



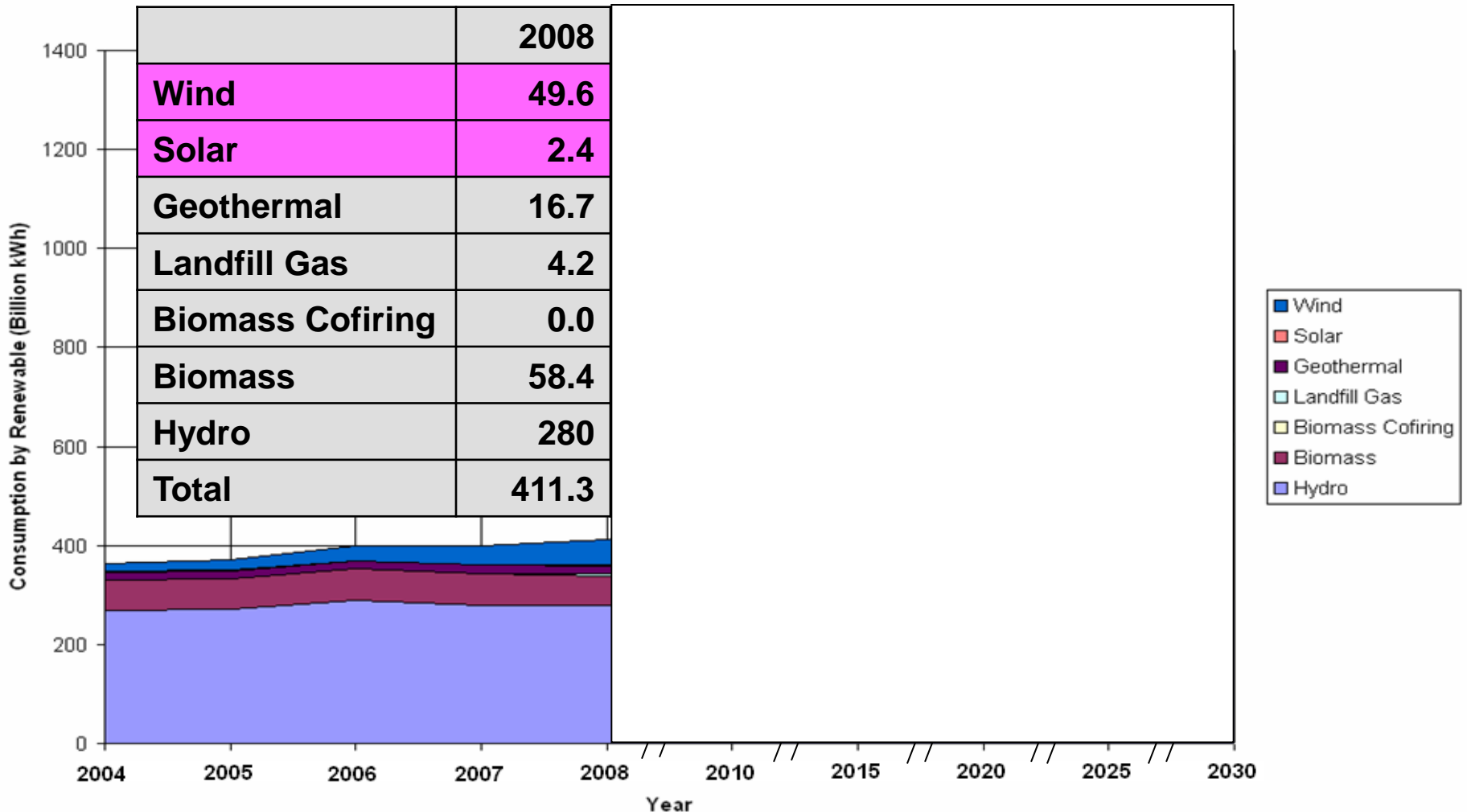
EPRI | ELECTRIC POWER
RESEARCH INSTITUTE

Renewable Growth and Grid Challenges

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Technology Director
Power Delivery & Markets
EPRI Director

