

An aerial photograph of a residential development featuring numerous houses with solar panels installed on their roofs. The houses are arranged in rows, and the surrounding area includes green lawns, trees, and a clear blue sky with scattered clouds. The solar panels are a prominent feature, indicating a focus on renewable energy in this community.

# Trends in Renewable Energy

APEC 2015

**[e]** enphase<sup>®</sup>  
ENERGY

# The Global potential of Solar

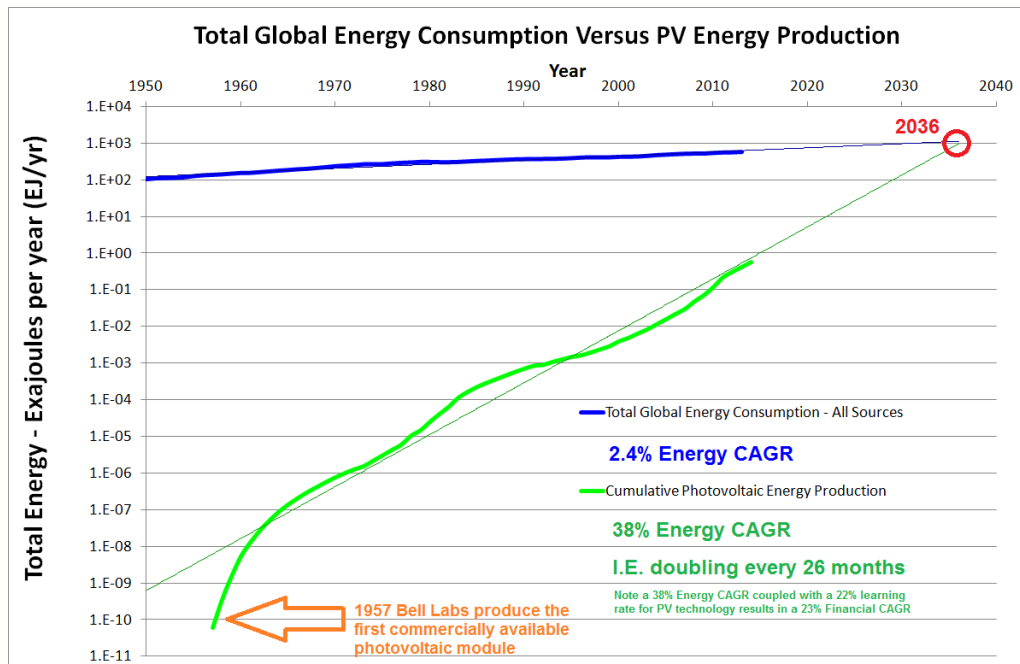
- **Solar is less than 1% of energy mix in the US**
- **Approximately 500,000 solar homes in US, while 600,000 new individual homes are built annually**
- **Solar is approximately 3% of energy mix in Europe**

Solar <1%



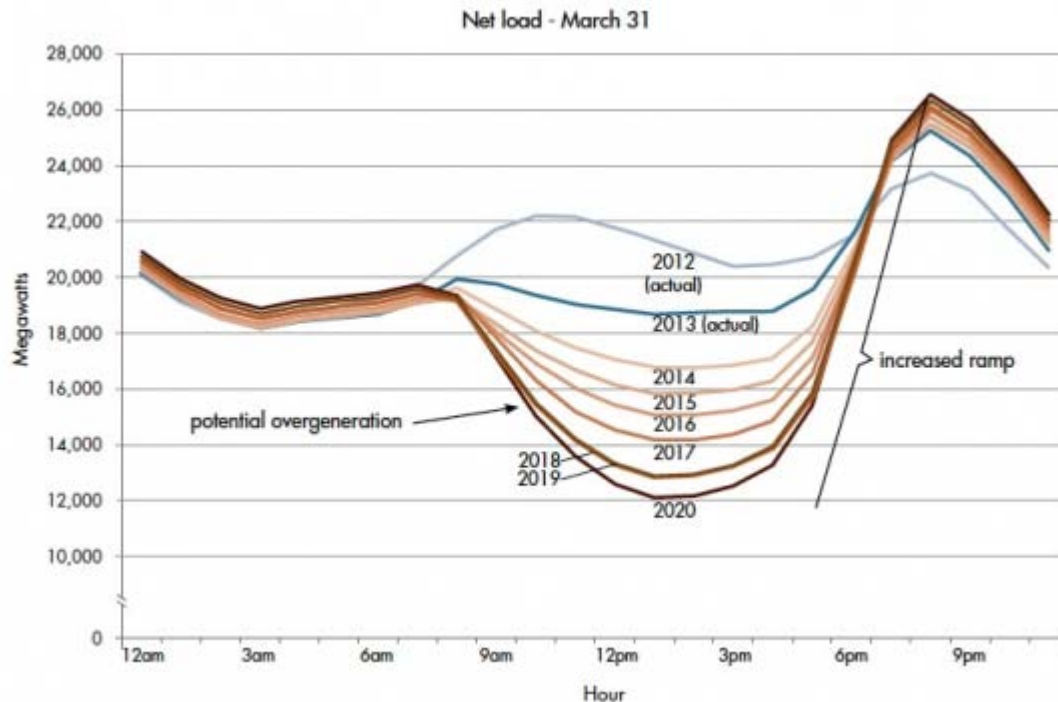
# But penetration is growing very fast

- **Global PV solar is expected to become a dominant global source of power generation by 2050**
- **Grid Parity is obtained in most US states today**
- **Solar is an absolute no-brainer in some locations**



# The rise of distributed solar is creating issues to the operators

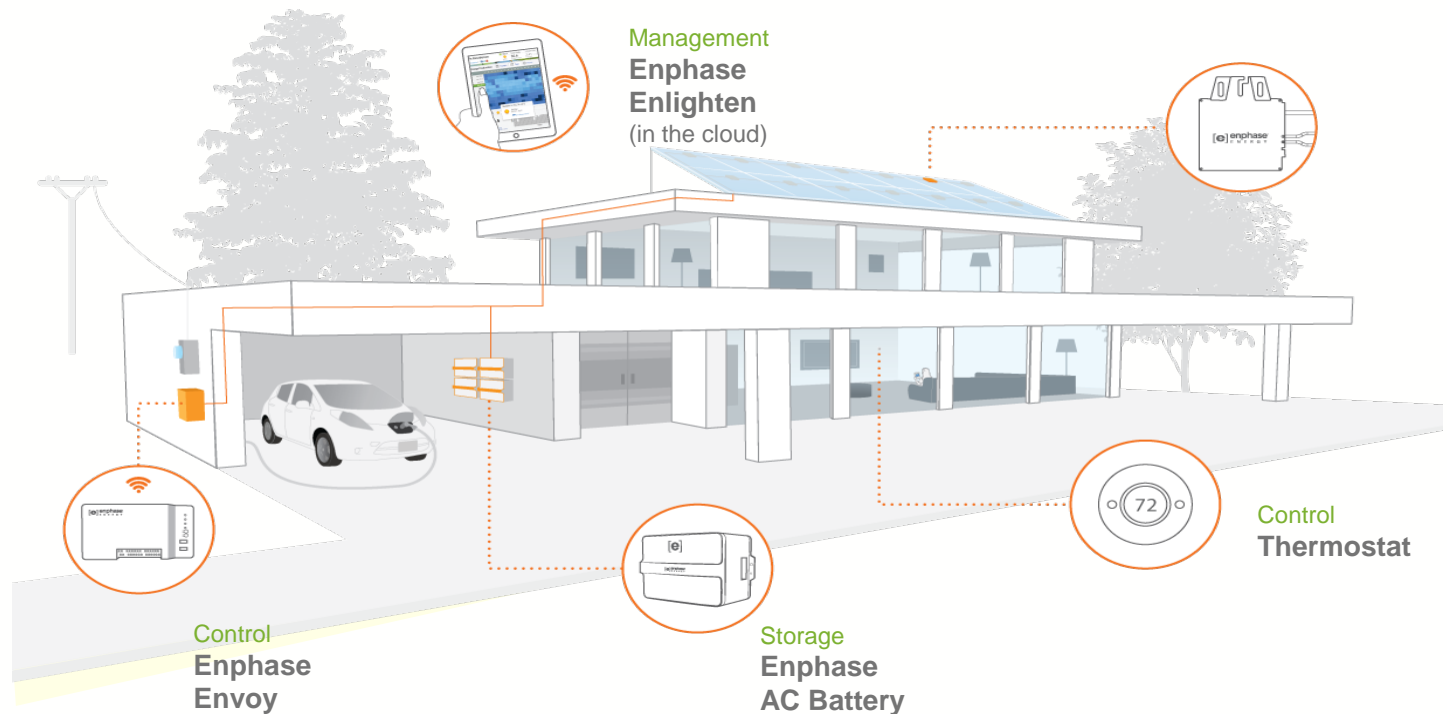
- **Loss of revenue**
- **Devaluation of assets (Coal power plants)**
- **Voltage fluctuations in the feeder network**
- **Hard transition in the afternoon (the duck curve)**





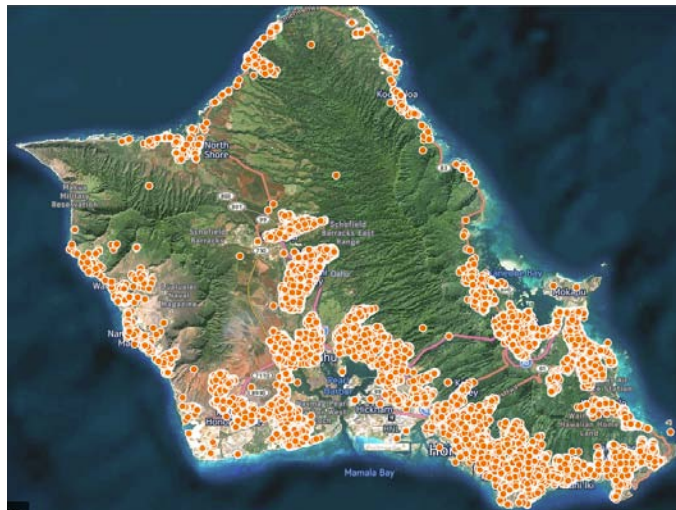
# The consumers are changing

- Consumers now realize that they can optimize their energy requirements
- Requirements are changing from a solar solution to an energy solution



# DERs are an asset to the grid

- **These resources can be leveraged to solve the problems and stabilize the grid**
  - Storage can be used as a dispatchable resource
  - All inverters can be used for Volt/VAr and F/W functions among many other functions
  - The data gathered by these resources is very useful to the operators



# Impact on equipment vendors

- **There is a major transition from Power electronics to Systems offering with a huge software content**
  - Move towards “software defined inverters”
  - NOCs are required
- **The solar inverter cost curve is very steep ~15%/year**
  - Can only be sustained by fundamentally better designs
  - Move towards “ideal converters”
  - Efficiency gains are necessary because of cost of cooling
  - We love predictive digital control
  - Custom chip solutions are a must



# Take away

- **From basic Solar to Energy offering**
- **From Inverters to Systems**
- **From grid attached to grid integrated**
- **Adding data services to Energy delivery**



Questions?