

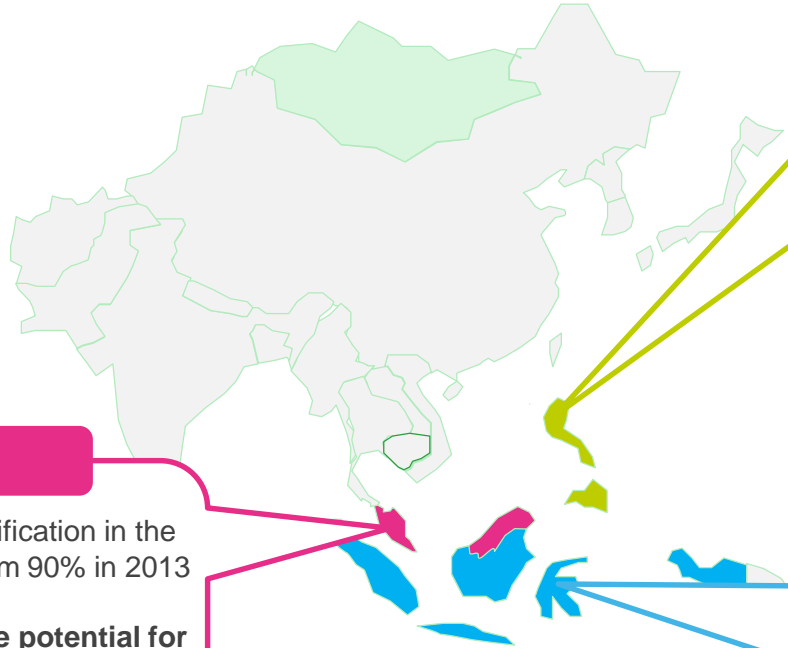


Renewable Energy Integration Development Singapore / architectures

By Jean Wild
Date : June 2018

Explorers wanted

Advanced multi-energy grids for Islands



Malaysia

- Ambitious target of electrification in the province of **Sarawak**: from 90% in 2013 to 100% in 2020
- Sarawak region has **huge potential for renewable energy sources** such as solar, hydro, and biomass

Philippines

Rural electrification projects, powered by solar, wind, and mini-hydro are planned by the Department of Energy (DOE)

- 3.9 million unelectrified households in 2012
- Targets to complete **90% of the electrification by 2017**
- National Electrification Authority received a **fund of \$138 million** to achieve this target.

Indonesia

- Seven provinces have **electrification rates below 60%**.
- Large rural and island electrification program: **1000 islands project** with solar PV microgrid during 2012–2020
- The World Bank has a **\$600 million budget** for electrification in the 1000 islands project with solar PV microgrid during 2012–2020

* Source: Frost & Sullivan September 2014

REIDS Project

Renewable Energy Integration Development Singapore

Production: Solar PV, Wind, Marine, Bioenergy, Biogas, Genset, Biogas

Energy Storage: Battery, Hydrogen

Flexible loads: Desalination, fish hatchery, H2 production

Challenge: Break the 30% renewable penetration limit, with a plug & play, scalable approach compatible with use of generators and inverters forming together a Microgrid

Schneider Electric contribution

The PMS (Power Management system), that ensures the stability will be provided by Schneider Electric as well as smart inverters for PV

