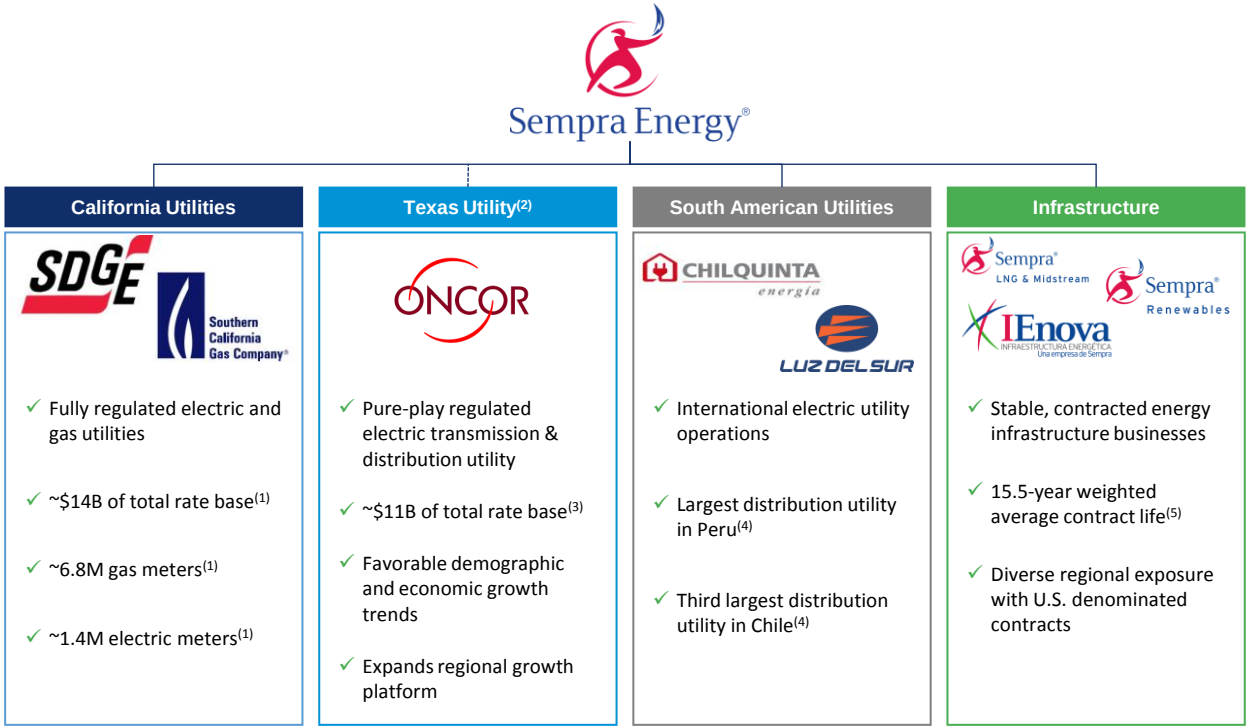
Redefining Renewables SCADA

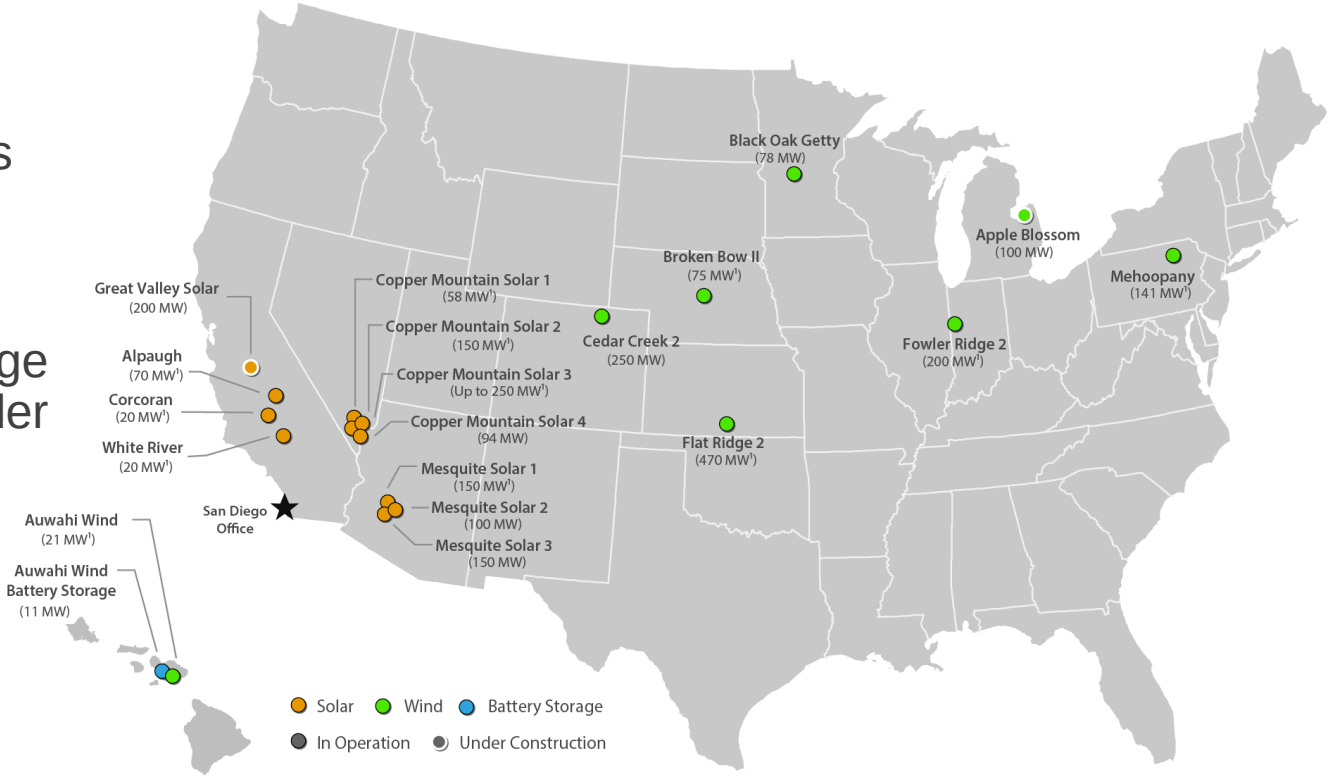
David Jeon, Technical Services Manager - Sempra Renewables



(1) As of September 30, 2017.
(2) Pending Merger, subject to closing conditions, including the receipt of approval of the Public Utility Commission of Texas and US Bankruptcy Court of Delaware, among others. There can be no assurance that the Merger will be completed on the terms or timetable currently contemplated, or at all.
(3) As of December 31, 2016.
(4) Reflects local regulators 2016 annual statistical reports; Ministro de Energia y Minas (Peru), and Comisión Nacional De Energia (Chile).
(5) Contract life primarily relates to contracts with customers for energy transportation, delivery, storage, generation and processing and other services, and is comprised of the remaining life of current contracts after September 30, 2017 or the full life of contracts starting after that date; includes renewables assets, Cameron LNG facility and IEnova. Sempra owns 66.4% of IEnova and a 50.2% joint venture interest in the Cameron LNG facility. The ability to successfully complete major construction projects, including the Cameron LNG facility currently under construction, is subject to a number of risks and uncertainties, Please refer to the "Risk Factors" section of our most recent Annual Report on Form 10-K and the "Factors Influencing Future Performance" section of our most recent Quarterly Report on Form 10-Q for a description of the risks and other factors associated with these opportunities.

Sempra Renewables

Over 3,000 MW of solar, wind, and battery energy storage in operation and under development and construction



(1) Sempra's ownership is 50%

Case Study: Retrofitting SCADA at Great Valley Solar

- Great Valley Solar is located just outside of Fresno, CA
- It is made up of four sites:
  - Rojo – 100 MW
  - Verde – 60 MW
  - Amarillo – 20 MW
  - Azul – 20 MW
- All sites are tied together at a single Substation
- The sites were built with five separate SCADA systems, one for each site plus the Ocho Substation

What is SCADA ?
Standard vs Advanced

Standard SCADA for Solar

- Need to custom configure to all end devices and HMI Screens
- Standard PID loops to control three (3) loops, Power and combination of Var/Voltage/PF
  1. Power & Var
  2. Power & Voltage
  3. Power & Power Factor

  Boils down to controlling Active and Reactive Power.
- Costly to deploy, commissioning time is in months.
- Typical solutions ranging from PLCs to DCSs and other options in between.
- Need to add Data Historian, whether it's a system version or third party solution.
- Heavy engineering work required to tie in storage.

Its main duty is Data Collection, a very expensive data collector.

Next Generation SCADA for Solar
(PXiSE SCADA Embedded with PI System)

- Template configuration to all end devices.
  1. Leverage 400+ Interfaces available in PI to communicate to multitudes of end devices
  2. Leverage PI AF to minimize error on end device configuration
  3. Faster checkout
- Advanced PID with feed forward to control three (3) loops, Power and combination of Var/Voltage/PF
  1. Power & Var
  2. Power & Voltage
  3. Power & Power Factor

  Combination of active and reactive power control at 60 Hz vs 1 Hz
- Economical to deploy, commissioning time is weeks.
- Off the shelf hardware, SEL3355 industrial computer or a Server Class Computer
- Built in OSIsoft PI Historian.
- Advanced Energy Storage control ready.

Efficient Data Collection and intelligent control that leverages the strength of the OSIsoft PI System.

Solving the Complexity of Renewable SCADA

Sempra Renewables

To most EPCs in the renewables sector, SCADA has always been the most complex part of the project. Without heavy oversight it is often overlooked and rushed. Most of the time they lack the expertise and have to rely on contractors.

CHALLENGE

Great Valley Solar has five (5) SCADA systems to manage 4 sites.

- The existing system was not flexible or scalable to manage the 4 sites.
- Time consuming to deploy, tedious to commission.
- Another system to manage in the Remote Operation Center (ROC)

SOLUTION

PXiSE ACT was utilized to provide for the single SCADA for the facility

- PI AF was leveraged to setup the database
- PI Vision was used for the HMI.

RESULTS

Through the PXiSE ACT solution, we have a single system that ties the 4 sites together.

- PXiSE ACT provides a single Web based control screen for the operators.
- Underlying PI structure makes it easy to maintain and use.

Standard SCADA Challenges

- Operators requires 5 separate HMI stations to operate the site.
- 5 licenses needed to be managed and maintained.
  - High O&M cost
  - Heavy reliance on contractor O&M service.
- Tied to the operating system
  - Microsoft OS's have end of life date!
  - Potential for whole system upgrade due to OS expiration.
- Database and HMI needs to be manually configured.

Advanced SCADA Solution

- Leverage the strength of PXiSE ACT and OSIsoft PI System.
  - Initially a joint venture formed between Sempra Energy and OSIsoft.
  - Underlying structure is OSIsoft PI platform integrated with high-speed advanced control and data analytics
- 1 license need to be managed and maintained.
  - Low O&M cost
- Loosely tied to the operating system
  - Because the platform is software based, just an update on software is needed.
- Database and HMI are self replicating. PI AF database and PI Vision are used.

Benefits and Implications

- Easier and faster to deploy
  - All 4 sites are treated as one under a single platform.
  - Simple configuration easily scaled and deployed in weeks
  - Unified Alarm system.
- Lower cost to implement and operate
  - Lower field installation cost
  - Lower O&M cost – software license cost decreased by a factor of 4.
- Better performance with intelligent controls
  - Energy Storage ready.
  - Unifying control for Remote Operations Center (ROC).
- Applicable in large scale wind farm or solar farm with or without Battery Energy Storage System (BESS)

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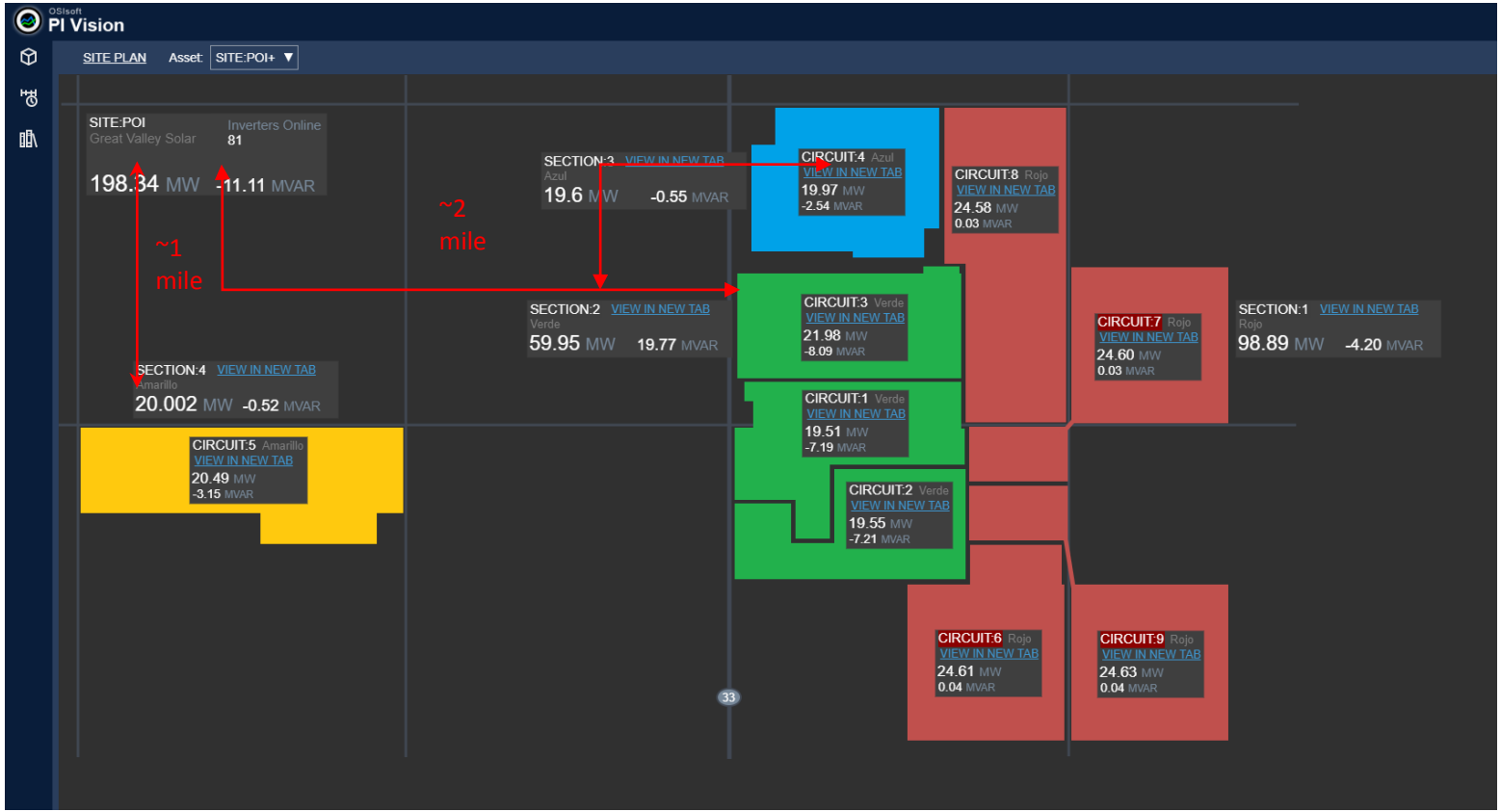
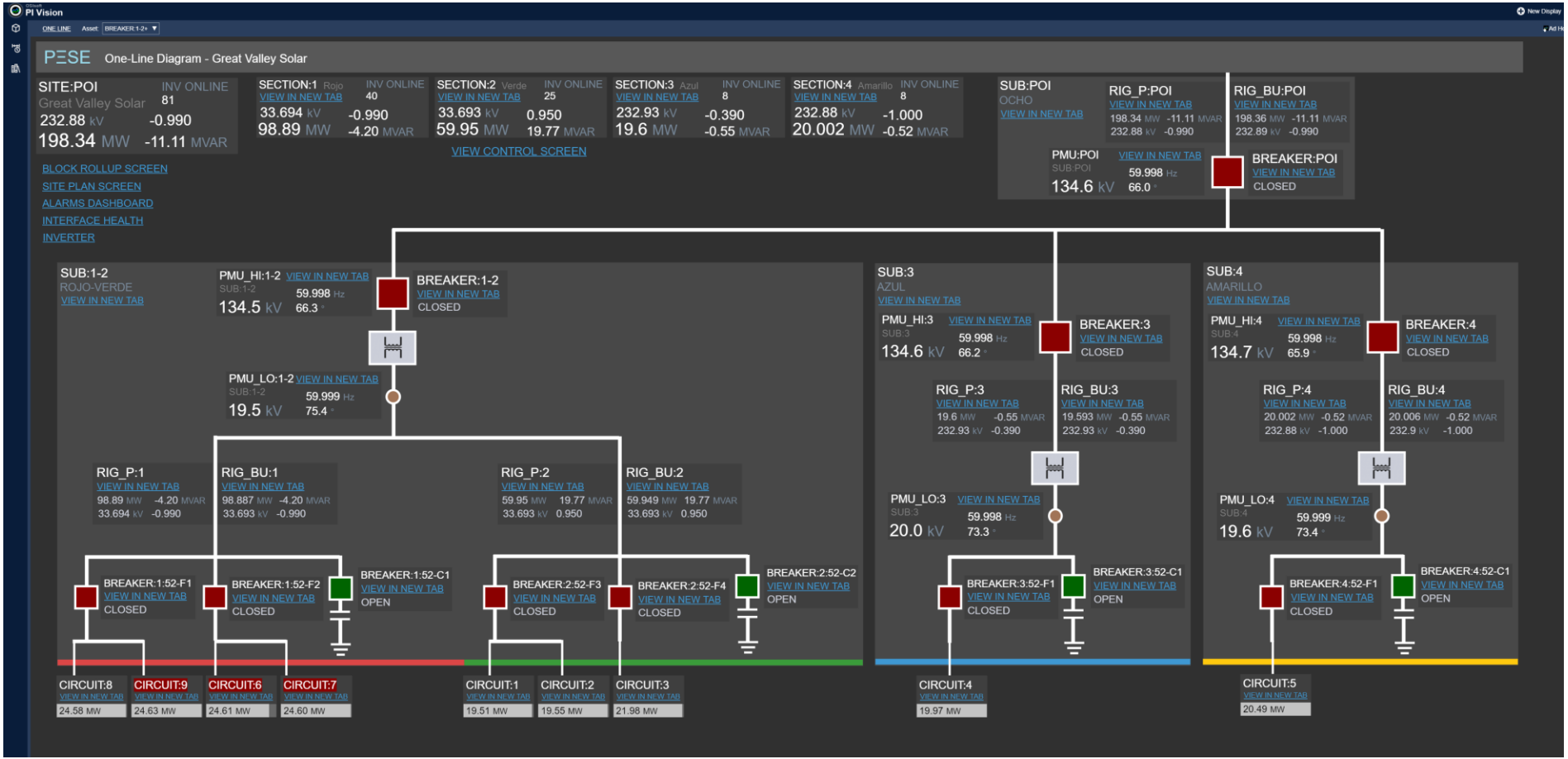
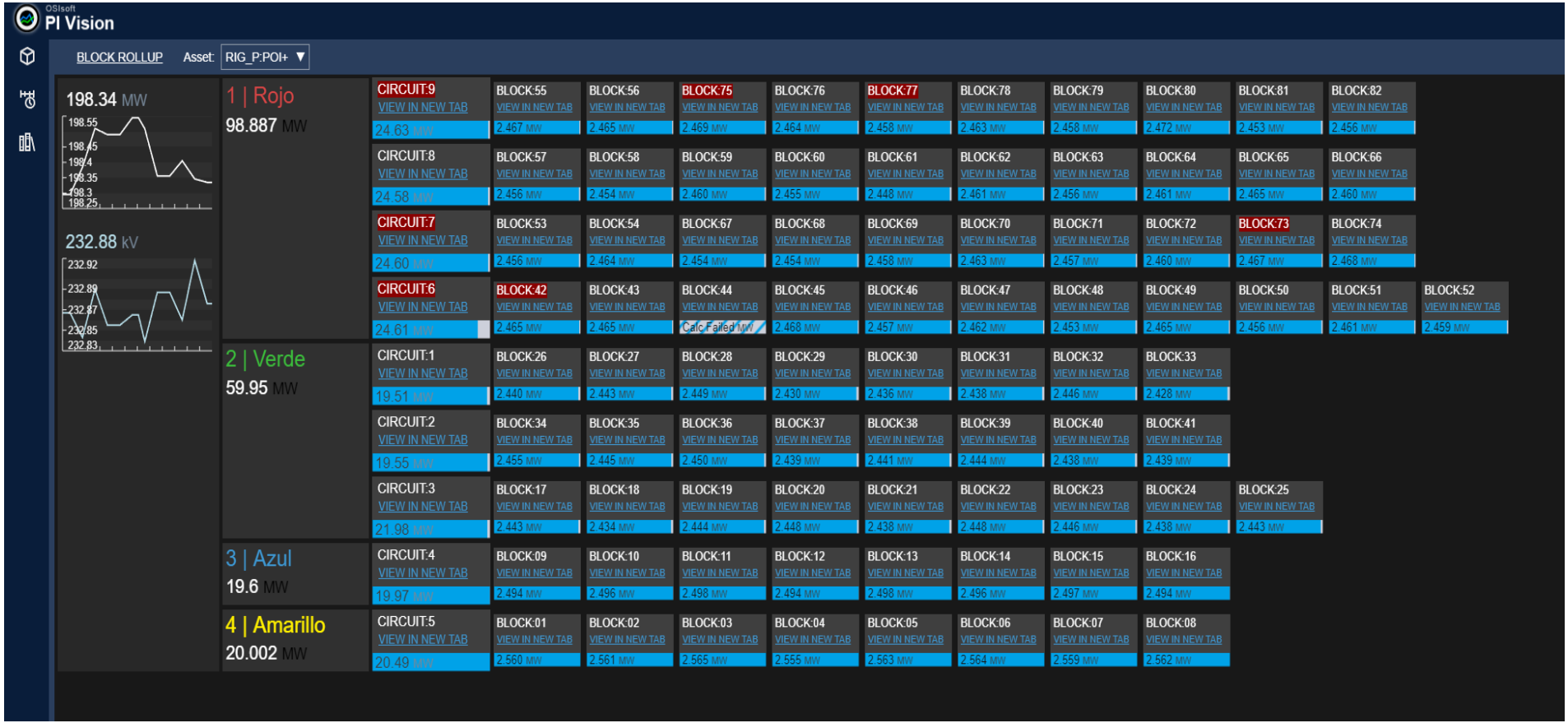
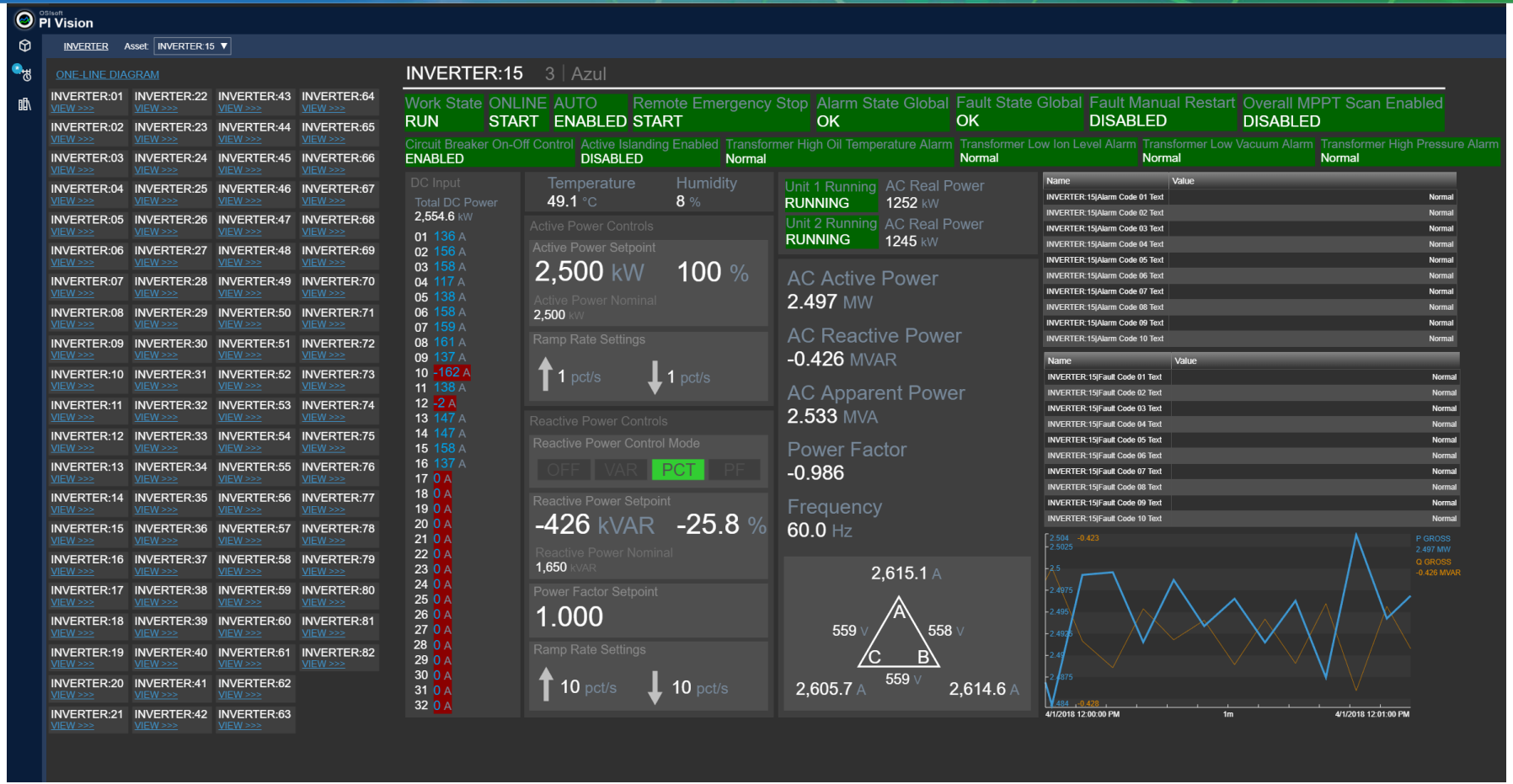
Great Valley Solar









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Questions

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

State your **name & company**

Please remember to…

Complete the Online Survey for this session

Merci

谢谢

Danke

Спасибо

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado