INTERNATIONAL RENEWABLE ENERGY AGENCY

IRENA

International Renewable Energy Agency

Grid integration of renewables in islands

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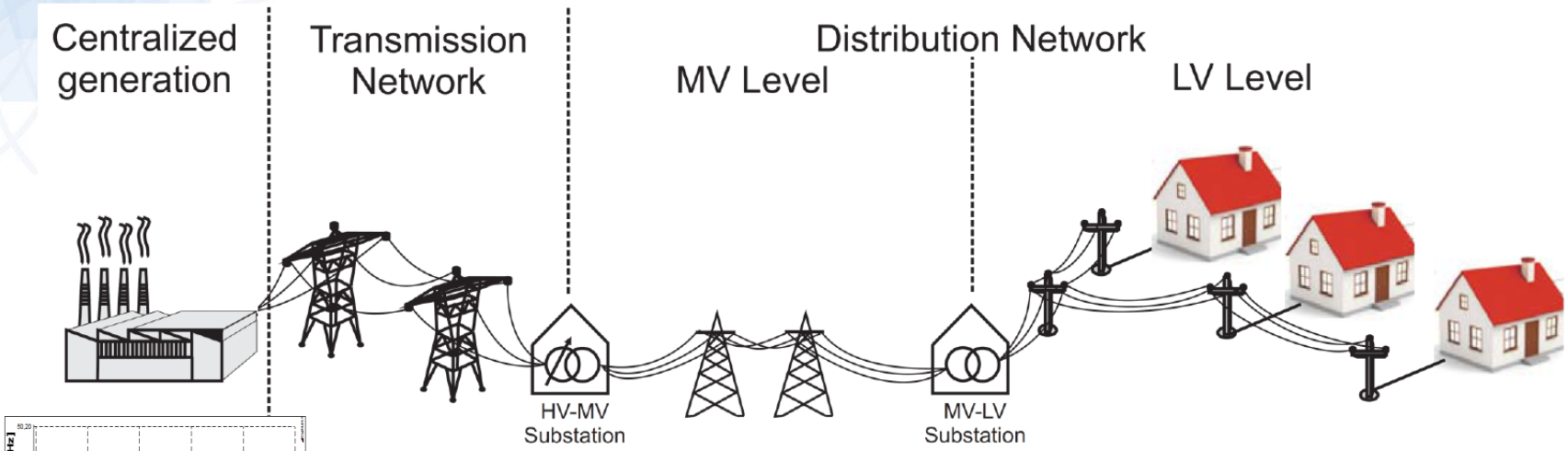
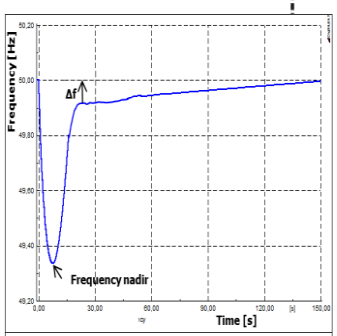
Fiji, 13 November 2015