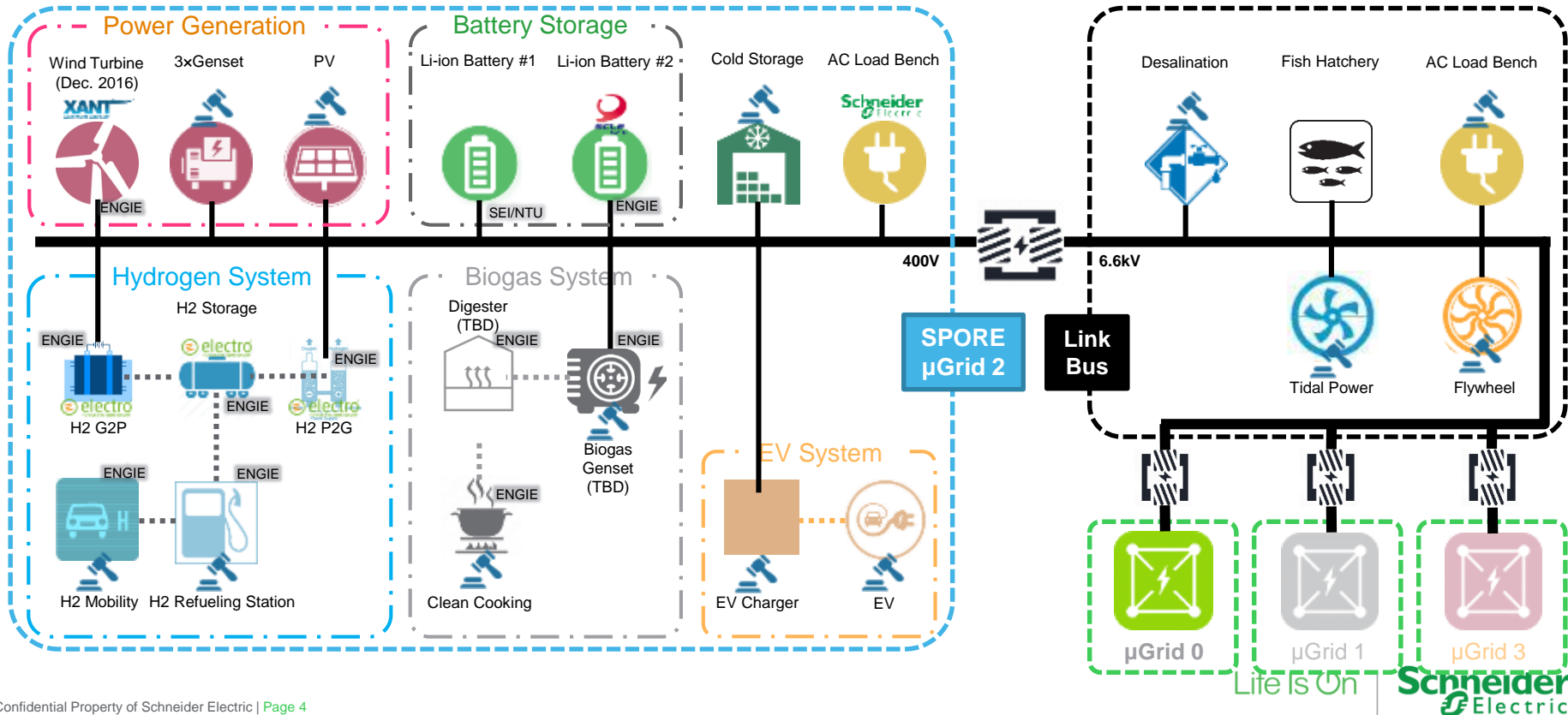
Schneider Electric local Team

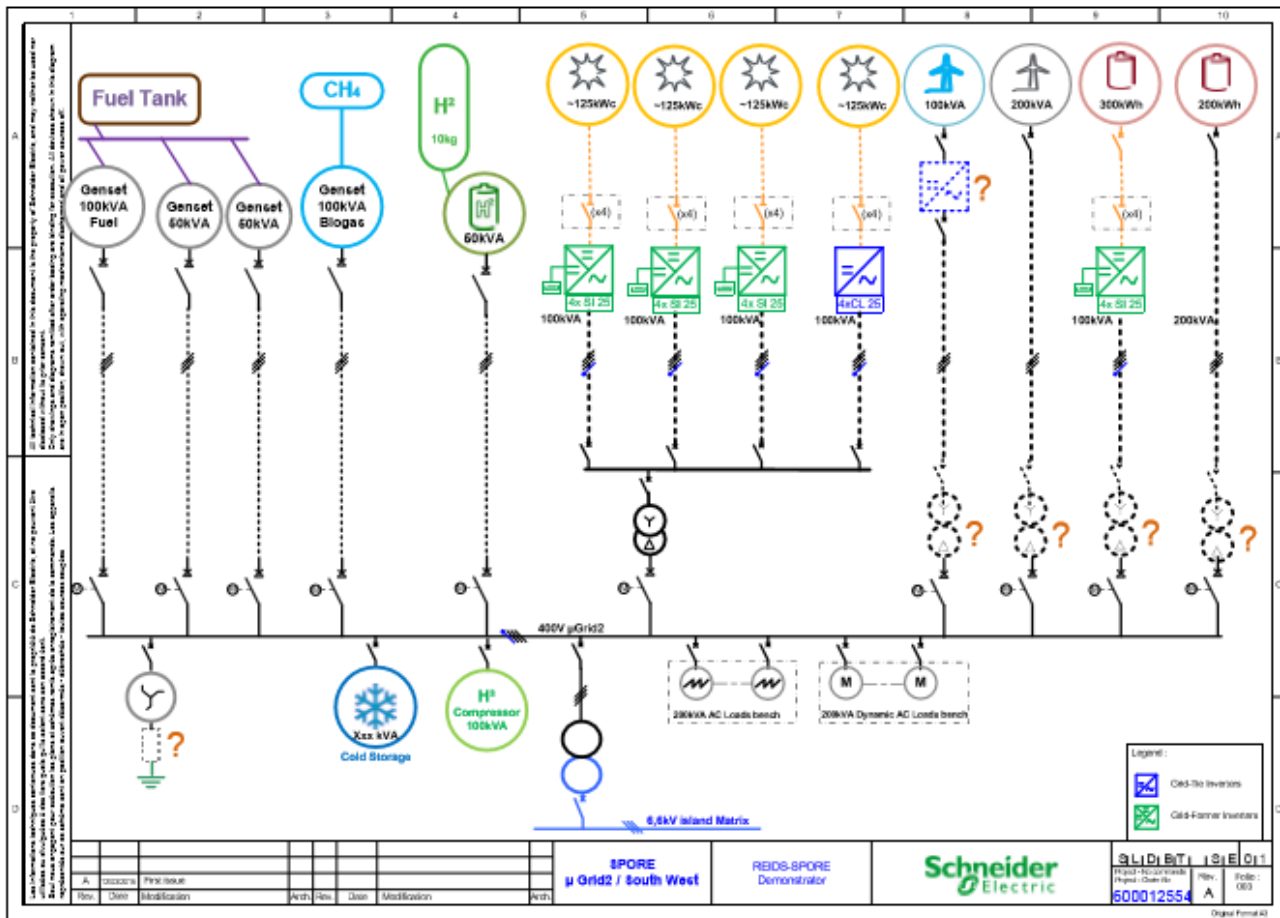
- Soni Wibisono PM
- Tushar Menon PSE
- Jake Jikang Xu ASE
- Thomas Polliand BD



Single line diagram

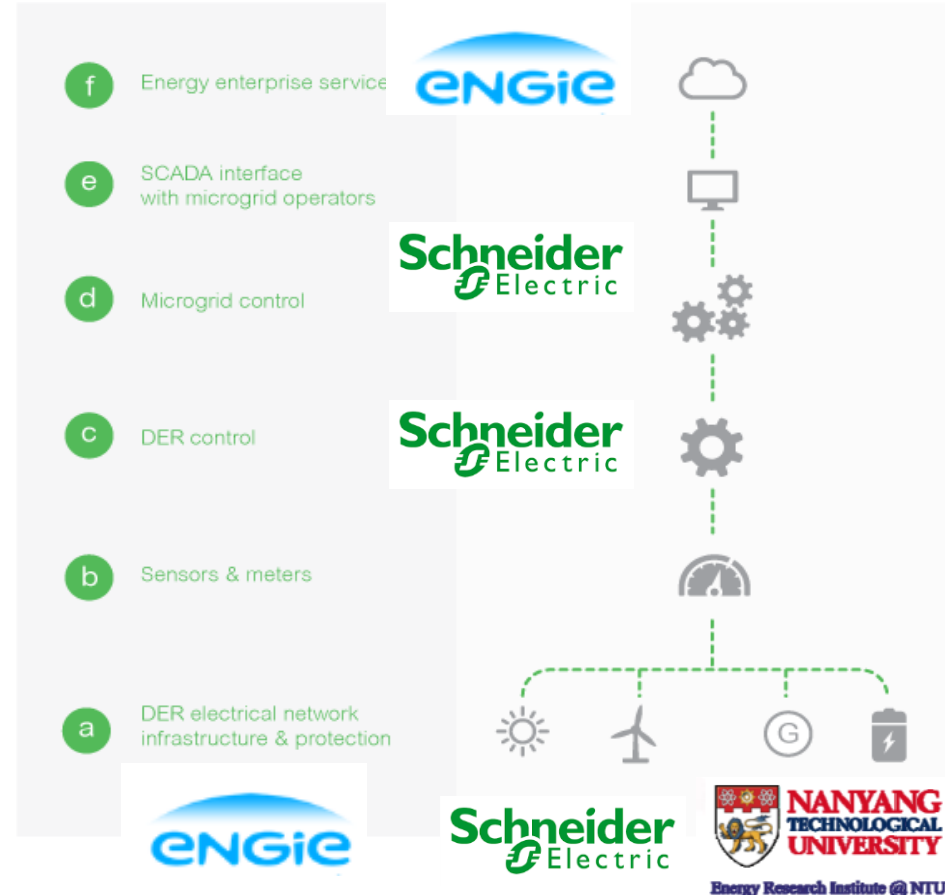
REIDS architecture



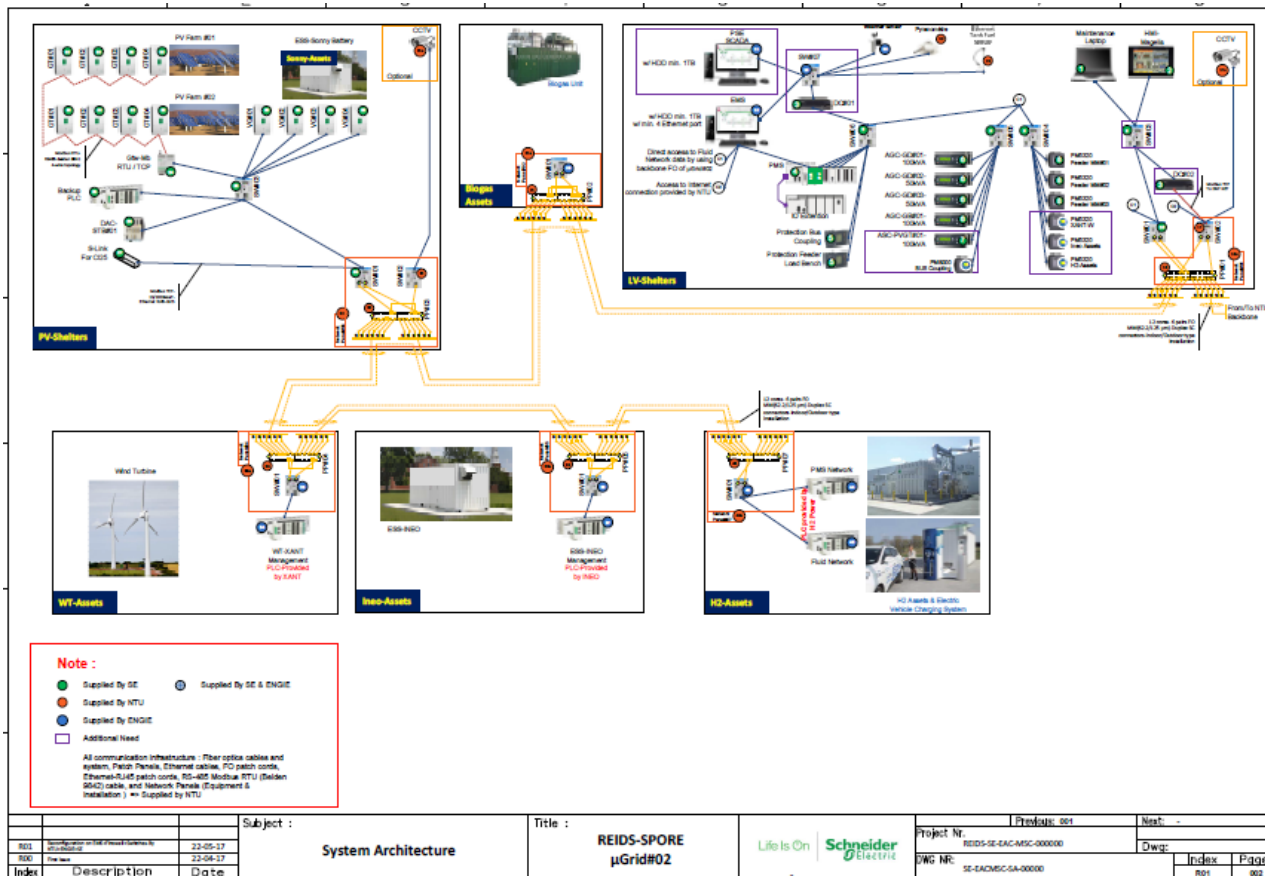


Control architecture

- a** Energy network infrastructure that includes DER
- b** Sensors, meters, and protection
- c** Controls at the DER level
- d** PMS at the microgrid level
- e** SCADA to interface with microgrid operators
- f** EMS services such as tariff management, demand charge optimization, demand response, self consumption, CO₂ reduction, etc...

