

# A Speculative Peak into the Future

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## Renewable Energy and Smart Technology

Renewable Energy Challenge may be Small or it may be Big

- The Small Potato Certainty
- The Big Potato Potential

## The Small Potato Certainty

- **“Small” refers to Solar/Wind/Renewable generation content**
  - 5%, 10% maybe up to 20% of the system
  - This is what is envisaged in the near term future; lots of work going on
- **This is what people mean by smart grid applications**
  - Voltage control using smart technology (Intelligent SVCs)
  - Switching technologies to improve grid performance
  - HVDC
  - Optimising transmission system usage
  - Distribution automation

## The Small Potato System

- **System still dominated by large rotating masses**
  - Conventional stability and frequency dominate operating concerns
  - Conventional optimality and energy planning dominate dispatch
- **System tied by a great transmission grid, but small potato can help**
  - Synchronous operating limits problem modified by fast, smart activation of new power sources
  - Voltage control and reactive dispatch issues modified substantially
  - Smart solar plant reliability services
  - Smart frequency control
  - Smart voltage control
  - But needs 10 to 20% headroom for fast response

# The Big Potato Challenge

- **Generation economics is changing**
  - Imagine future levelised cost of energy (In today's money in US\$)
    - Nuclear \$120 / MWh
    - Coal \$ 100 / MWh
    - CCGT \$ 50 / MWh
    - On-shore Wind \$ 50 / MWh (Available quantity uncertain)
    - Solar \$50 / MWh (Available quantity uncertain)
- **Solar and wind WILL (why not?) produce 30, 40, 50%**
- **Dominance of rotating masses in system dynamics declines**

# Technology of the Big Potato

- **Since non-rotating-mass generation is more than 30%**
  - New and smart approach to system reliability
  - New and smart approach to frequency definition
  - Power swings and stability issues take on a different meaning
  - New and smart approach to voltage control
  - Frequency – transmission – transformer have to be reconsidered
  - Within minutes restart capability after system shut down
  - Battery pricing, battery technology or other storage
- **A whole new ball-game; rewrite all the textbooks**

**END**