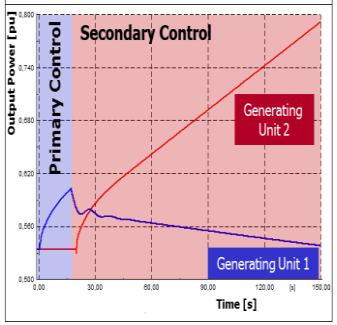
This presentation

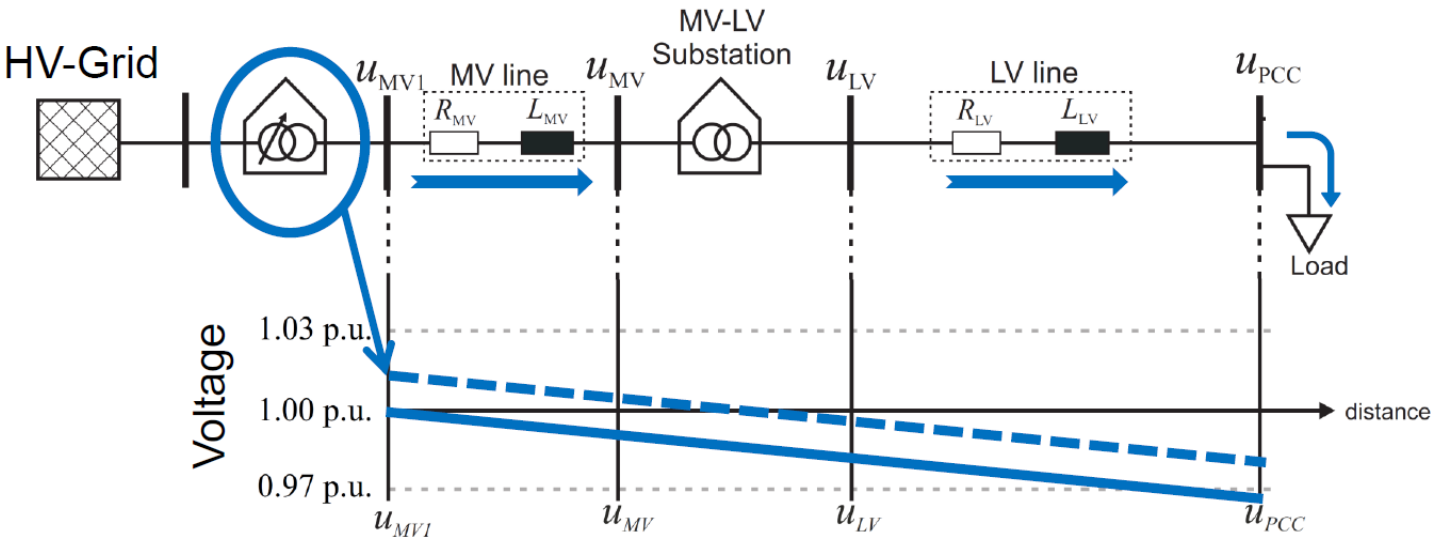
- The transformation of the power systems
- The challenges
- Grid studies
- Case studies

