Smart grids for the Pacific:

Evolution, innovation and future resilience

Ross Waddington, CEO, The Utilligence Group

www.utilligence.co

www.pacificislandrenewables.com

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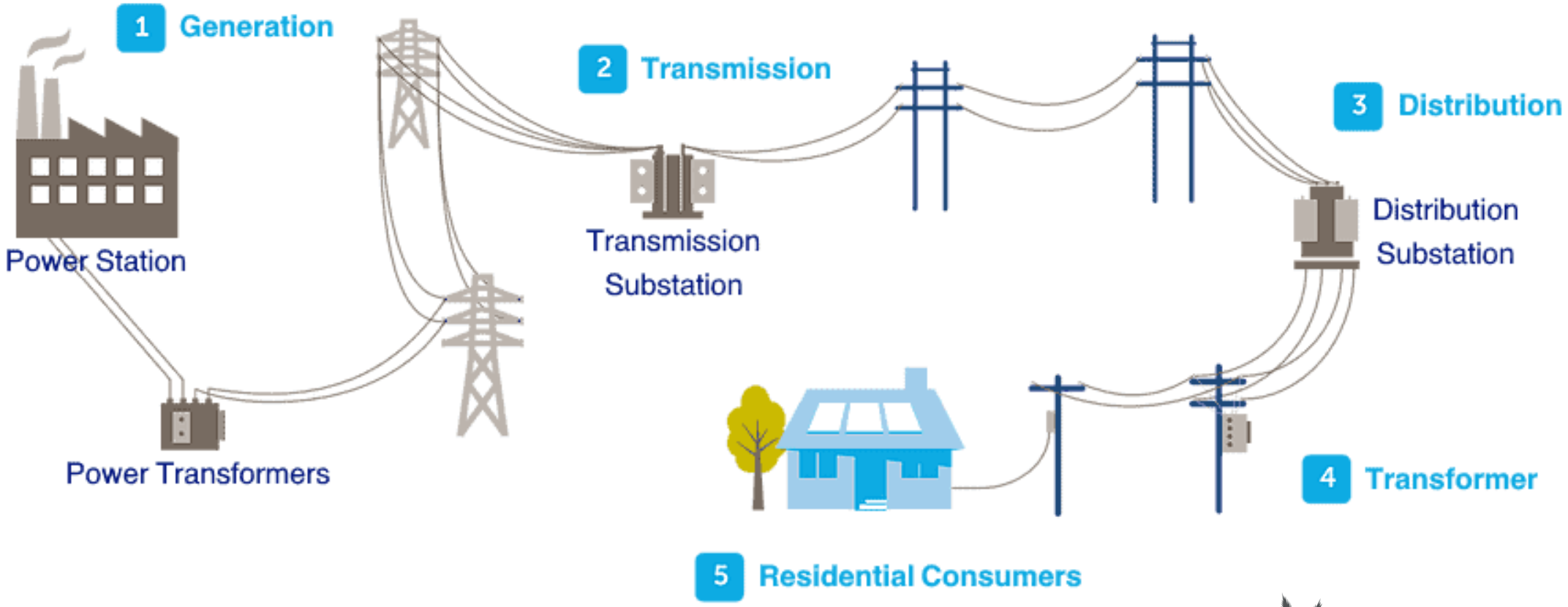
How it's been: The power grid we all know and understand



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Grid technology evolution

ERA	GRID TYPE	KEY FEATURE
1920s -1960s	Electromechanical grid	Centralised system Manual control One-way power flow
1970s – 1990s	SCADA-Enabled grid	Remote monitoring Digital relay Semi-automated system
2000s – 2020s	Smart grid	Decentralised system Two-way communication Renewables integration Real time pricing Demand response Excess energy arbitrage and resale
2030s	AI grid	Autonomous Fully automated dispatch Self-healing Predictive maintenance Load forecasting

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Conventional grid power systems

An interconnected network that generates, transmits, distributes, and delivers electricity from generators to consumers.

Three primary components:

- Generation
- Transmission
- Distribution

The European smart grid architecture model

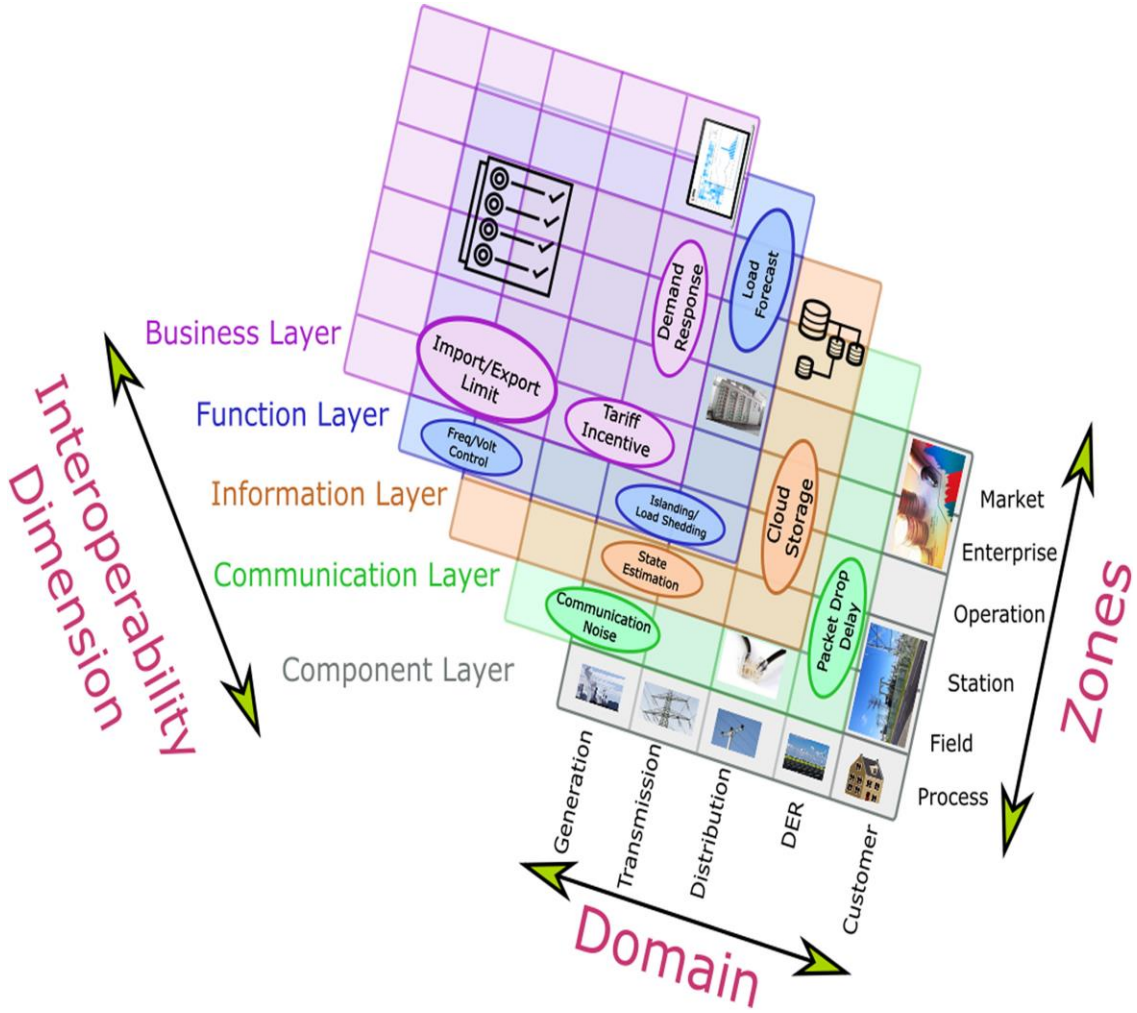
Component layer: Physical distribution of all participating components including power system

Communication layer: Communication protocols and mechanisms for information exchange

Information layer: Information objects being exchanged + underlying canonical data models

Function layer: Describes services & their relationships from an architectural viewpoint

Business layer: A business view on the information exchange related to smart grids



Today’s modern smart grid

- Two-way power and data flow
- Advanced metering infrastructure, providing real-time data for dynamic pricing
- Distributed renewable energy resources at scale
- Self-healing automation: AI and IoT instantly detect & isolate faults
- Microgrids: Localised grids operate independently during outages
- AI and big data analytics
  - Predictive maintenance
    - Monitor equipment health
    - Prevent failures before they occur
  - Load forecasting
  - Energy optimisation

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Why we need smart grids in the Pacific

Meet climate goals	Support renewable energy integration for net zero emission
Reliability	Reduce grid outages Improve resilience
Empower customers	Enable them to manage their energy use and costs
Lower operational cost	Automation reduces manual interventions Reduce maintenance expenses
Efficiency	Minimize electrical energy waste by real-time adjustments
Reduce energy theft	Advance monitoring detect unauthorised usage
Job creation	Drive innovation in green tech AI-driven grid management & cybersecurity

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The Pacific Islands' power experience to date

- A predominately diesel power grid
- Unidirectional power flow
- No automated grid control
- Poor grid power quality
- No automatic load forecasting
- No network digitalisation
  - Without network modelling, you cannot:
    - Assess new connection points
    - Forecast/understand network weak points and make improvements/reinforcements
    - Produce an outage management scheme

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The Pacific future: Network digitalization

1. **Build a realistic software model of the grid**
2. **Install power quality meters around the network**
    - Collected detailed network data (voltage, current, harmonics, network impedance etc.)
    - Assess the data and model outputs

= *An understanding of the impact of renewable energy on the existing grid*

- Integration of renewable energy to a weak grid is challenging; modelling means you can mitigate the impact

Mitigation strategies are different for every island and local grid, but the following allow for successful integration:

- Grid forming inverters
- Grid scale batteries
- Moden protection control systems, including smart sensors

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About us: Part of the Utilligence Group

- Pacific Island Renewables builds upon the successful model established by Palau Solar, harnessing our expertise in solar, wind and smart grid technologies
- A regional hub, providing comprehensive engineering, procurement and construction services for commercial renewable energy projects in island nations throughout the Pacific
- Fostering strong local partnerships and developing a skilled local workforce, so that the benefits of renewable energy deployment are accrued by the local communities, building long-term sustainability and self-reliance
- Tailored energy solutions for the unique infrastructure challenges faced by Pacific island countries. This includes grid modernisation and storage - crucial in supporting the transition to low-carbon, resilient power systems
- Partnering with local communities, sharing global expertise and delivering bespoke energy solutions is driving forward the region's transition to a more sustainable, resilient, and self-sufficient energy future

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Conclusion:

Smart grid technologies play a pivotal role in the Pacific's modern power systems. These will enhance:

- Grid performance
- Reliability
- Efficiency
- Sustainability

- Island grids will evolve from dumb wires, to smart ecosystems that can fully support and optimize the advantages of renewable power

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Questions?

Come and see us at table 22.

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