Projection of Renewable Consumption in USA by PRISM Requirements

Projection of Renewable Consumption by PRISM

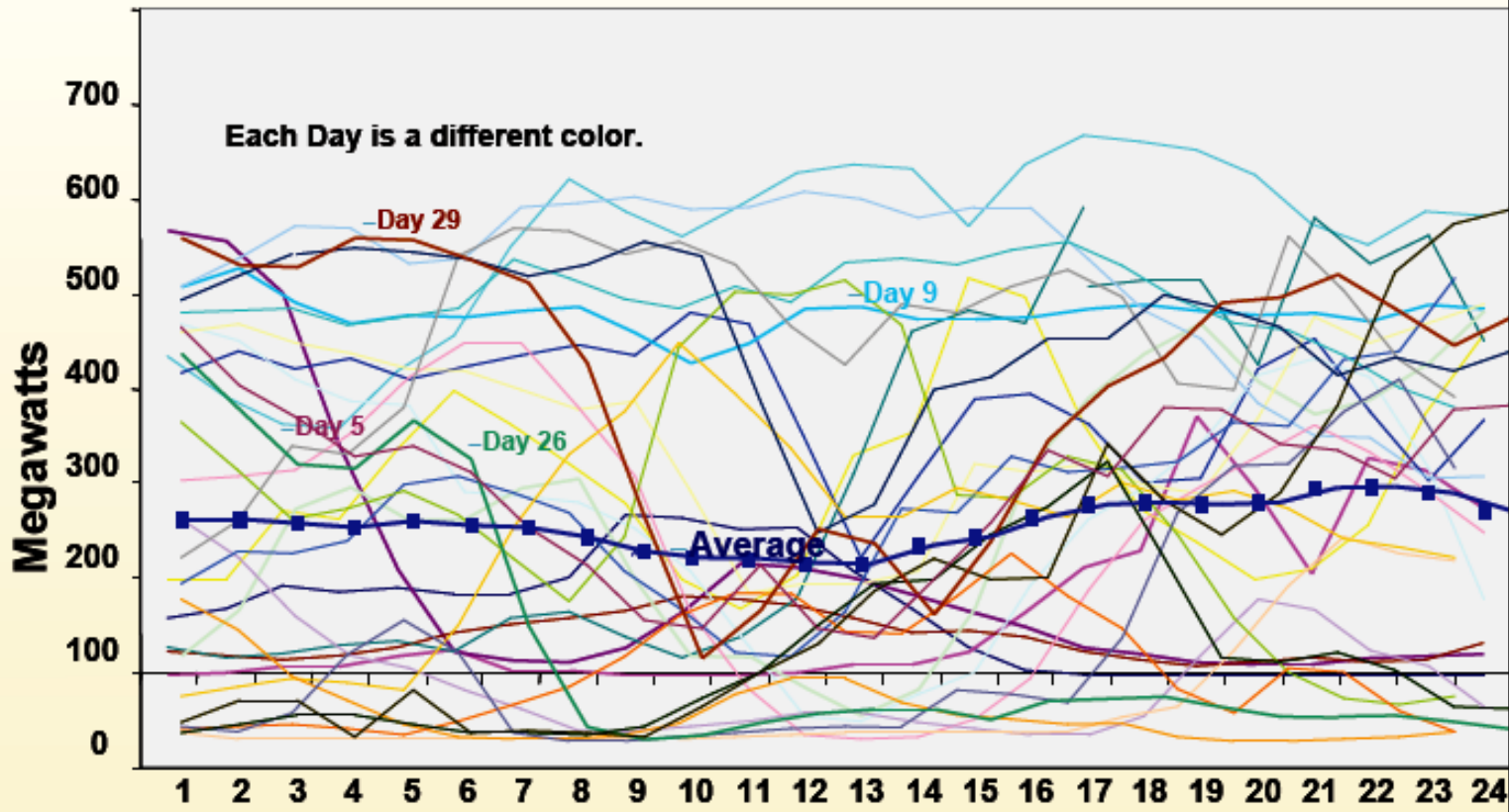


* Note: bottom axis not to scale.