Traditional power system





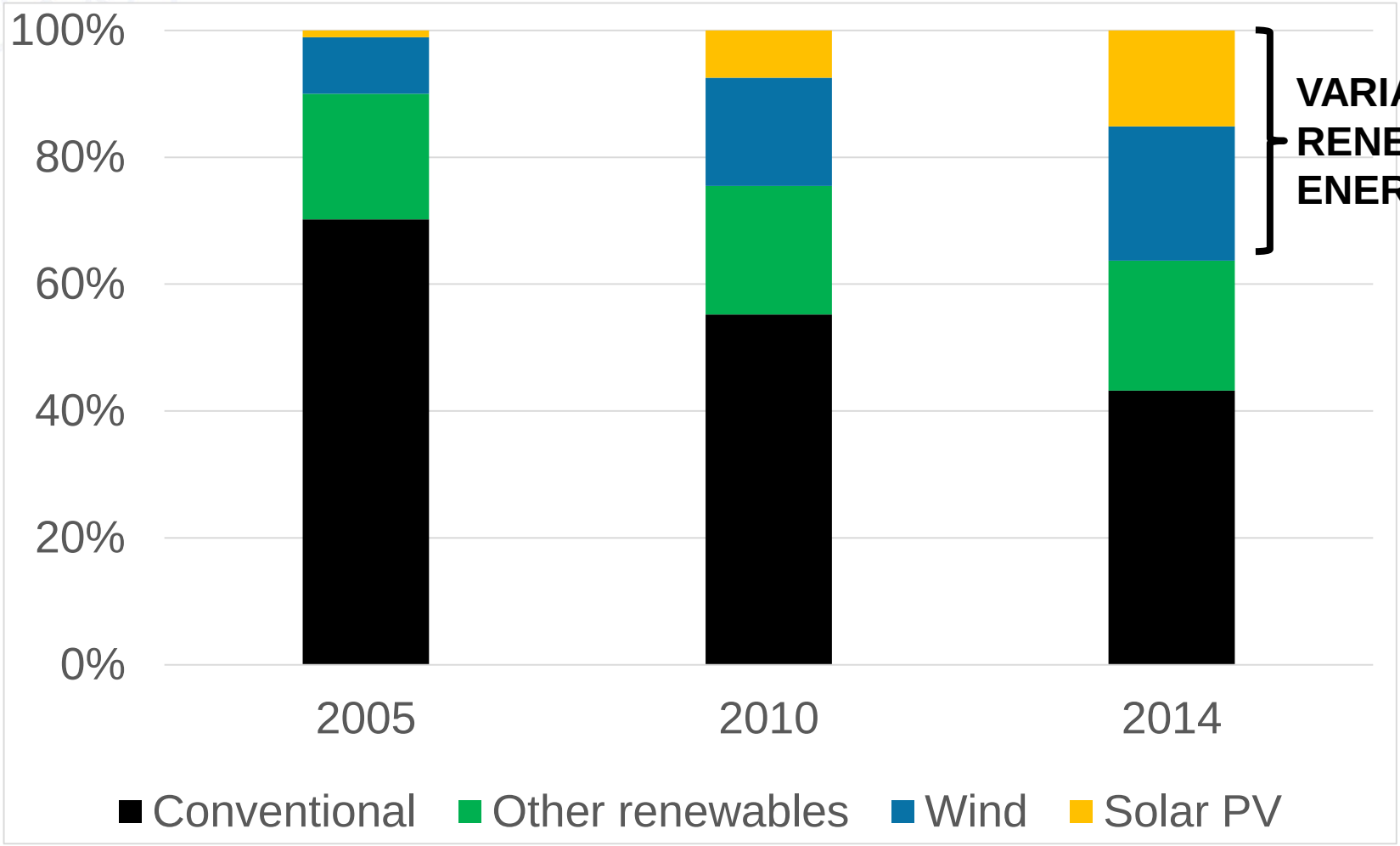




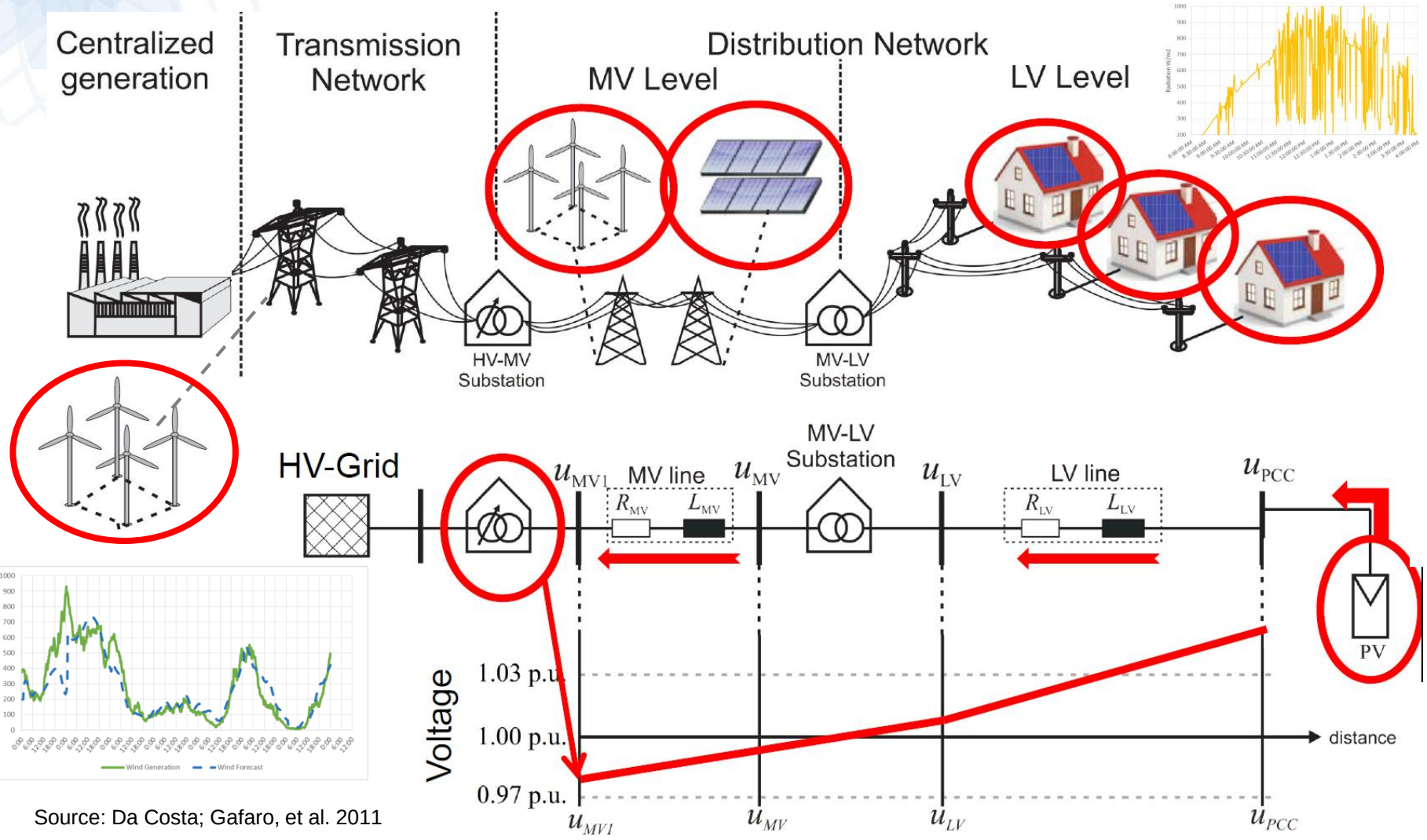
Source: Da Costa; Gafaro, et al. 2011

Newly installed global generation capacity

2015:
50-55 GW solar PV - >200 GW installed capacity worldwide
55-58 GW wind installed - >400 GW installed capacity worldwide

