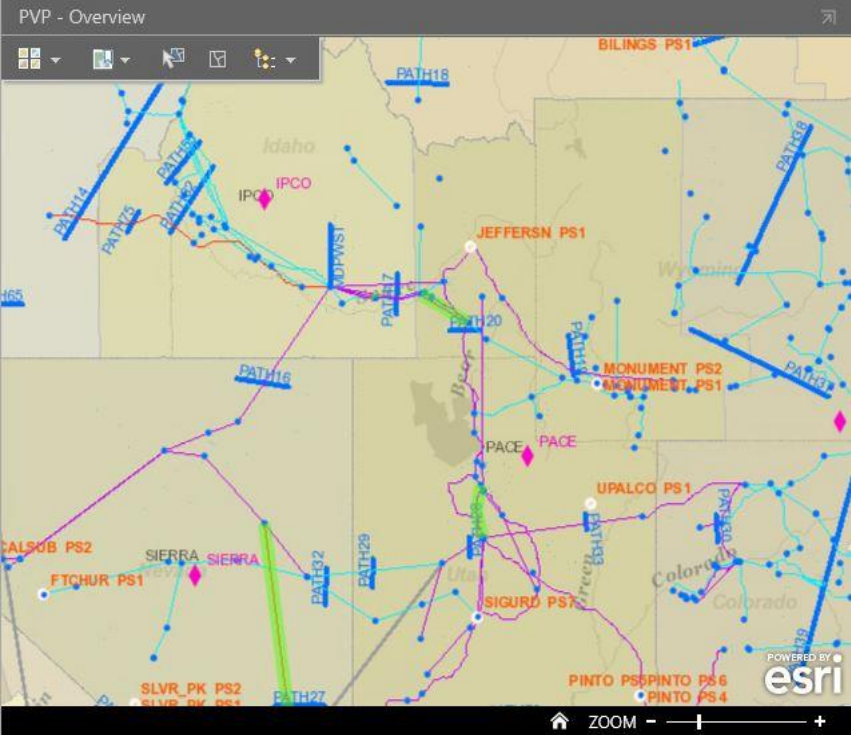
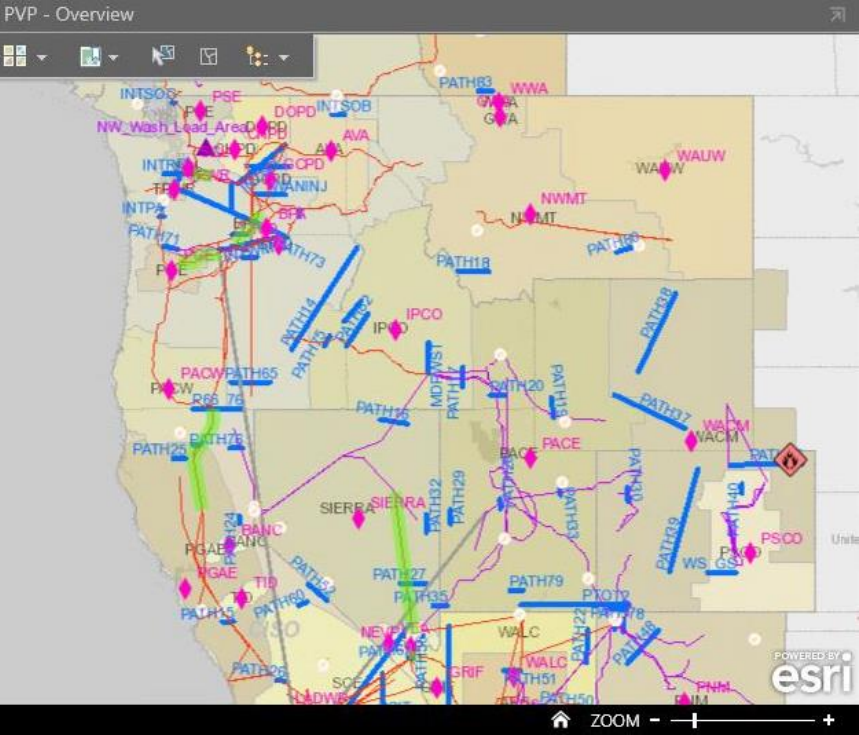
29EDD56

Substations 230 to 500 kV: 26R

voltage	0.0
unacknowledgealarm	false
totalofmx	0.0
totalofmw	0.0
totalofmva	0.0
TO	LO
PO	LO
GY.	GY.



