RENAC’s international trainings on the integration of variable renewable energy in power supply systems

Topics and lessons learnt

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Agenda

1. About RENAC
2. Seminar examples:
   power system integration of variable renewable energy
3. Lessons learnt
About RENAC

- RENAC is a Berlin-based training specialist for renewable energy and energy efficiency
- Until now we operate with participants from over 145 countries
- We offer renewable energy (RE) and energy efficiency (EE):
  - Trainings
  - Academic education
- We support third parties to build up own capacities for EE and RE training (installation of Training Centre / lab, Train-the-Trainer)
- RENAC is independent
RENAC activities worldwide
2 Seminar examples
Classroom training: Management aspects of wind and PV grid integration

- **This training suits those who**
  - Plan and operate grid, work in energy service companies or for energy traders
  - Are responsible for grid integration at regulators, energy ministries, advisors or consultancies.

- **Content**
  - Wind and photovoltaics feed-in time series
  - Residual load approach for system planning and operation
  - Wind and PV short-term power forecasts for system operation
  - Loss of load probability and reliable generation from wind/PV
  - Positive and negative balancing power calculation
  - Grid integration strategy implementation

- **Duration:** 3 – 5 days
This training suits those who

- Are engineers (prerequisite)
- Are responsible for technical aspects at grid operators, grid system planners or energy service companies.

Content

- Photovoltaic (PV) and wind power inverter technology
- Wind turbine generators types
- Grid code for low, middle and high voltage grids
- Frequency control
- Reactive power and voltage control strategies
- Monitoring and control of grid-connected generation units.

Duration: 3 - 5 days
Online training: Certified ReGrid® Manager (CRGM) - Grid integration of wind and PV

- **This training suits those who**
  - are engineers who wish to become experts planning and operation of electricity systems with large amounts of wind and solar power
  - international consultants
  - technical leads in transmission and distribution companies

- **Content**
  - Scenario development
  - Short term prediction
  - Generation expansion planning
  - Balancing power

- **Course details**
  - Duration: 6 months
  - Study time: ca. 250 hours
  - Exam

- **Generator concepts**
- **Grid codes**
- **Generation expansion planning**
- **Grid and system integration studies**
- **Energy storage**
Online-participants from all over the world

- **240 CapREG 2014-2017**
  - MX, EC, PE

- **521 ReGrid 2011-2013**
  - MA, DZ, TN, LY, EG, JO, LB

- **123 participants RENAC Online-Academy 2014-2017**

- **250 CapREG 2014-2017**
  - TH, VN, ID, PH
Lessons learnt
Challenges are not comparable with Germany. Solutions must be adapted to countries.

In many cases:

- Central power plant dispatch and single buyer approach are applied instead of market driven solutions.
- Importance of wind and PV is very small compared to conventional thermal generation.
- Power consumption and peak load are rising. Peak load often occurs after sunset. → Power supply systems require enormous investments in reliable power generation.
- Power purchase agreements for new conventional thermal generation rarely consider future flexibility needs.
- Need for long term power system flexibility strategies is underestimated.
- Grid operators have inadequate knowledge how to control frequency and voltage with wind and PV farms.
Thank you!

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