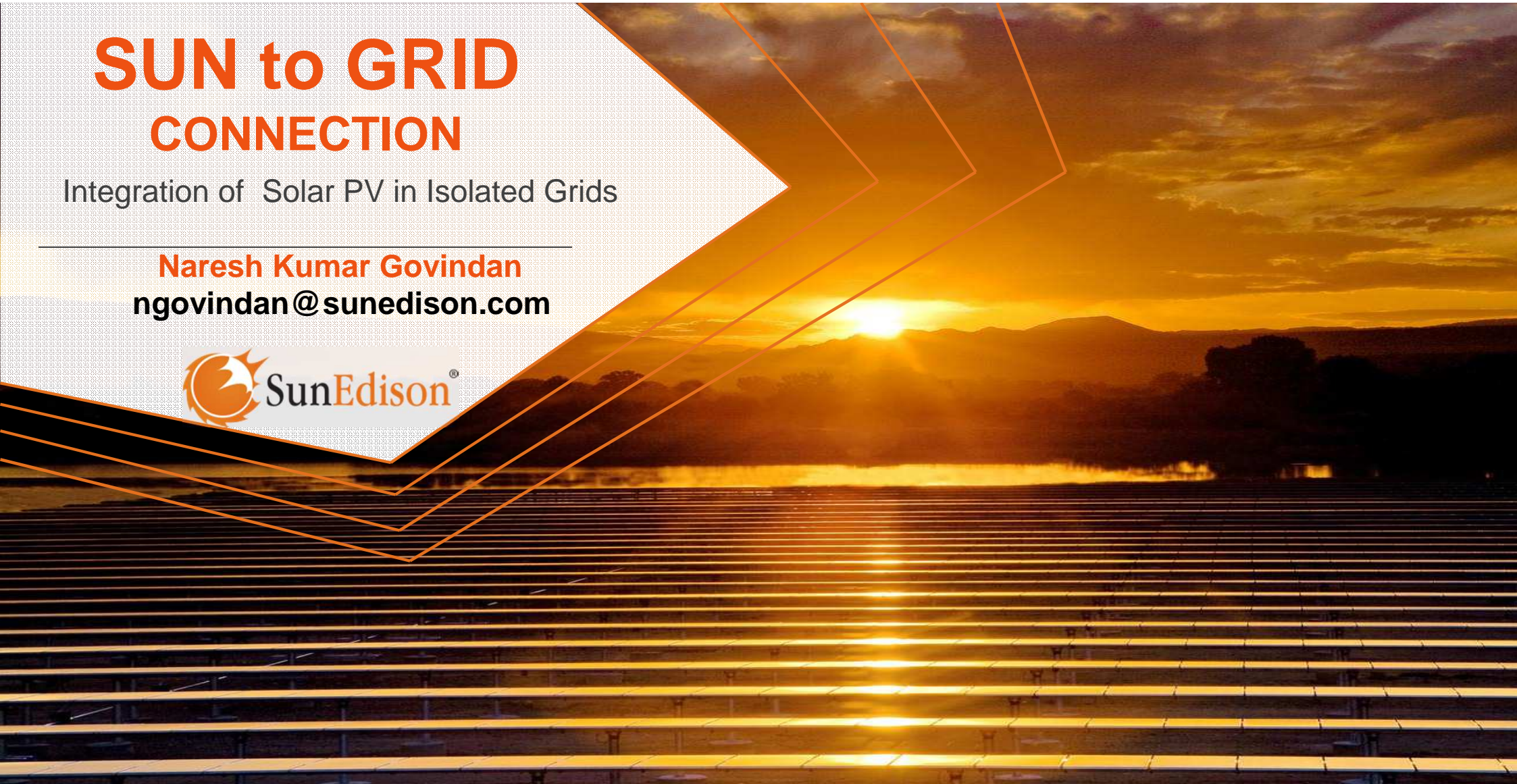


SUN to GRID CONNECTION

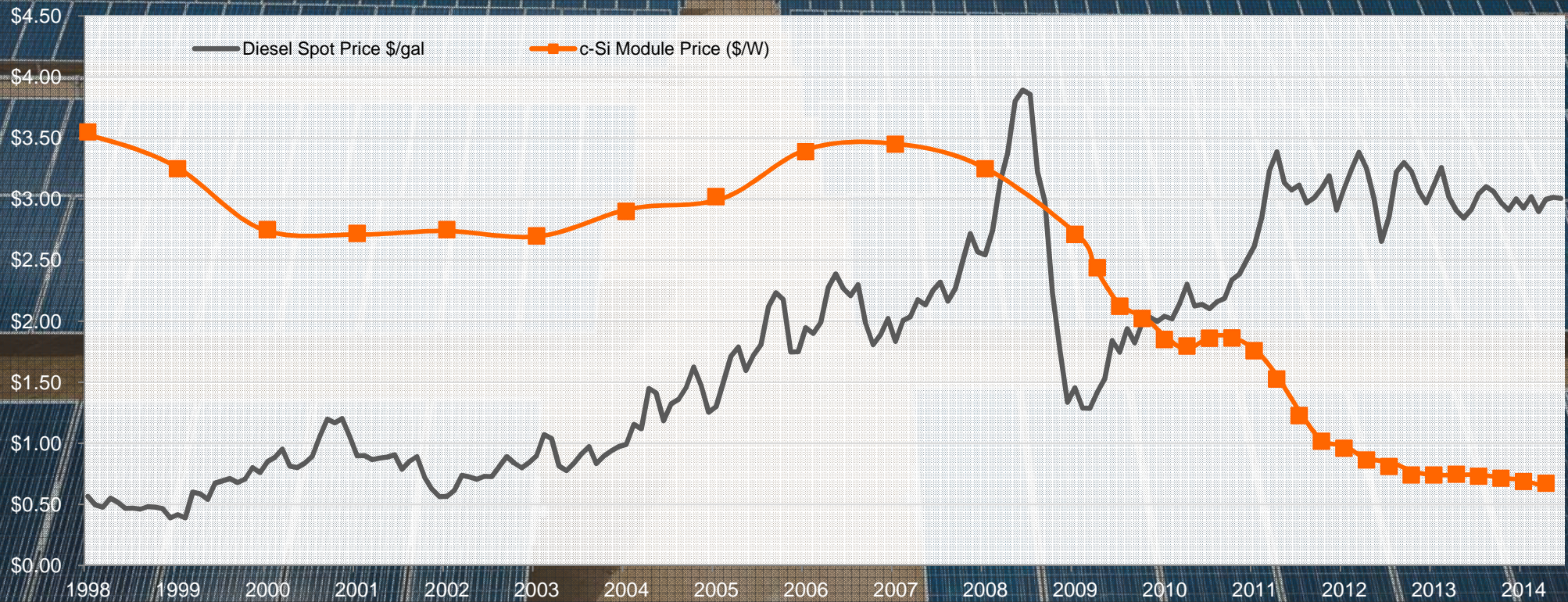
Integration of Solar PV in Isolated Grids

Naresh Kumar Govindan
ngovindan@sunedison.com



Solar & Diesel prices over Time

Declining solar costs stand in stark contrast to high fossil fuel volatility

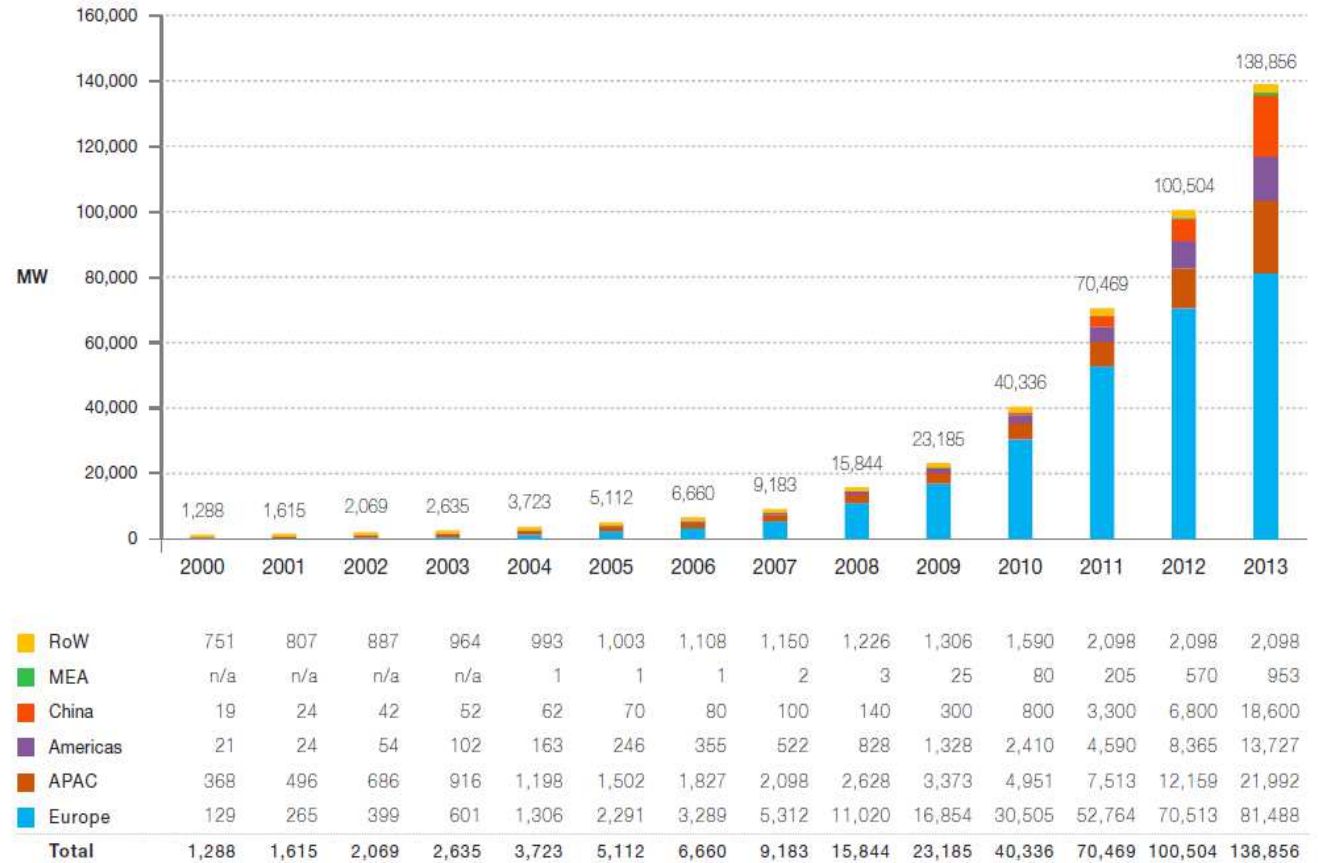


Big Picture

→ Renewable Energy use Growing

- In 2013 Power from RE sources- wind, solar and hydro grew strongly almost 22% of global generation.[1]
- From 2009, Grid connected Solar PV capacity expanded almost 1.5X[2]
- Source -[1] IEA.ORG [2] EPIA. ORG

Evolution of Global PV Cumulative Installed Capacity 2000 - 2013



RoW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.
Methodology used for RoW data collection has changed in 2012.

Challenges in Isolated Grid

- Safety
- Stability / Power Quality
- Intermittent / Uncertainty

❖ Power Quality

Reverse flow of Power due to imbalance between load and generation

- defining new specifications for special controllers communicates with the isolated grid.
- Using new equipment such as intelligent distribution transformers or decentralized storage

❖ Measures for Uncertainty

Variability due to climate changes

- Short Term- Forecasting / Predictability; Provision for Marginal storage
- Long term- Low cost dispatch options

Hybrid Solution

24x7

Built on Sun Edison's best in class monitoring, control and O&M platform

End To End

Customized solution designed and optimized by Sun Edison

100 %

Compatible with all inverters, generators, and system configurations

Proven

Backed by Sun Edison's experience in finance, engineering and PV operations

24/7 Plant Management



SunEdison ROC

PV Hybrid Controller



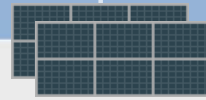
- Produce higher quality, more reliable power at lower cost
- Optimize operation of each power asset based on load
- Hedge against supply chain disruptions, price volatility and energy security of fossil fuels



Grid



Gen-Set



Solar Panels



Storage



Load

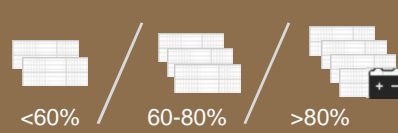
Connection

Fuel Type

Penetration

Integration

Profile



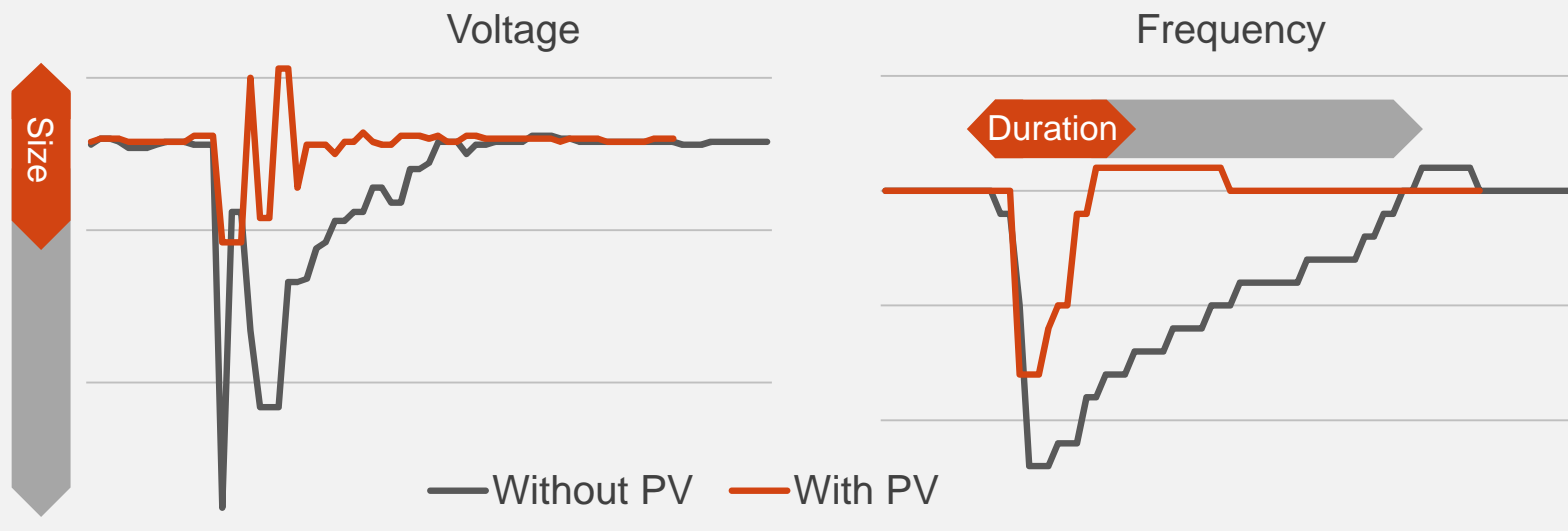


Specialized Controllers



Transients are reduced with specialized Controller / PV

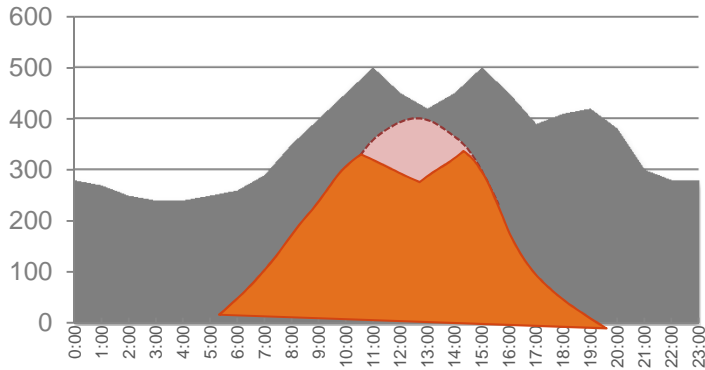
- Maximized Reliability
- Full Compatibility
- Improved Power Quality
- Improved Asset Lifespan



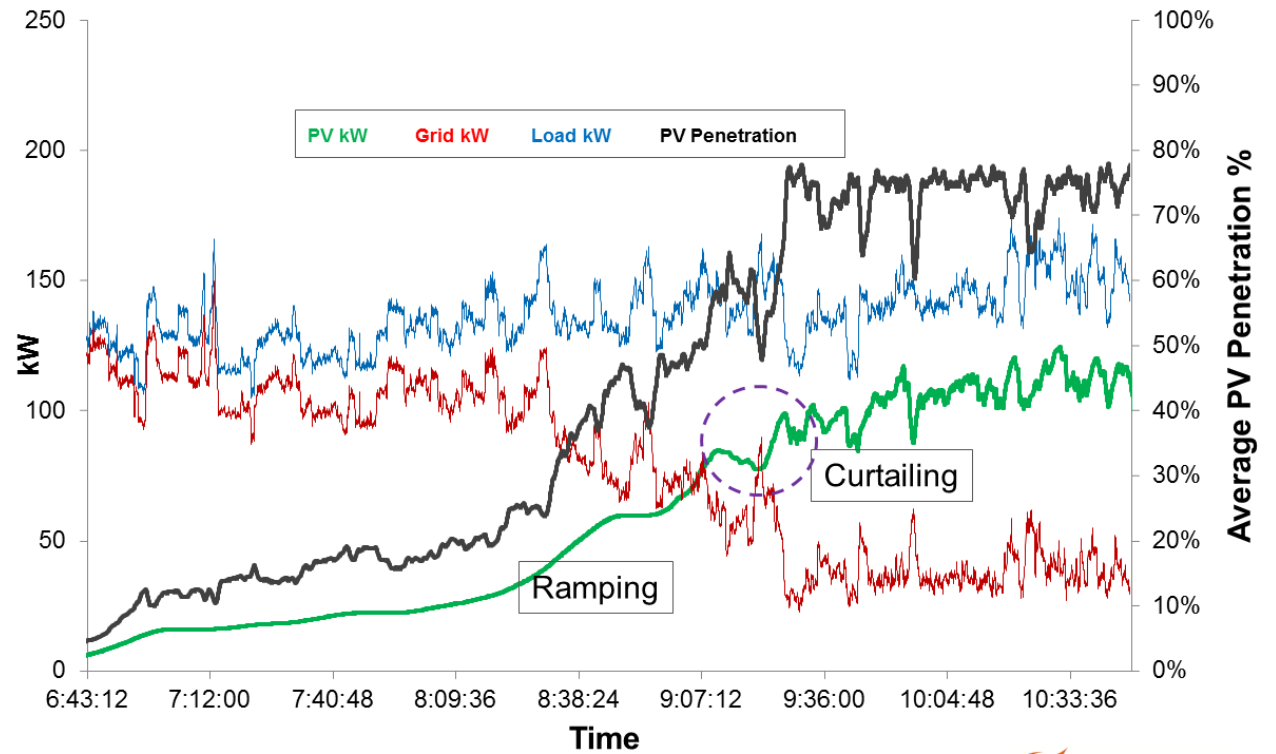
Hybrid Case Study-1

- Location: Southern India
- Business: Textile Mill
- Max load: 500kW
- Load variability: Constant
- Solar size: 300kW (60% penetration)
- Existing generation: 3 diesel gensets

12,000 liters of diesel saved in year one



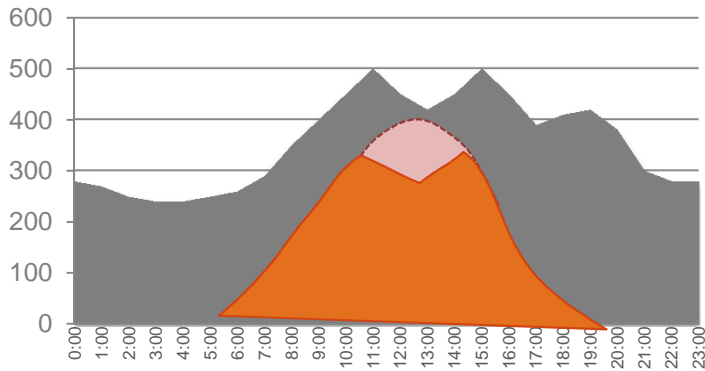
Hybrid Controller action ramping up of PV conditions



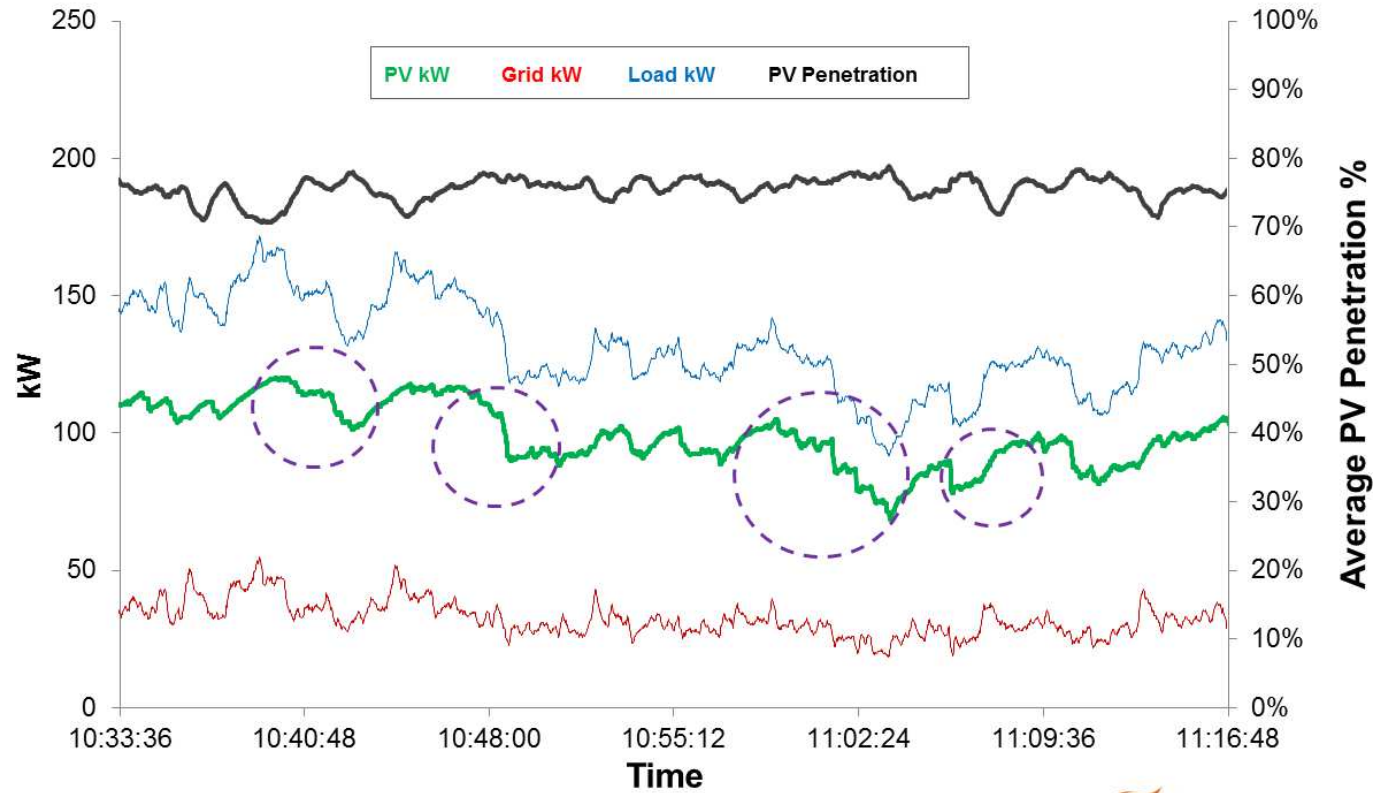
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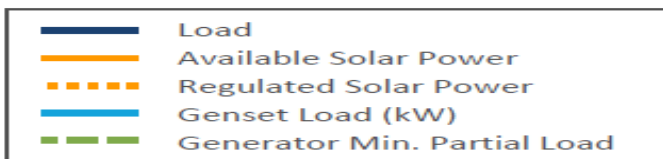
Hybrid Controller maintaining steady 75% penetration



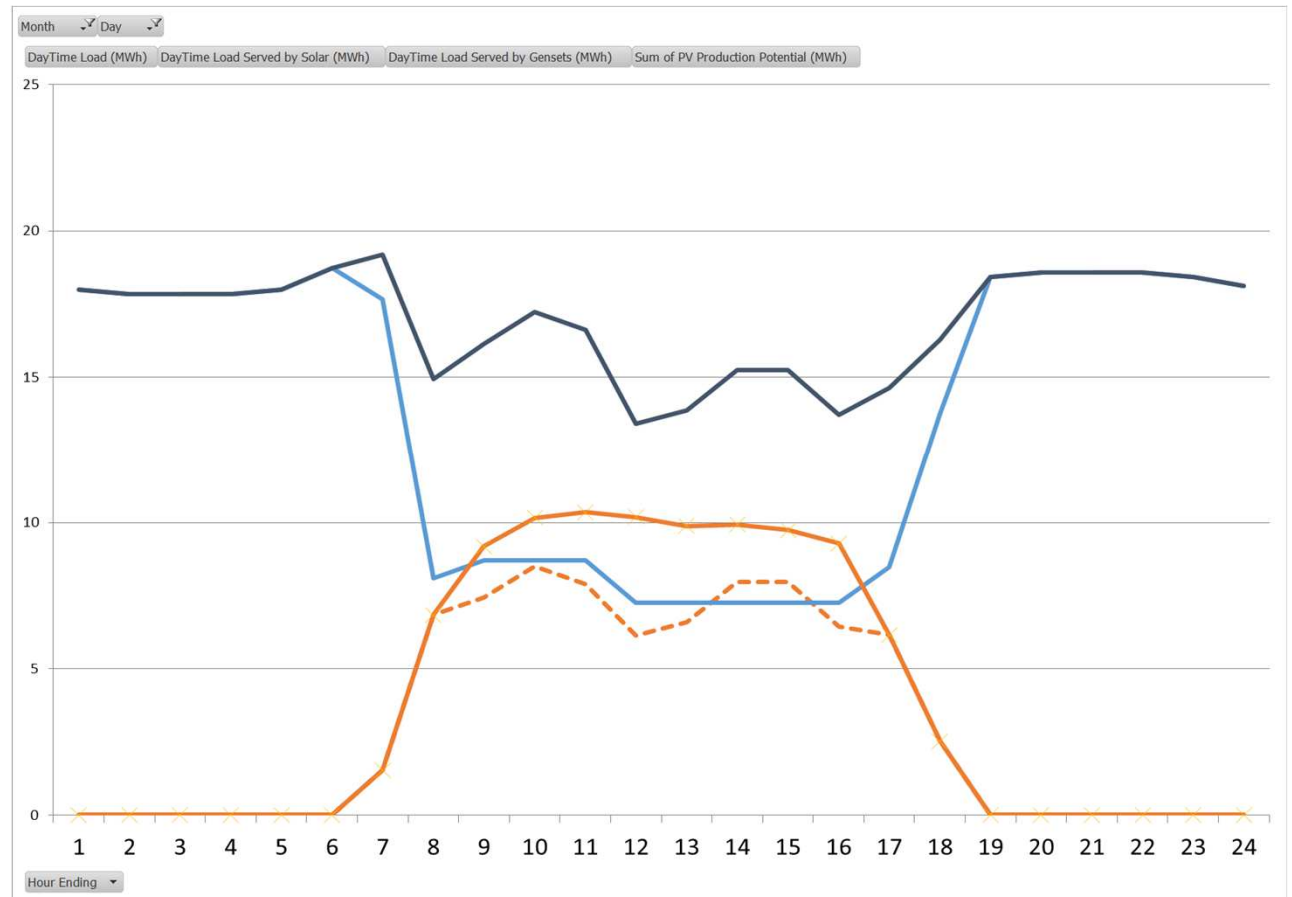
Hybrid Case Study-2

- Location: Indonesia
- Max load: 30 MW
- Load variability: Constant
- Solar size: 14 MW (~ 46% penetration)
- Existing generation: diesel /MFO gensets

By Installing a 14 MWp system
System would save 4,989,000 liters of fuel



LOAD PROFILE



Summary

- **Grid Code assessment** - DSO /TSO – Apply cost-effective and innovative strategies to apply involving reactive power control , Fault Ride-Through (FRT), voltage support to manage and improve their grids
- **“Smart solutions with Smarter PV”** DSOs can include grid monitoring, controlled distribution transformers; decentralized storage managed by Intelligent Hybrid controllers- Distributed Solar PV- can provide generation Data to TSO’s

“Conception” – PV can be used in a stable source of electricity with Variability during day rather than an intermittent one.

Embrace the fastest growing Power generation source by deploying large Scale PV to Isolated Weaker Grids without any technical barriers/ technical Limits.

Thank You !



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