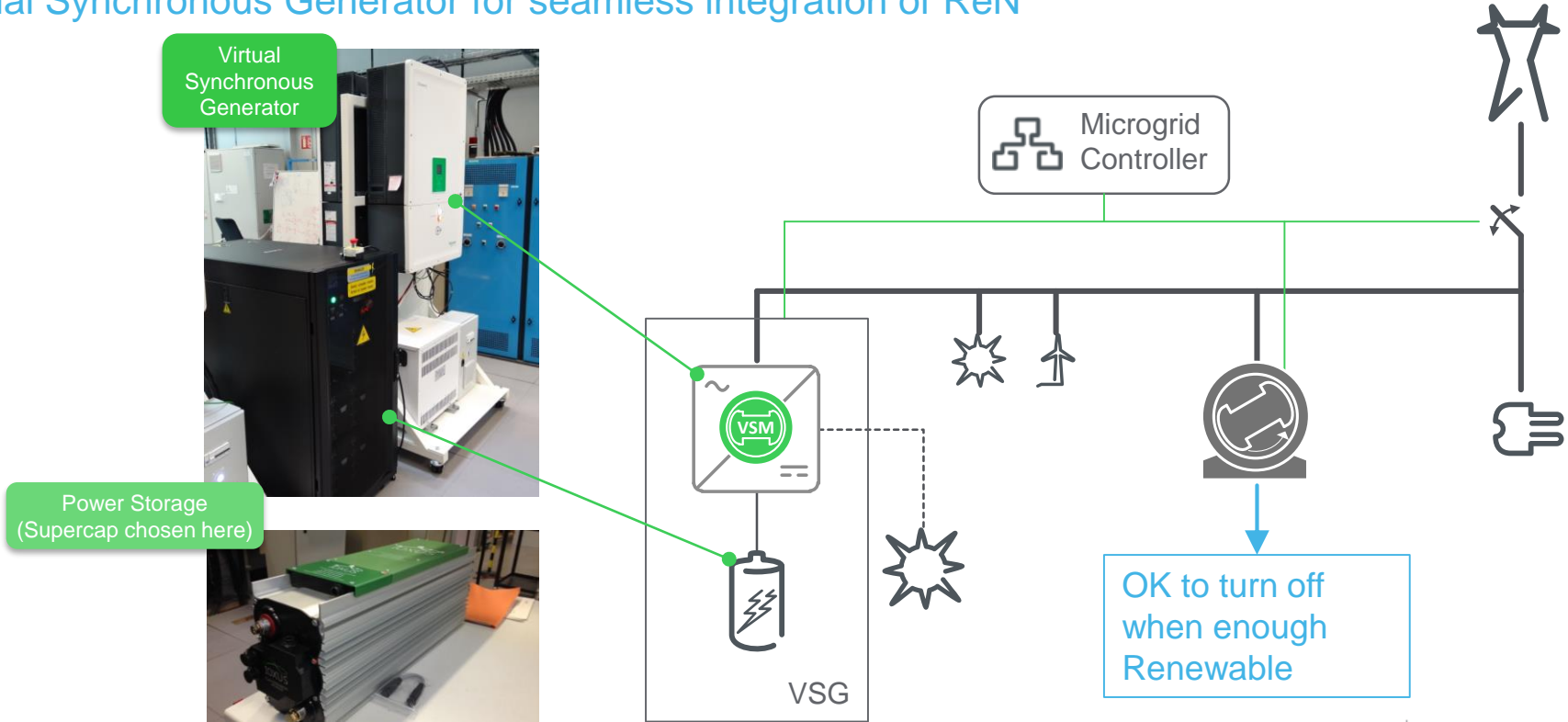


System Architecture



Distributed Energy Resources innovative solution

Virtual Synchronous Generator for seamless integration of ReN



Power Management System

Advanced algorithms to manage stability of the microgrid

Description

- ✓ Control system piloting Gensets and inverters to maintain 400V/50Hz while limiting fuel consumption
- ✓ Patented solution associating the Virtual Generator and the microgrid controller

Functionalities

- ✓ Power management system: pilots the whole microgrid DER
- ✓ Real-time renewable energy production maximization and fuel consumption minimization
- ✓ Unlimited renewable integration possibilities



First prototype developed in our Lab in Grenoble

Civil works on going

Commissioning started in April 2018