Navigation

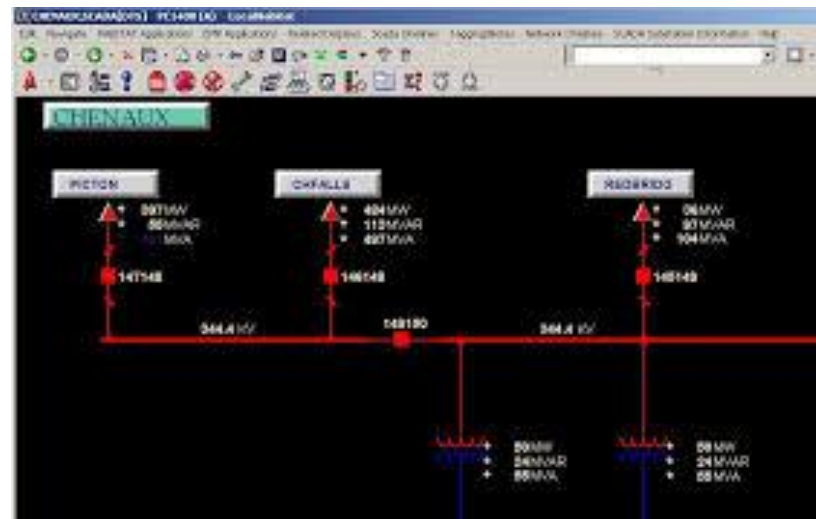


Context specific App launch

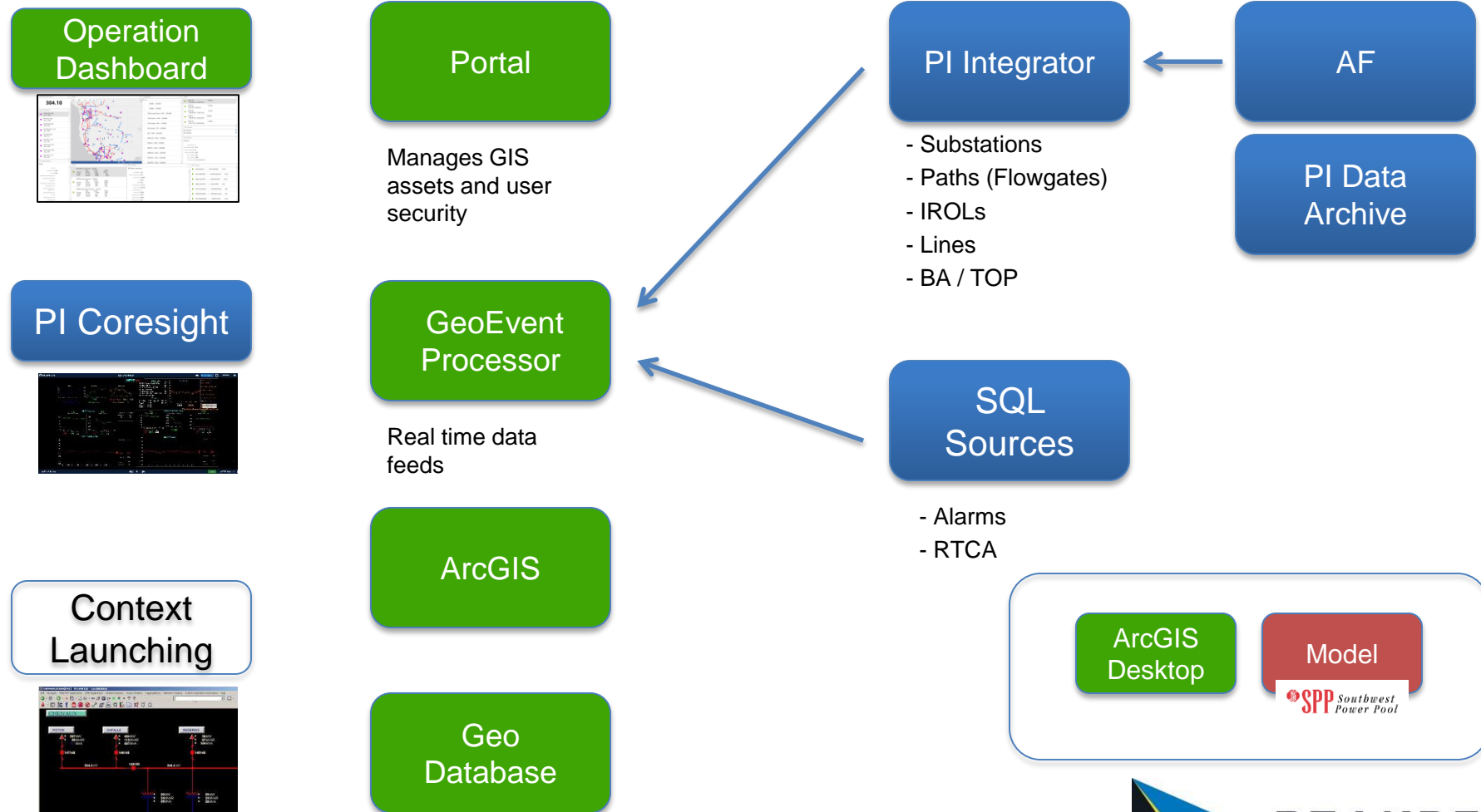
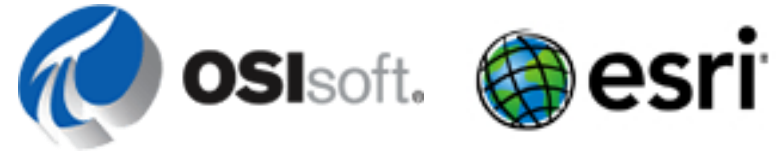
- Any URL

