

iDERgridy for

Energy Democracy



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**IENE — Electricity Storage and Grid Management for Maximum RES
Penetration — 28/9/22 - Athens**

SMART GRIDS

EMTECH

EMTECH is a group of three micro-SMEs



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EMTECH Product Lines

■ iReact — Substation Automation Systems

- Controllers & Smart-sensors for HV/MV substations
- Backend & Front-end Software
- Algorithms & Artificial intelligence for optimized operations
- Today installed in 150 substations in Greece

■ THORACLE — Secondary Substations / Power Quality / Asset Monitoring

- PMU + RTU + RT Power Quality +
- Backend & Front-end Software
- Algorithms & Artificial intelligence enabling smart-operations (NTL detection, MV faults, Grid Harmonics, etc.)
- Today installed in 4 secondary substations in Cyprus for pilot operation. Already arranged 20 new installations in Spain and Italy

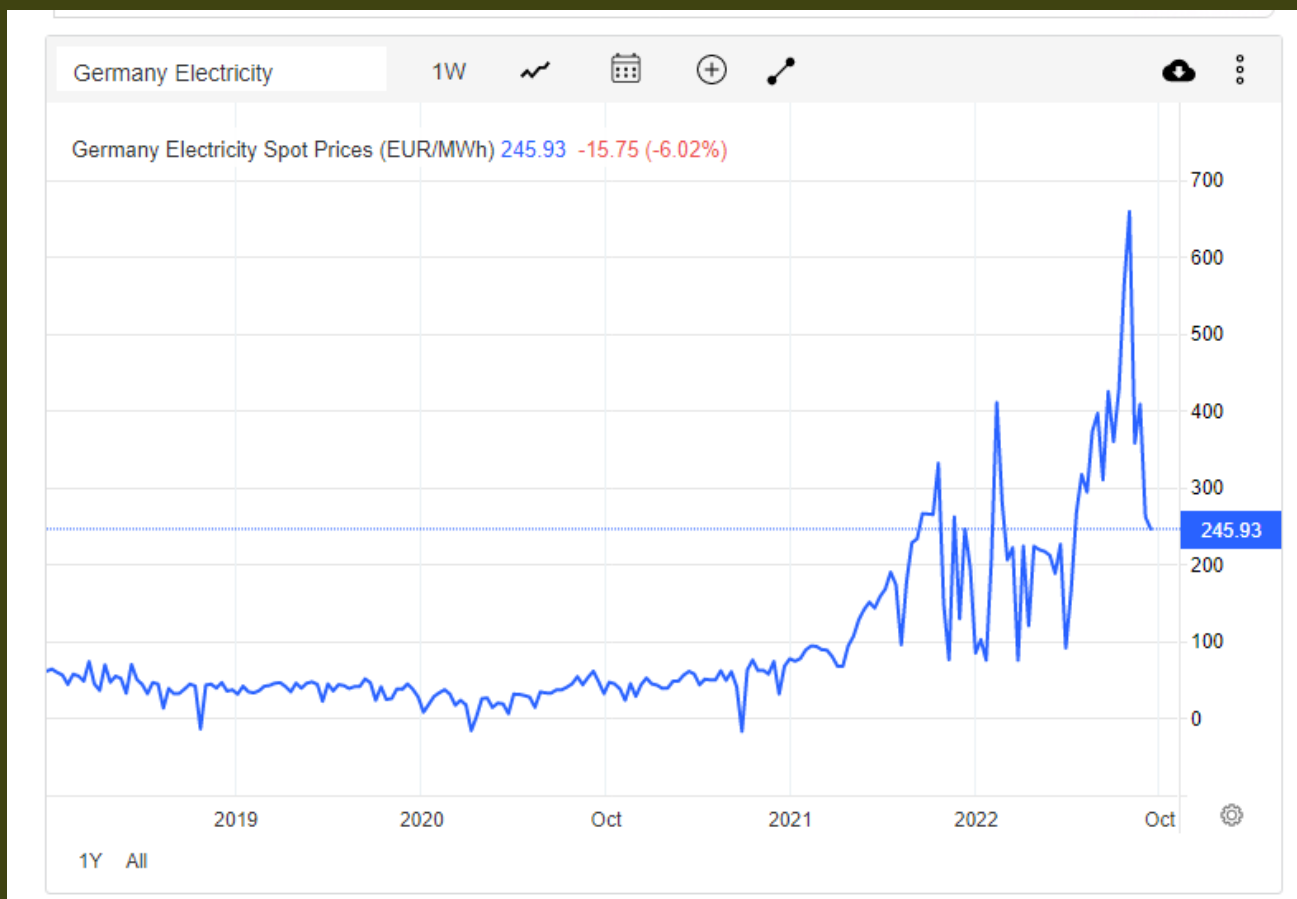
■ iDERgridy — Distributed Energy Resource Management System

- Backend & Front-end Software
- Smart-phones front-end
- Gateway device
- Simulation for LESVOS island

Greek technology for smart-grids

European energy crisis today

- Europe has focused on reduction of emissions
- A transition to low-carbon economy has not properly managed or stress-tested against scarcity and volatility



How can **Energy Democracy** help those paying the bill?

Two strategic frameworks for advancing energy future

Topic	Centralized model of renewable energy	Decentralized model of renewable energy
Analysis of the crisis	The climate crisis is separate from the economic crisis	The economic and climate crises are inextricably linked—an integrated crisis
Solution to the Crisis	Replace fossil fuel energy with renewable energy in order to transition to a de-carbonized capitalism	Sustainable economic development based on renewable energy to meet the needs of human beings, rather than the needs of capital accumulation
Structural aim	De-carbonize the current economic system without fundamentally changing it	Transition to a new, de-carbonized, ecologically-sound, life-sustaining economic system
Programmatic approach	Reduce greenhouse gas emissions—mainly through market mechanisms and new technology, but within the current structure of corporate economic and political power	Create an alternative, equitable, social and economic order based on democratic principles and an energy platform that seeks to replace the corporate energy establishment with alternative institutions.
View of energy	Energy is a commodity, the basic enabler of capital accumulation and an expanding growth economy	Energy is a resource, a basic enabler of economic life—to be democratized and harnessed to meet human needs and transition the world to an ecologically sustainable economic future

The **decentralized model** is related to the concept of **Energy Democracy**

What is Energy Democracy?

- Energy democracy concerns **renewable energy transition** with efforts to democratize the production and management of energy resources
- Energy democracy is **social ownership** of energy infrastructure, decentralization of energy systems, and expansion of **public participation in energy-related policymaking**
- Energy democracy has been endorsed by community organizations, think tanks, labor unions, and NGOs as a **framework for decarbonization**.
- Energy democracy is also associated with a number of campaigns in Europe and North America calling for the **municipalization of energy companies** and democratization of their governance structures.

Possible **Early Adopters** of energy innovative business models?

Problem: Fossil-fuel based island economies



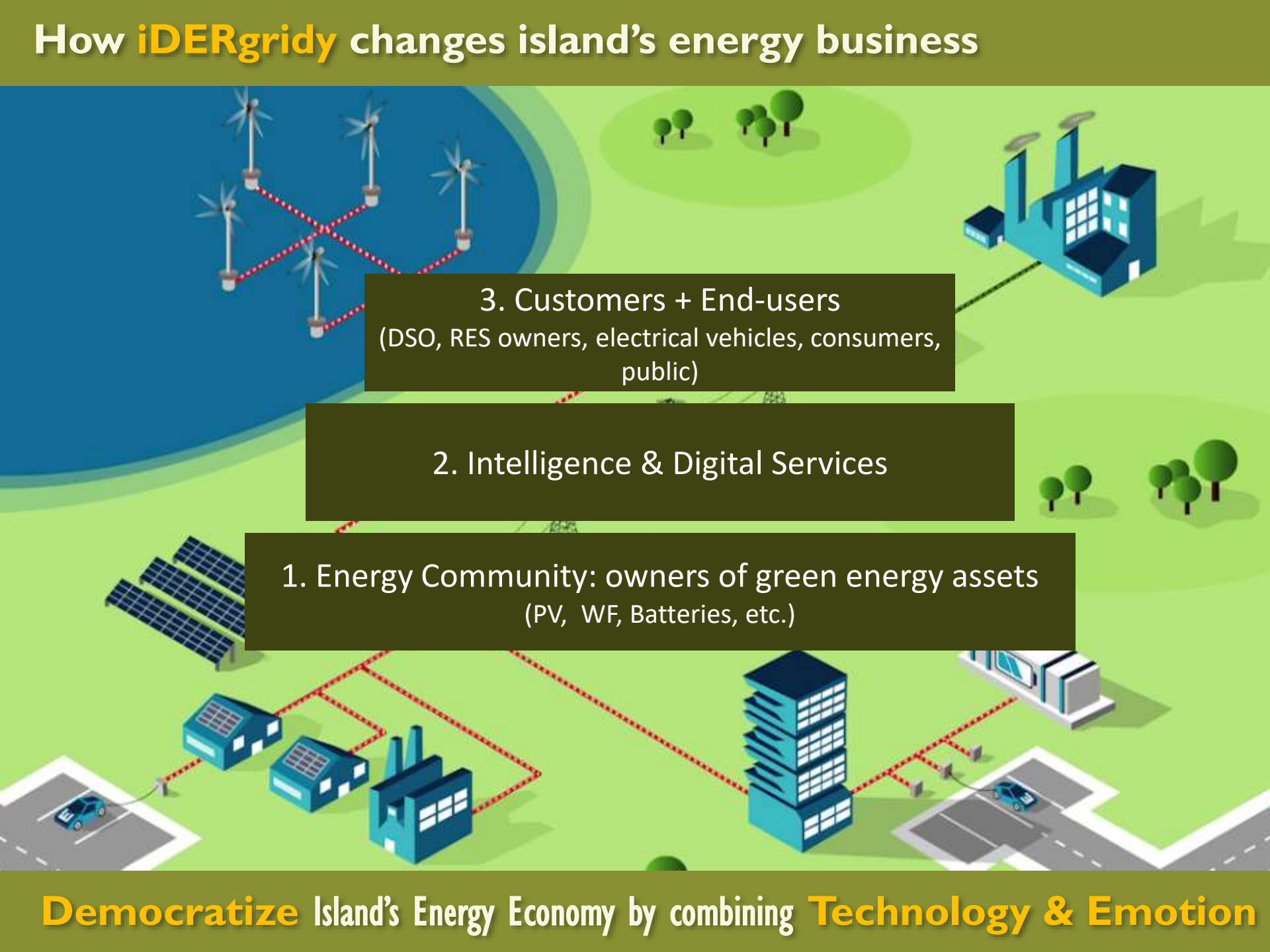
Let's make **GREEN** all islands.
REDUCE CO2 emissions and **INCREASE RENEWABLE**
energy sources today!

Electrical System in Small-Medium Island - **TOMORROW**



We need to install RES and electricity storage to reduce total power generation uncertainty

How iDERgridy changes island's energy business

The background of the slide is an isometric illustration of an island's energy ecosystem. It features offshore wind turbines connected by red dashed lines to a central grid. On the land, there are solar panels, a factory, a city building, and a car charging station. The three numbered boxes are overlaid on this scene.

3. Customers + End-users
(DSO, RES owners, electrical vehicles, consumers, public)

2. Intelligence & Digital Services

1. Energy Community: owners of green energy assets
(PV, WF, Batteries, etc.)

Democratize Island's Energy Economy by combining **Technology & Emotion**

iDERgridy: Digital Platform for Energy Communities



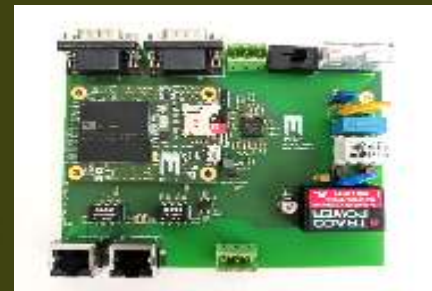
Interconnect all energy assets to cloud intelligence and provide ALL Digital Services in a Pay-as-you-go offering

iDERgridy Technology: AI, Optimizations, Virtual Assistant

- **Digital-Twin** to support electrical grid analysis and various scenario execution
- **Forecasting** for power generation & demand (more than 100 AI models run in parallel)
- **Optimal Energy Resource Scheduling** using optimization algorithms
- **Optimal Power-Flow** to offer joint optimization targeting various objectives
- **Crowd Flexibility** to engage inhabitants and visitors and shape energy behavior
- **Intuitive Graphical User Interfaces** (easy deploy in compact operation centers, smartphone applications)
- **iDERgridy-Gateway** to Interface energy assets



IoT Gateway



Vertical, Robust, Secure, Simple-to-use

iDERgridy Emotions: Community, Education, Awareness, Flexibility

- **Step I: Awareness & Education: INSPIRE**
 - Communication Strategy and Mapping of local society
 - Organize campaigns
 - Organize thematic workshops for selected target groups
 - Feedback analysis and decisions how to proceed
- **Step II: Gamification & Responsible Consumption: HABIT**
 - Game for Notifications and Situational Awareness
 - Engagement by rewarding responsible consumption
- **Step III: Community Benefits: ENJOY**
 - Raise awareness and improve local environment
 - Certifications for responsible consumption
 - Financial return via dividends



Key success factor is the power and responsibility of iDERgridy community

iDERgridy Technology: Deployment: Step #1: Digital Twin

Digital-Twin of the island consists of

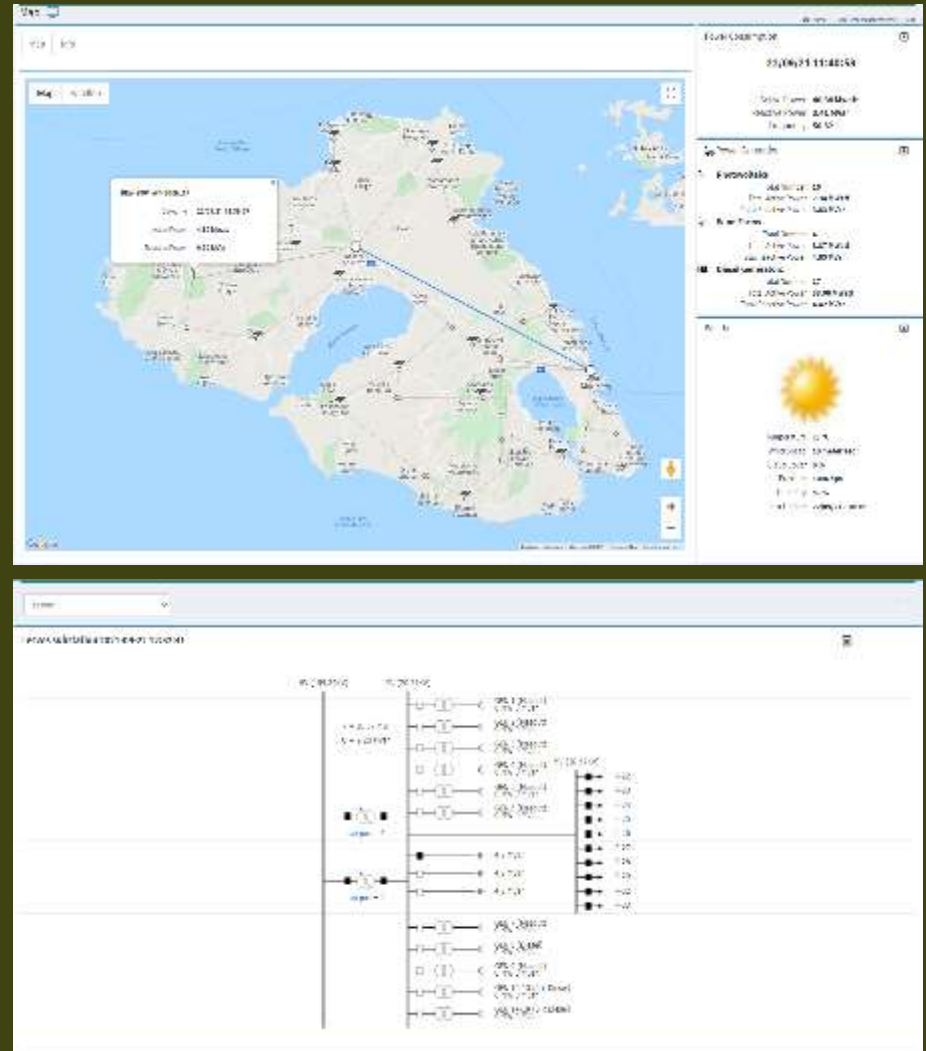
- Configure PVs, WFs, Diesel, etc. generators
- Configure Substations' One-line Diagrams
- Configure High/Medium Voltage Grid
- Feed available data (if exist) to train forecasting models (PVs, WF, power demand, etc.)

Create several operational scenarios based on

- Different weather conditions
- Different power demand
- Different asset configurations (battery size and placement, PVs, capacitors, etc.)
- Simulate System failures
- Simulate Grid failures

Configure iDERgridy applications

- Configure SCADA
- Configure Energy Management System
- Configure Advanced Distribution Management System



iDERgridy Technology : Deployment: Step #2: SCADA operation

Interface Assets

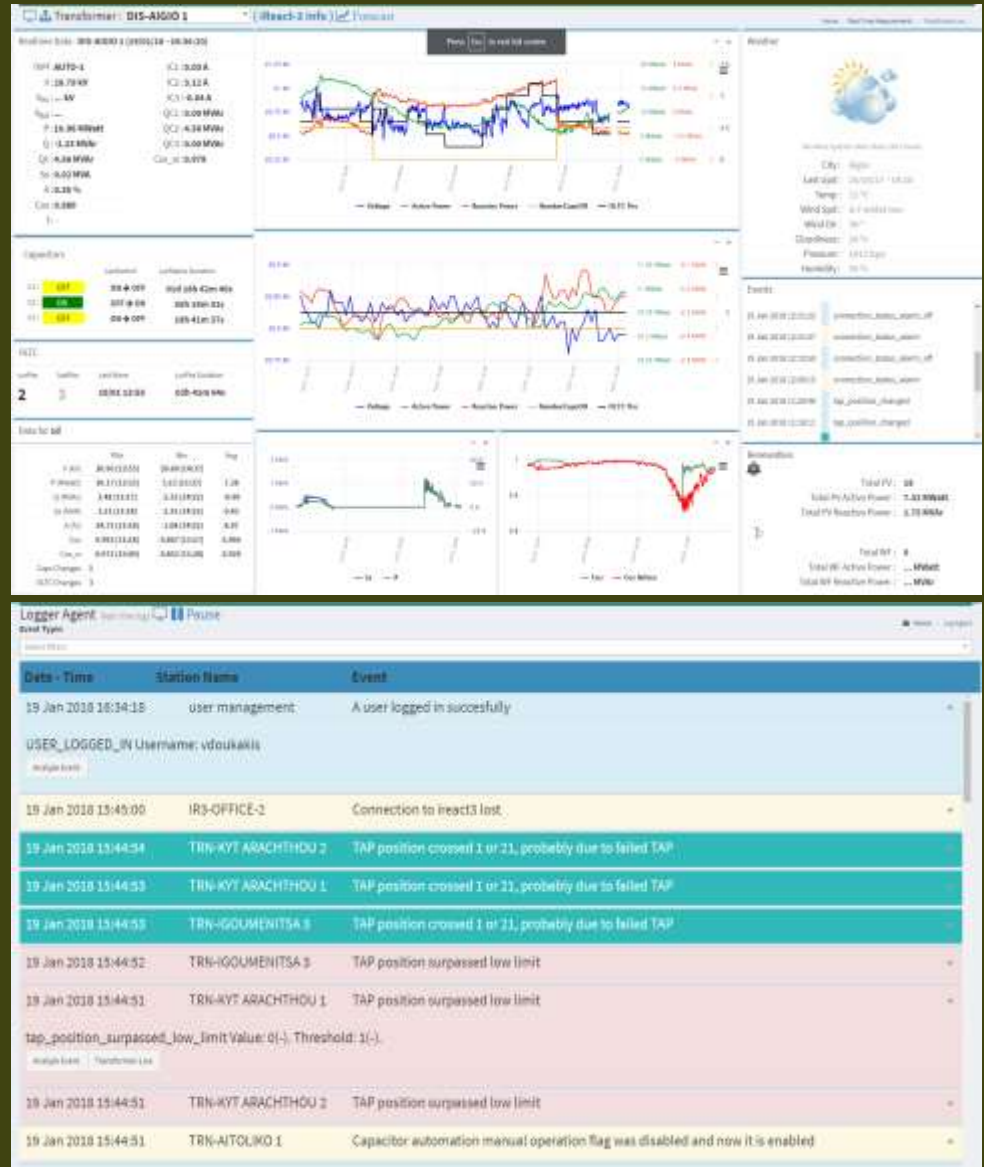
- Install iDERgridy-gateway
- Configure iDERgridy-gateway to interface energy assets

SCADA operations

- Data acquisition & control of substation assets
- Data acquisition & control of distribution grid assets
- Data acquisition & control of power generators

Prediction models' training based on acquired data

- Power generation prediction models training
- Power demand prediction models training



iDERgridy Technology: Deployment: Step #3: Energy Management

Energy Management System

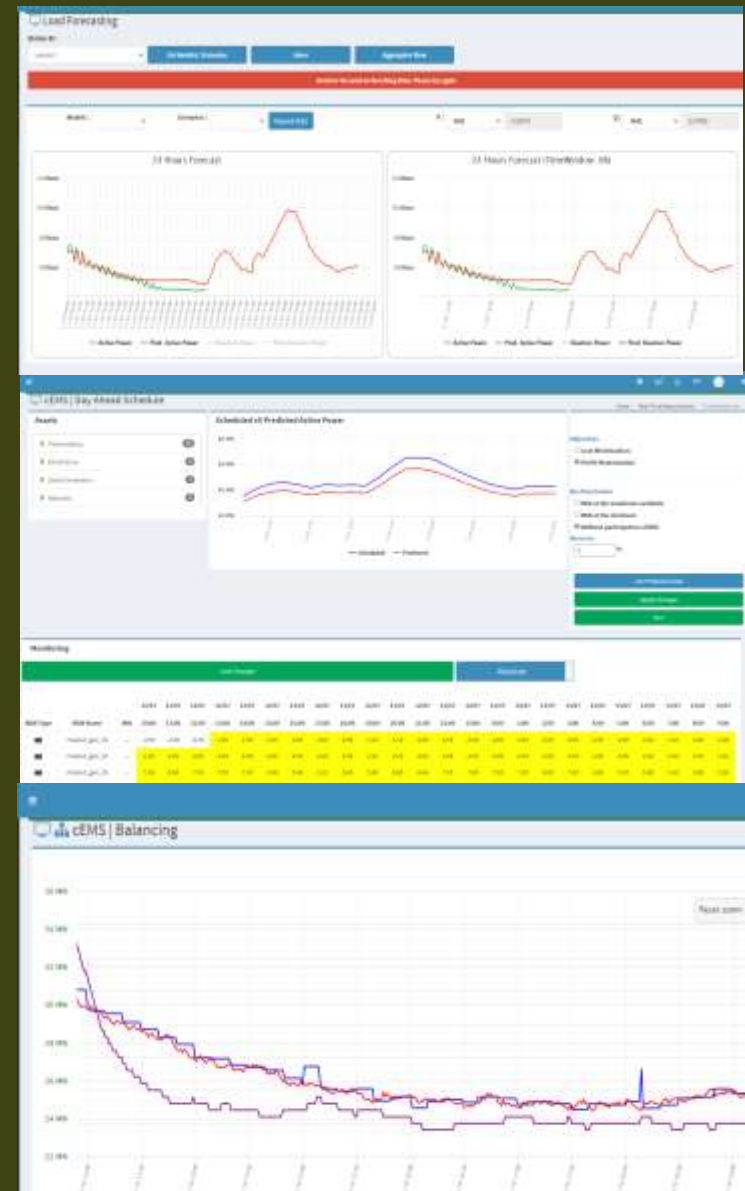
- Forecasting of power demand
- Forecasting of power generation
- Get availability of energy production asset owners
- Day-ahead scheduling supporting contingency
- Hour(s)-ahead scheduling to optimize power generation schedule
- Minutes-ahead balancing by tuning generation set-points according to power demand
- Real-time frequency control (AGC)

Flexibility of large energy consumers

- Waterworks (e.g. water pumps)
- Industrial units (e.g. desalination plants)
- Large hotels (e.g. batteries, backup power generators)

Crowd Flexibility

- Gamification to participate in energy efficiency
- Smart-phone applications to interface inhabitants and visitors



iDERgridy Technology : Deployment: Step #4: Optimize Performance

Advanced Distribution Management System

- Optimize grid operations based on different target objectives
 - Volt/Var
 - Minimize voltage violations
 - Other user defined objective functions
- Fault detection isolation and recovery (optional install iDERgridy-PMUs)
- Interface grid management crew (smartphone applications for field operations)



Continuous System-Analysis

- Use data analytics to assess grid performance
- Use Digital-Twin to analyze what-if scenarios in parallel executed and synchronized virtual grids of interest
- Evaluate system



iDERgridy Technology: Asset interface & EDGE processing

- **iDERgridy-Gateway** in two versions
 - Communications + EDGE processing
 - Communications + EDGE processing + Controller
- **Interface energy asset**
 - Communication protocols with energy generation assets
 - Communication with iDERgridy backend (IoT)
- **Features**
 - High-end processor (Octavo OSD3358 1GHz)
 - Linux OS (Debian) executing high-level SW
 - Data concentrator - local database
 - Interface with 4G/5G external com module
 - Access Local Network using Ethernet or wireless com



we **Dream** of all Islands to be **Blue, Green, and Intelligent**



we create **iDERgridy** to fulfill our vision



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