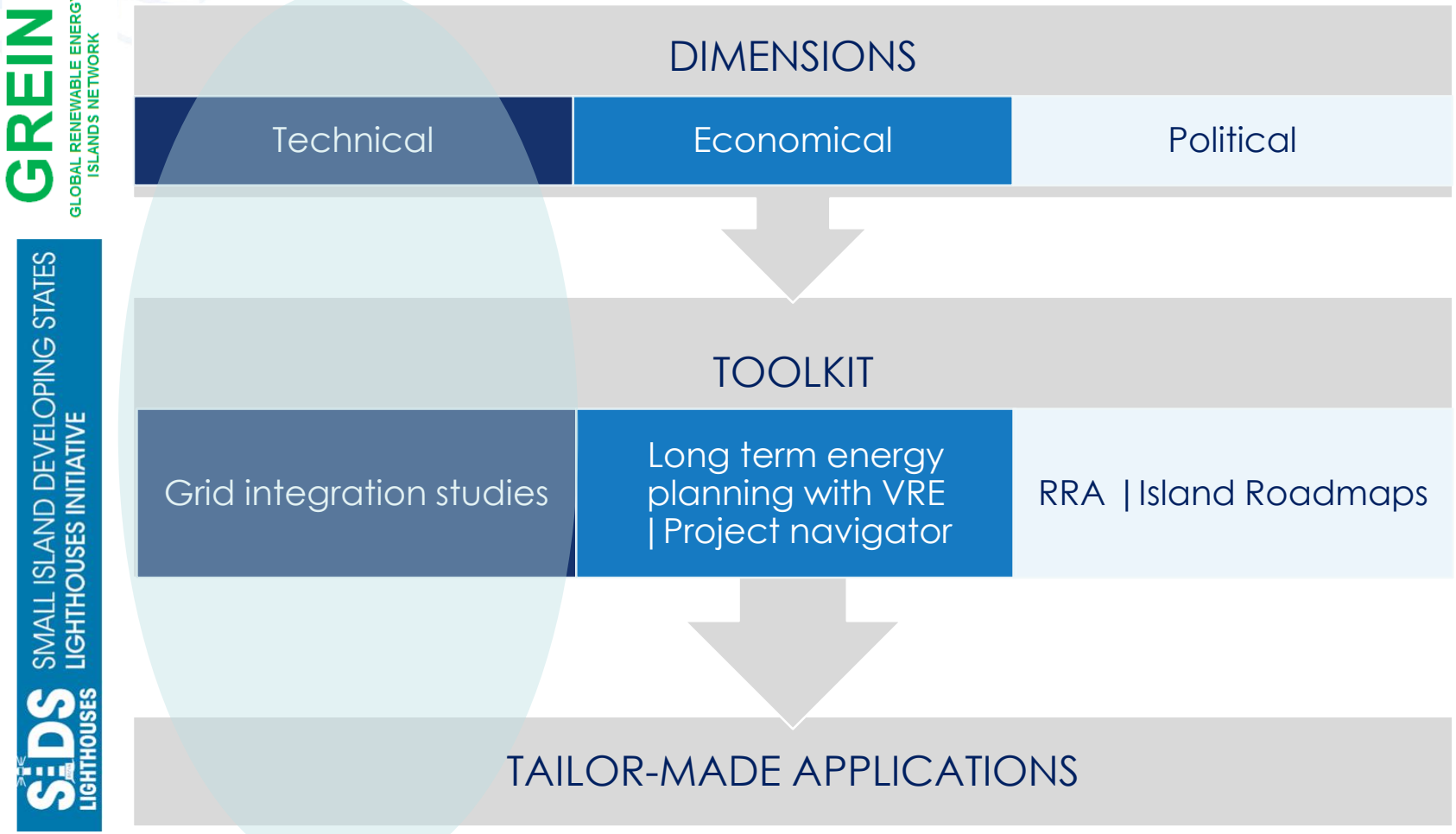


Power System transformation



Source: Da Costa; Gafaro, et al. 2011

The challenges and the tools for SIDS



The technical challenges

VRE Characteristic	Impact
Non-Synchronous Generation	Voltage & Frequency Stability
Uncertainty	Reserves
Variability	Short Term Changes Abundance / Scarcity Asset Utilization
Location	Installation Constraints Modularity

↳ Performed by experts on the field.

Impact depends on the characteristics of the power grid, islands are more vulnerable

Grid studies for islands

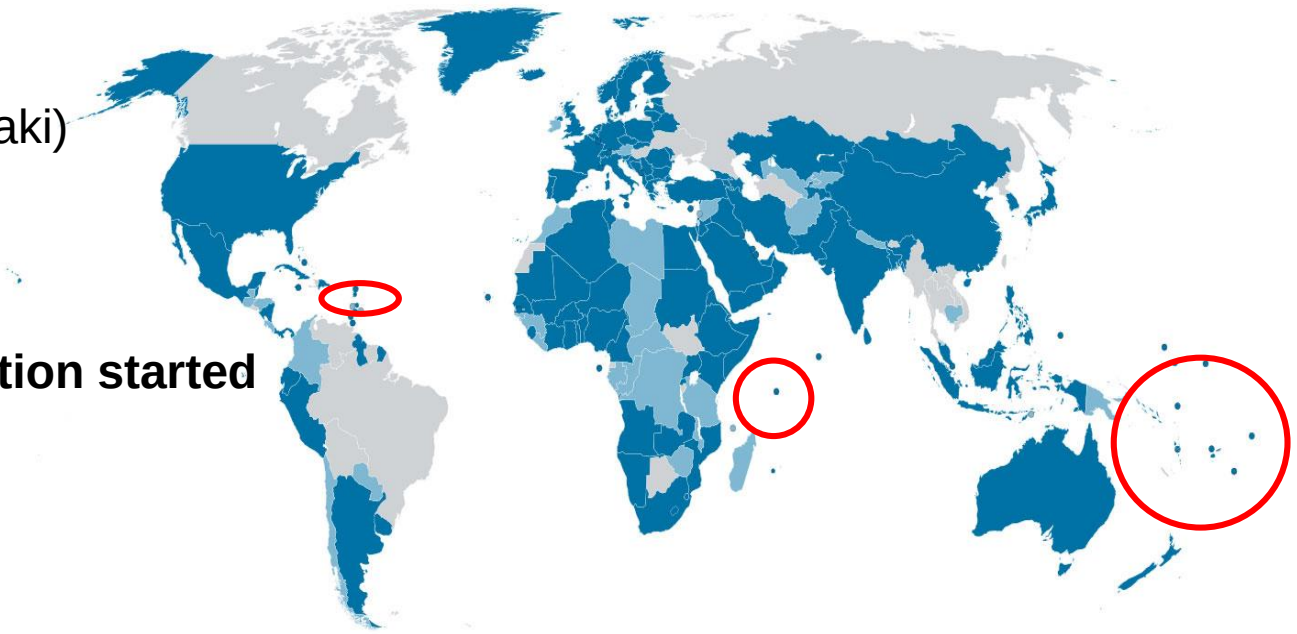
- ✓ Grid studies are technical analyses
- ✓ Grid studies are planning tools, help to answer the following questions:
  - **How much VRE can be integrated without major system upgrades?**
  - **Is it feasible to achieve the target shares of VRE?**
  - **What is required to achieve the target shares of VRE?**
- ✓ Type of studies depends on the characteristics of the island power system and the target share of VRE
  - Useful for medium to large size islands where integration takes place gradually
- ✓ Grid Studies are based on different type of computer simulations of the grid operation
- ✓ To do a study requires:
  - Accurate and sufficient input information
  - Tools
  - Engagement from authorities and the utilities

IRENA's grid integration studies: Study cases

Integration studies in association with energy authorities and network operators supporting evaluation of impacts and Operation & Expansion planning of the grid

Concluded Studies

- Samoa 1
- Cook Islands (Aitutaki)
- Antigua & Barbuda
- Palau



Ongoing or coordination started

- Samoa 2
- Kiribati (with PPA)
- Fiji, Tuvalu

Reviews requested by governments

- Barbados (April 2015), Seychelles (ongoing)

IRENA's grid integration studies: Study cases

Palau (pilot study)

- Identification of penetration limits for a secure operation without significant grid or operation upgrades

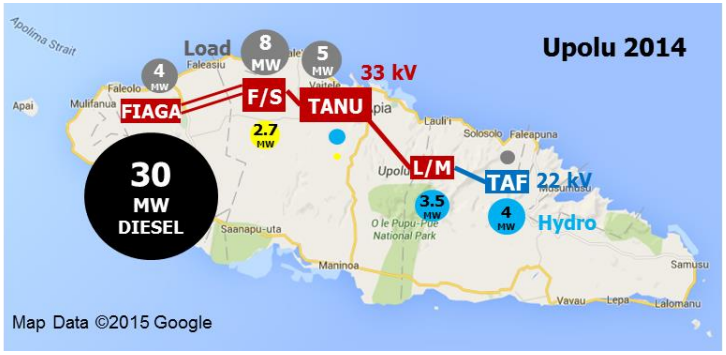
- Facilitated integration of c.a 3 MW of solar PV

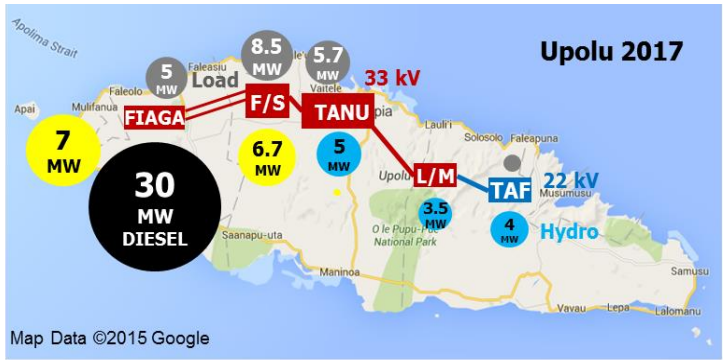
Samoa

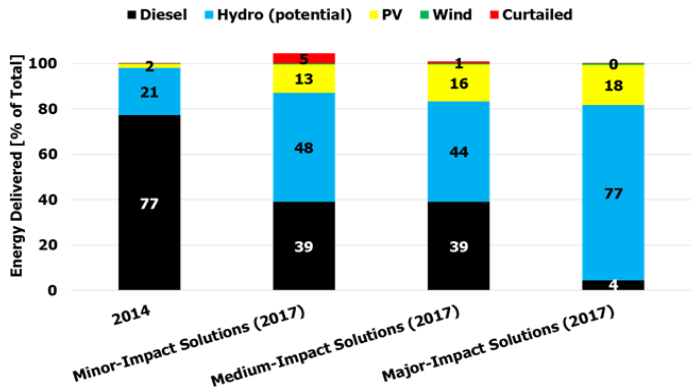
- Support identification of measures to host planned hydro and PV projects

- Integration of c.a. 14 MW of PV assessed

- New wind projects planned, new studies underway





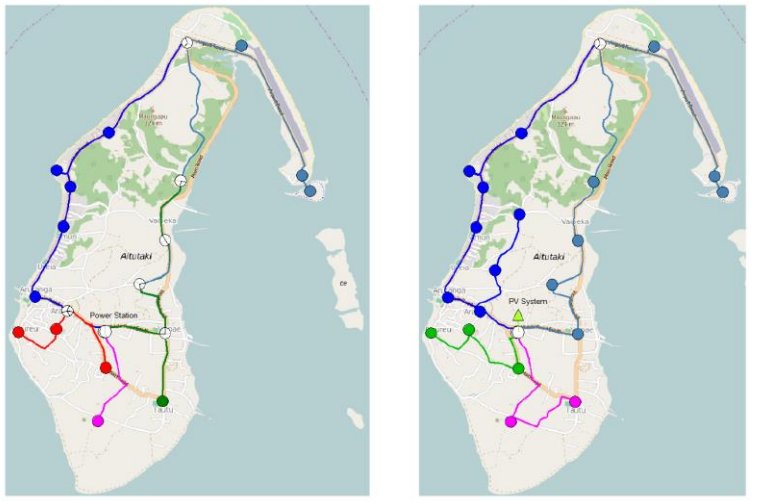


IRENA's grid integration studies: Study cases

Aitutaki

- Identification of penetration limits for a secure operation without significant upgrades

- Facilitated implementation of Cook Islands Renewable Energy Chart



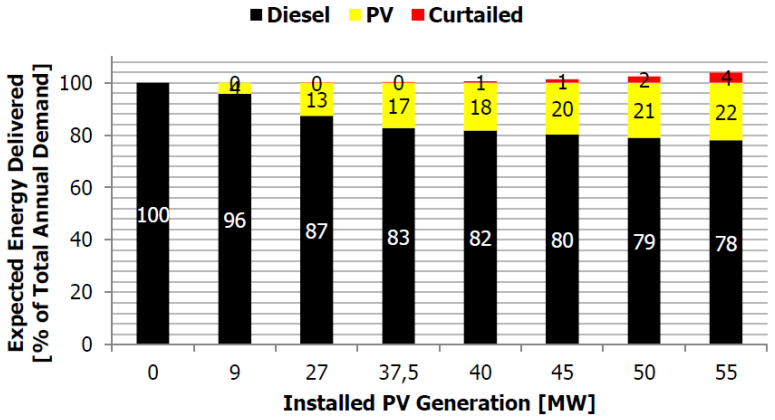
a) Current situation with 11 kV and 3,3 kV feeders

b) Future situation with 11 kV upgrade and PV system

Antigua

- Support identification of measures to host 9 MW of PV and 18 MW of wind

- Identification of maximum capacity of the network to host PV systems



IRENA's Grid Integration Studies: Lessons learned

IRENAS approach has evolved from stability studies to grid planning

- The deployment of high shares of variable renewables is a long journey
- Technical assessment of the grid integration is part of the journey and should not be isolated from the other planning activities
- Engagement and coordination between the energy authorities and the operators of grids hosting these targets is required from the beginning
- Each island is a unique case. Particularities define approach required for assessments
- Grid integration assessments are a continuous / repetitive process
- Long term capacity building efforts are fundamental
- Coordination of support activities among engaged developing partners is crucial

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