Station Tabular

Equipment Group	Device Name	ID	Value	Data Quality	EG Quality	Inhibit Alarm	Not in Service	Means Tag	EG Tag
LSD	1071	STTS	CLOSED	Good					
LSD	1272	STTS	CLOSED	Good					
LSD	1472	STTS	CLOSED	Good					
LSD	1572	STTS	CLOSED	Good					
LSD	1991	STTS	CLOSED	Good					
LSD	1995	STTS	CLOSED	Good					
LSD	1997	STTS	CLOSED	Good					
LSD	2091	STTS	CLOSED	Good					
LSD	2095	STTS	CLOSED	Good					
LSD	2097	STTS	CLOSED	Good					
LSD	2191	STTS	CLOSED	Good					
LSD	2195	STTS	CLOSED	Good					
LSD	2197	STTS	CLOSED	Good					
LSD	2272	STTS	CLOSED	Good					
LSD	2291	STTS	CLOSED	Good					
LSD	2295	STTS	CLOSED	Good					
LSD	2297	STTS	CLOSED	Good					
LSD	2372	STTS	CLOSED	Good					
LSD	2391	STTS	CLOSED	Good					
LSD	2395	STTS	CLOSED	Good					



Technical details



Decision Drivers

- Leverage Peak Investment in OSIsoft PI System
 - Staff Knowledge and Comfort
 - Relationship
 - Infrastructure
- OSIsoft and ESRI are the “best in class” in their core technologies
- Data driven solution



Solution Highlights

- Easy display creation and modification
- Rosetta Stone data Philosophy
- Whiteboard philosophy (can build anything – not limited)
- EMS vendor Agnostic
- Eye toward secure external tablet and mobile use
- Quickly reconfigure based on input from users
- 6 months from vendor selection to available in the control room



What value was achieved

- Organization of data to the operation staff
- Empowered operations staff to control their environment
- IT focuses on making data available
- Better decisions in less time



Contact

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 - Peak RC
 - daronson@peakrc.com
 - 360-448-2655



Contact Information

Dayna Aronson

daronson@peakrc.com

Enterprise Solution
Architecture

Peak RC



PEAKRELIABILITY
assuring the wide area view

Questions

Please wait for the **microphone** before asking your questions



State your **name & company**

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谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado