

EMAK10

Transition of Energy Management and Energy Efficiency and Conservation

Energy Efficiency in Vietnam with Hitachi's Solution

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Reference:

- 1) <https://www.evn.com.vn/userfile/User/tcdl/files/2019/8/EVNAAnnualReport2018.pdf>
- 2) IEEE PES GTD Grand International Conference and Exposition Asia (GTD Asia)
- 3) <https://www.hitachi.us/rd/HERO-GLOW-EPIC-Forum.html>

1. Importance of power loss reduction

Key indices from EVN's Annual Report (2018)

Gen. Output Energy	approx. 200,000 Million kWh
Power Grid Loss Rate	approx. 7%



Power loss
14,000 Million kWh

If transmission losses can be reduced by 3%, we would obtain the following energy without new construction of power station.

$$E_r = 20 \times 10^{10} \times 0.07 \times 0.03 = 422 \times 10^6 \text{ [kWh]}$$

Other hand, supply energy from a wind turbine rated 5,000kW with 50% capacity factor is following,

$$E_p = 5000 \times 0.5 \times 8760 = 22 \times 10^6 \text{ [kWh]}$$

3% grid loss reduction makes the energy of 19 wind turbines rated 5,000kW.

$$\text{Equivalent Number of WT} = \frac{E_r}{E_p} = \frac{422 \times 10^6}{22 \times 10^6} = 19$$

It is NOT easy to reduce power losses with maintaining power grid security, but Hitachi has some solutions. In this presentation, two high potential technologies are introduced.

- **OPENVQ:** Optimized Performance Enabling Network for Volt/var(Q)
 - Reduction of grid losses by optimizing voltage profile of transmission grid.
 - Values:
 - Not only reduce the CO2 emission, but also fuel cost
 - Transfer capability of power grid can be enhanced by OPENVQ, so that OPENVQ can contribute for shifting power output from conventional generators to RE with smaller CAPEX.
- **HERO:** Hitachi Energy Resource Optimization suite
 - Information platform of distributed energy resource (DER) to realize the optimizing local consumption of energy
 - Optimized local consumption can reduce the burden of trunk power grid missions
 - Values:
 - To increase the performance of the entire power grid by maximizing the potential of the local system as well as facilitating local consumption

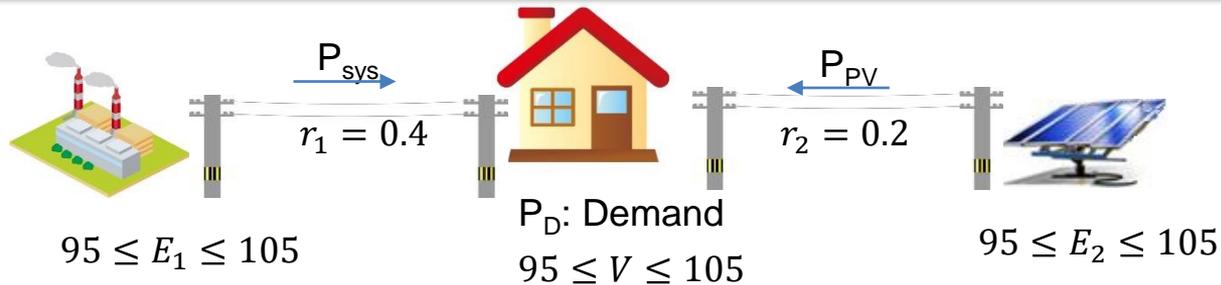
3. OPENVQ

– What Voltage Profile is -

The voltage profile that minimizes transmission losses is depending on the power flow condition. Uncertainty of power flow condition would be higher, then power system operator should have a new technology to maintain



OPENVQ is the most promised solution.



	P_D	P_{sys}	P_{PV}	E_1	E_2	Rate*
Night	500	500	0	105	103.1	-5.7%
Morning	600	200	400	105	105	-7.9%
Daytime	800	200	600	104.6	105	-7.1%
Evening	900	700	200	105	102.7	-4.3%

Rate* : Transmission loss reduction rate with flat profile ($V, E_1, E_2=100$)

Advanced calculation using ICT is indispensable to determine the optimal voltage profile that reduces the loss rate for the general network.

3. OPENVQ

– Values proven by numerical simulations–

OVENVQ simulation results on TEPCO Power Grid 1500-bus model shows:

<For Voltage Security>

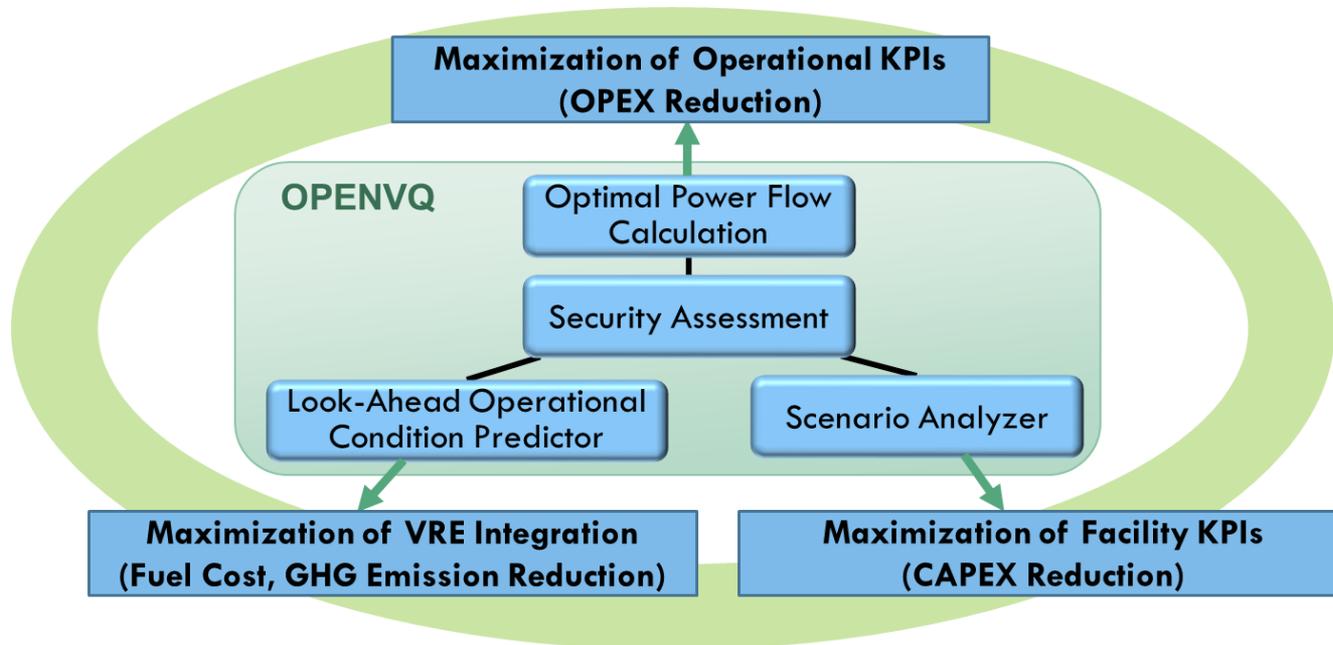
About 10% improvement of ATC could contribute grid integration of more variable renewable energy.

<For OPEX Reduction>

About 2% improvement of transmission loss could contribute fuel cost reduction.

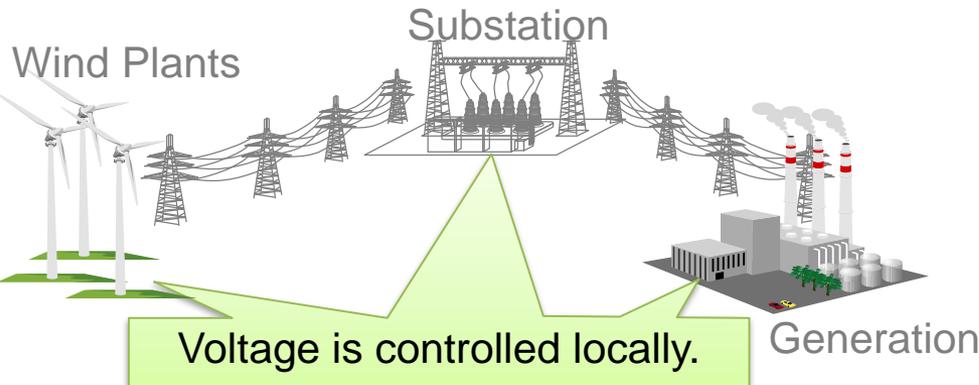
<For CAPEX Rationalization>

Management of voltage control assets could be rationalized.

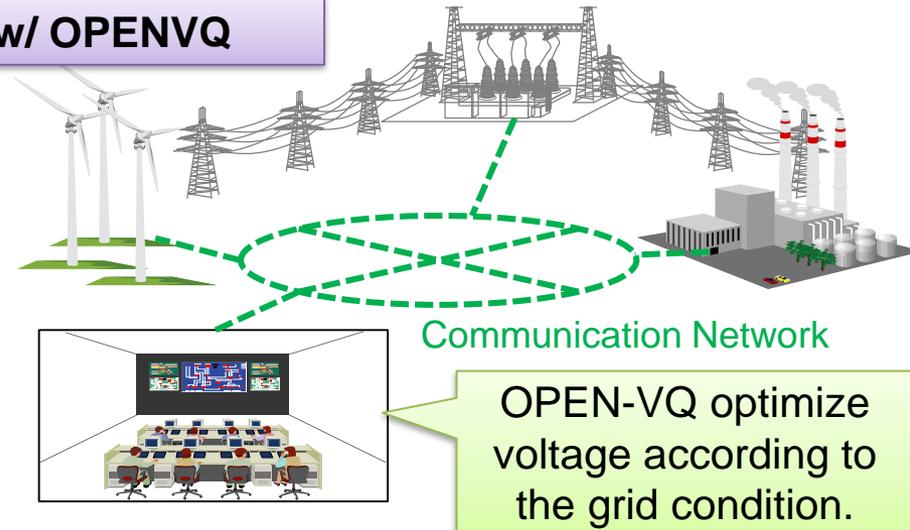


3. OPENVQ – Typical Architecture –

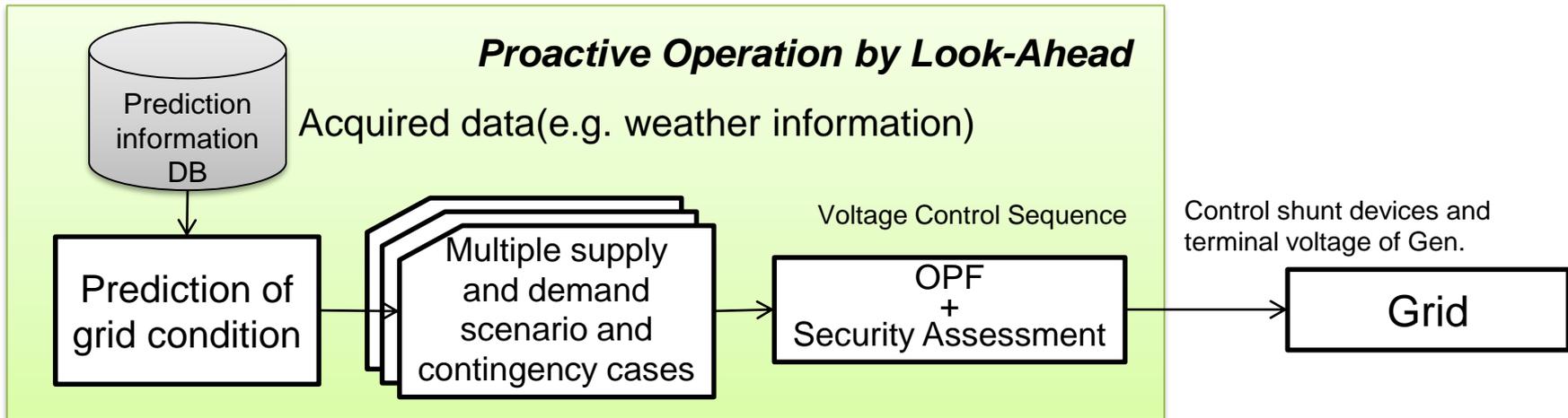
w/o OPENVQ



w/ OPENVQ



Key Functions

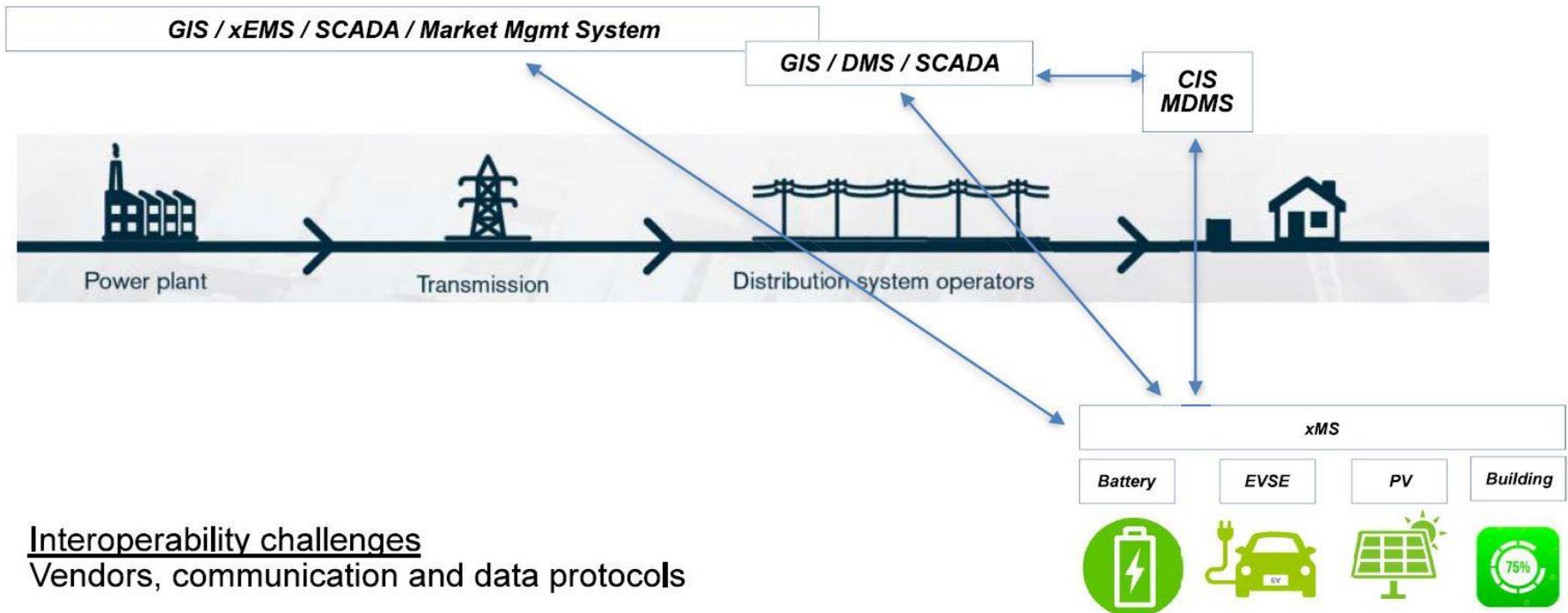


The demonstration project of OPENVQ funded by NEDO, which is Japanese government, has been started from December 2020 with cooperation of EGAT

4. HERO

- Current Concerns -

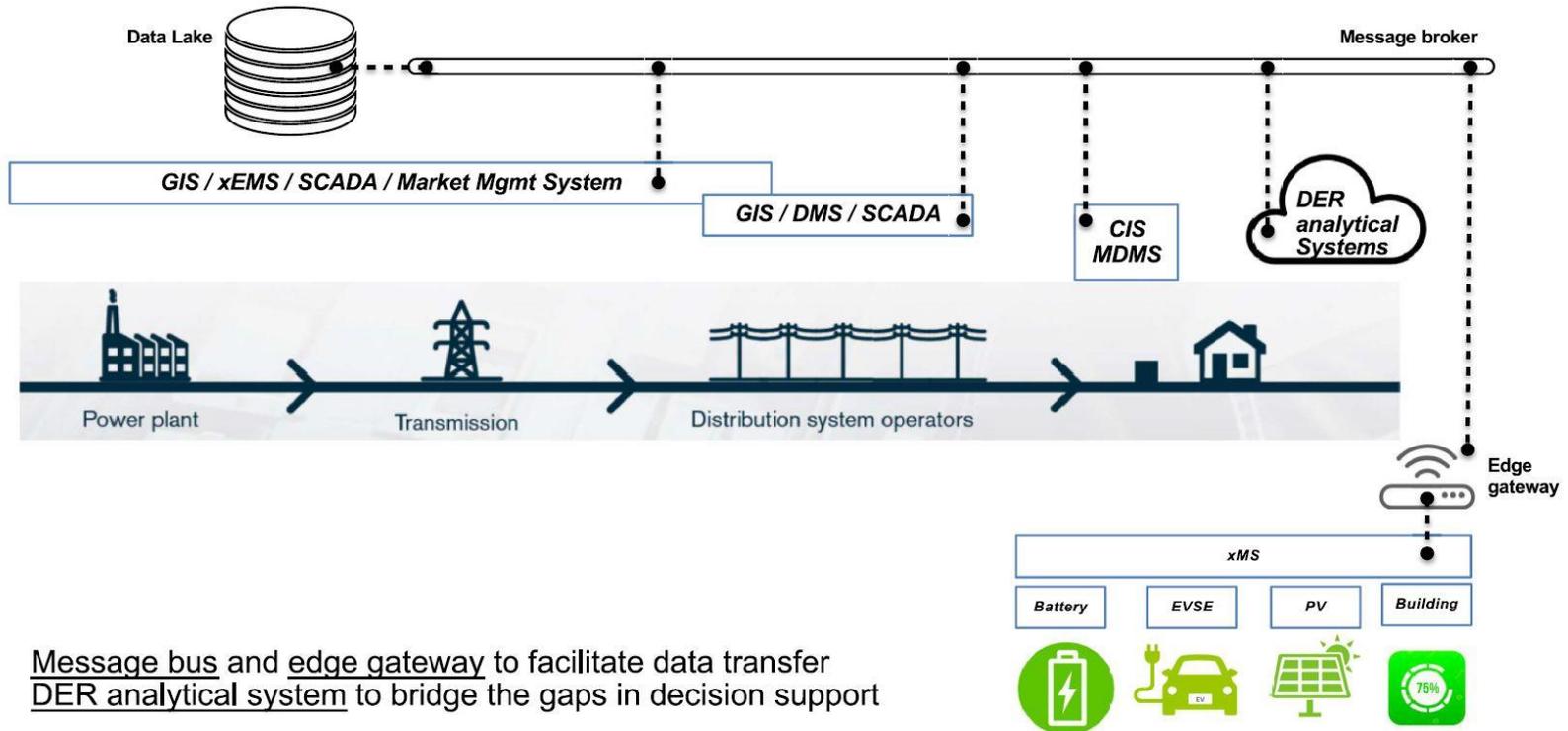
There is the severe situation to manage DER such as following. Each vendor and system should communicate and be integrated with decentralized energy resources by using its own communication and data protocols.



4. HERO

- To bridge the gap-

HERO, IoT platform of DER analytical system, can bridge the gaps of the silos with message bus and edge gateway



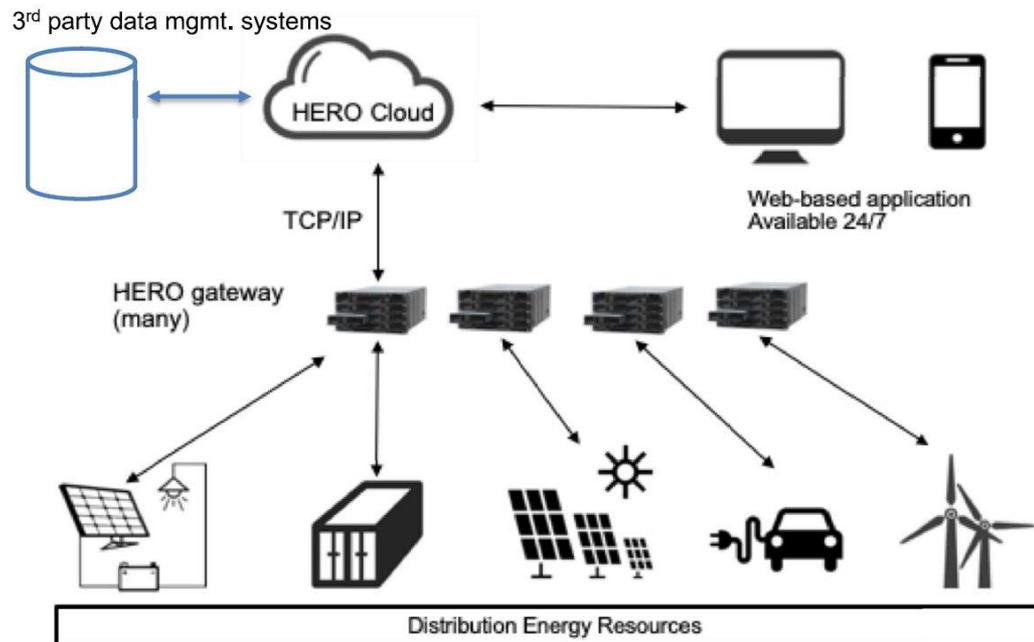
HERO provides state-of-the-art software applications and advance analytics to address technical issues that users cannot otherwise solve with traditional solutions.

4. HERO

- High level architecture -

HERO can offer following function which are important for sophisticating management of RE with the architecture.

- Real time monitoring
- Two way communication for monitoring and control
- Enabler for other business applications



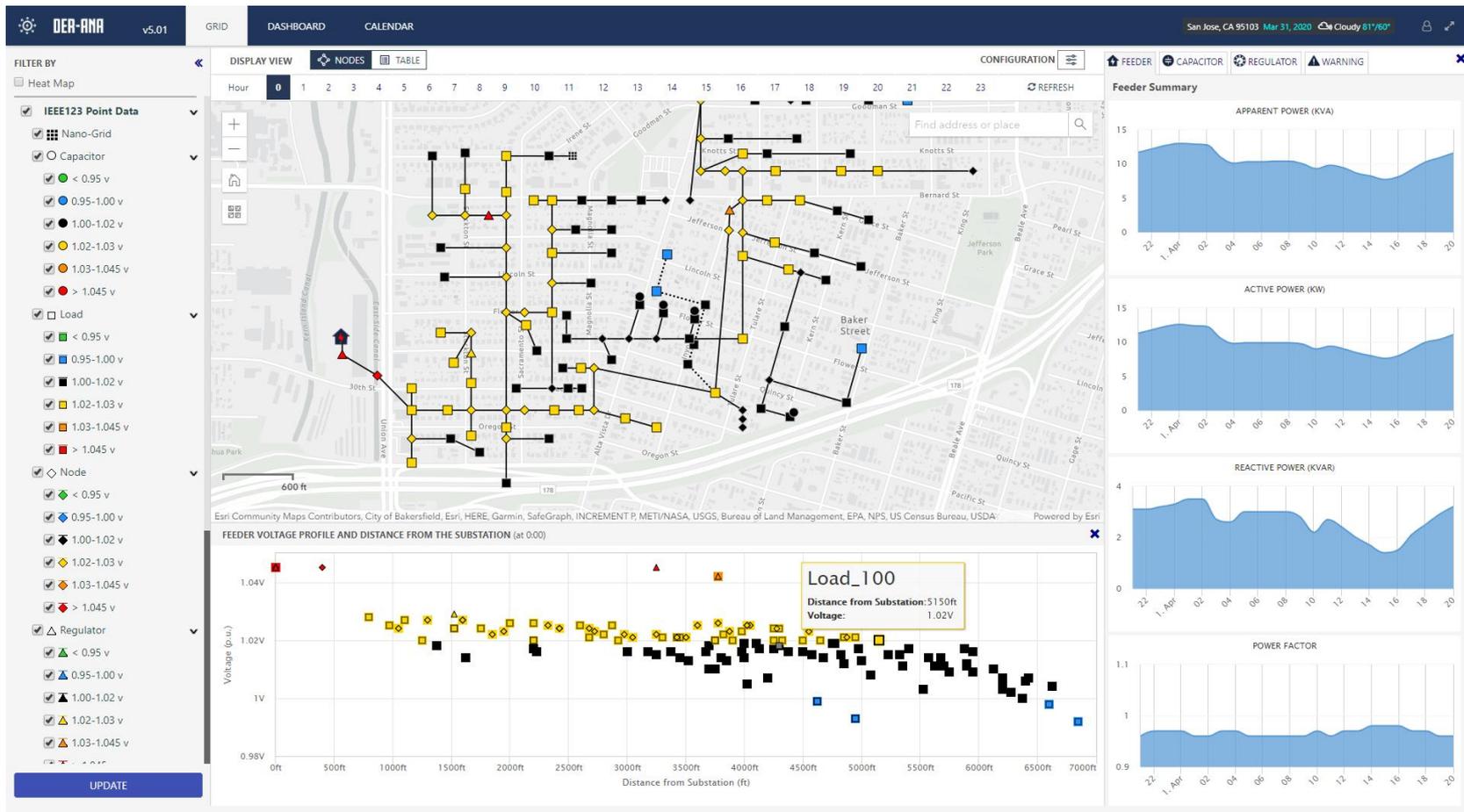
The Introduction video of HERO and another solutions are available here:

https://s3.amazonaws.com/bizzabo.file.upload/Gx71gjYTQbmNyzG6oEeU_03_Hitachi_Short_Video_08.20.20%20V1.3.mp4

4. HERO

- Example application: Real time monitoring -

- Monitors DERs and field devices conditions in real time
- Visualizes distribution grid with DERs and field devices
- Capability to calculate network loss



4. HERO

- Example application: Battery Management -

- Visualize actionable insights instead of data
- Optimize operational strategy based on quantified performance comparison
- Couple with business process and priority



- It is very important to make a smarter operation of power system, such as the expansion of use of renewable energy and reduction of losses.
- Two solutions that are representative of Hitachi were introduced.
- Customization is very important in order to maximize the effectiveness of the solution.
- One of Hitachi's most important corporate philosophy is harmonious with customers.
- Hitachi would like to offer our solutions for realizing sustainable society at Vietnam.

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