Variability & Predictability

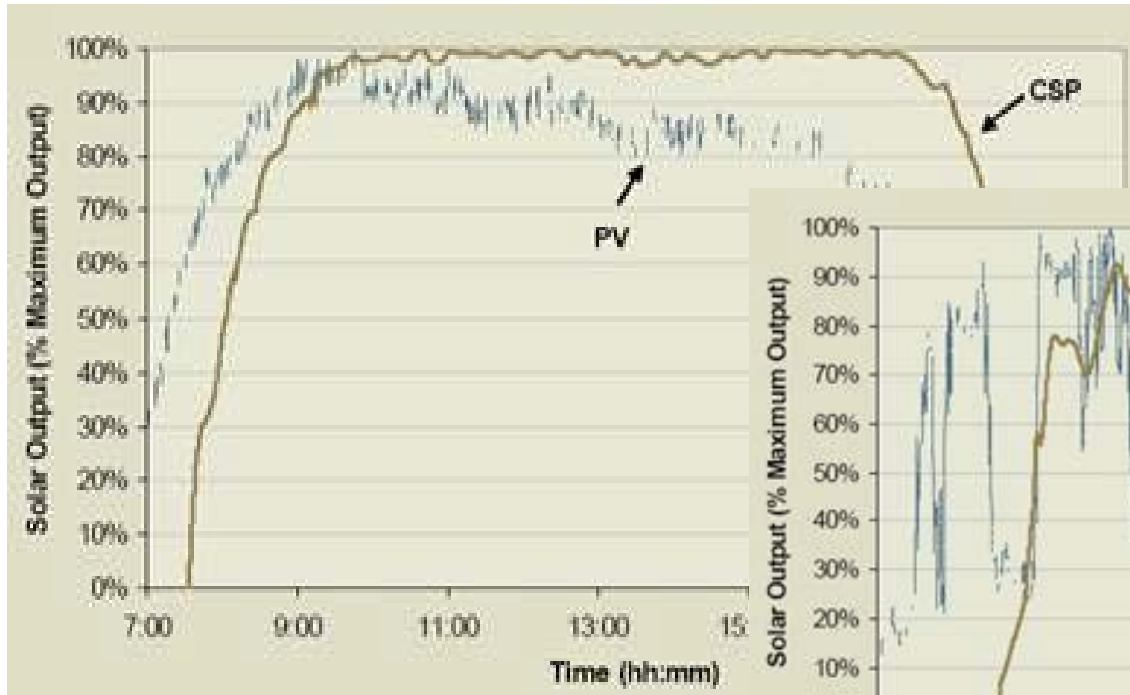
Tehachapi Wind Generation in April – 2005

Could you predict the energy production for this wind park either day-ahead or 5 hours in advance?

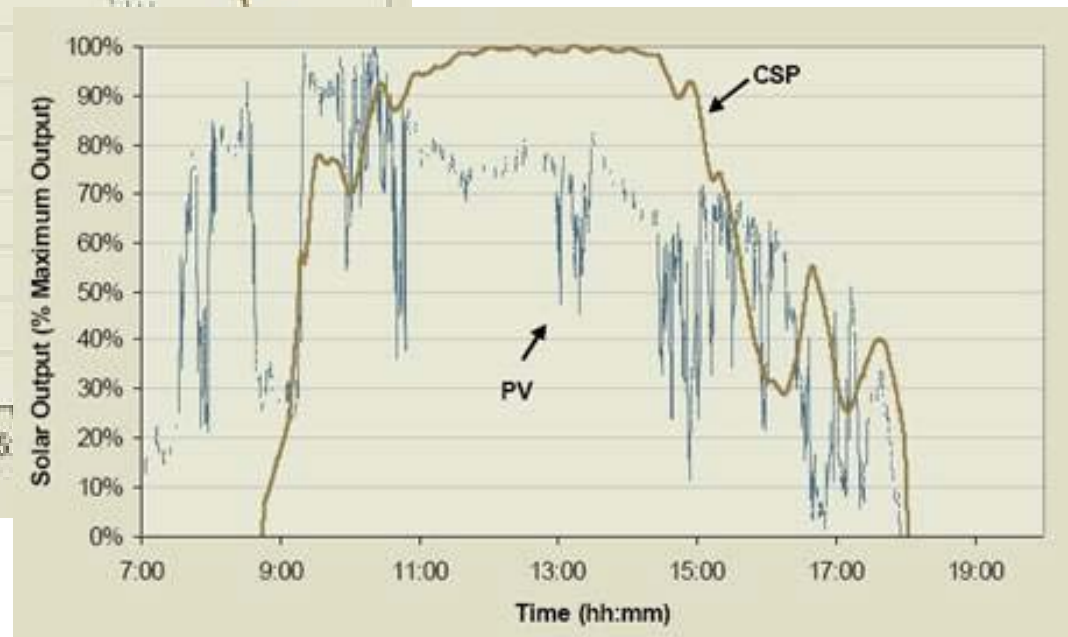


Solar Output

Sunny Day

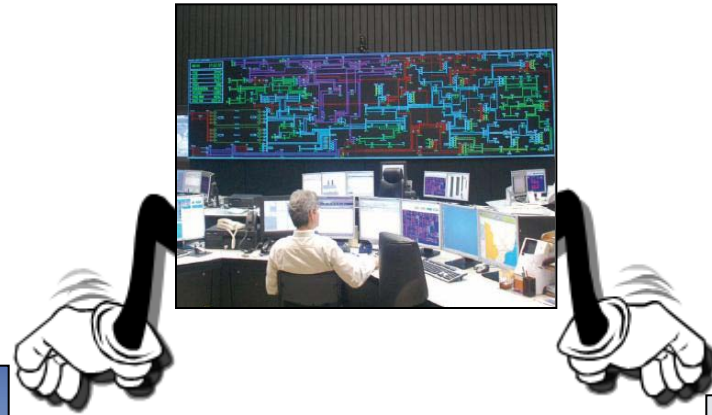


Cloudy Day



Source: Larry Stoddard, Black & Veatch

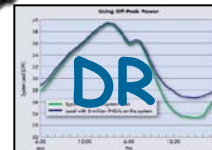
Integration will Require a Smarter Grid



Variable
Generation



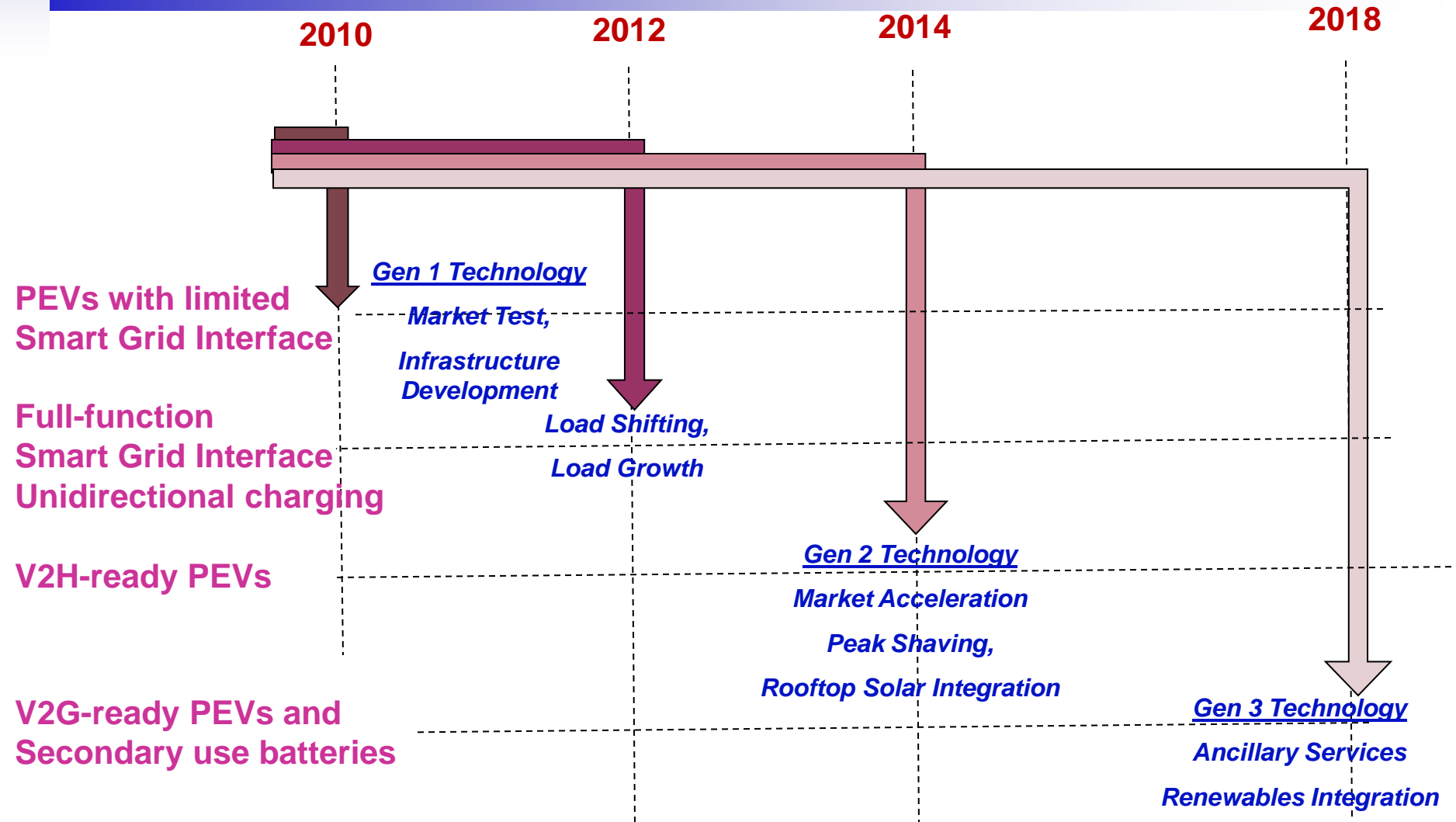
Controllable
Load



Smart Grid Smart Grid Smart Grid Smart Grid Smart Grid Smart Grid

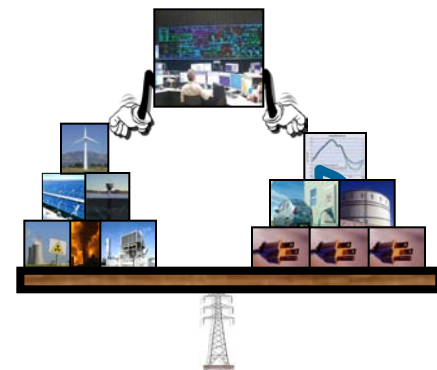


Evolution of PEV technology readiness



Key Insights

- Projected renewable energy adoption in the US is unprecedented
- Wind and solar provide little of the needed resources to operate the grid
- Renewable resource integration will require careful planning, visualization, operations tools, as well as balancing resources ***including new transmission***, demand response, power electronics controllers, and storage
- Wind and Solar will need to provide their share of the support
- Appropriate cost allocation is crucial
- We need to communicate our needs
- We need to tie pieces together through Smart Grid



Together...Shaping the Future of Electricity