Electricity 2018 - Eilat

PV & Battery Storage

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OVERVIEW

- Background: PV pros & cons
- Batteries: The challenge
- EDF Group experience
- Conclusion

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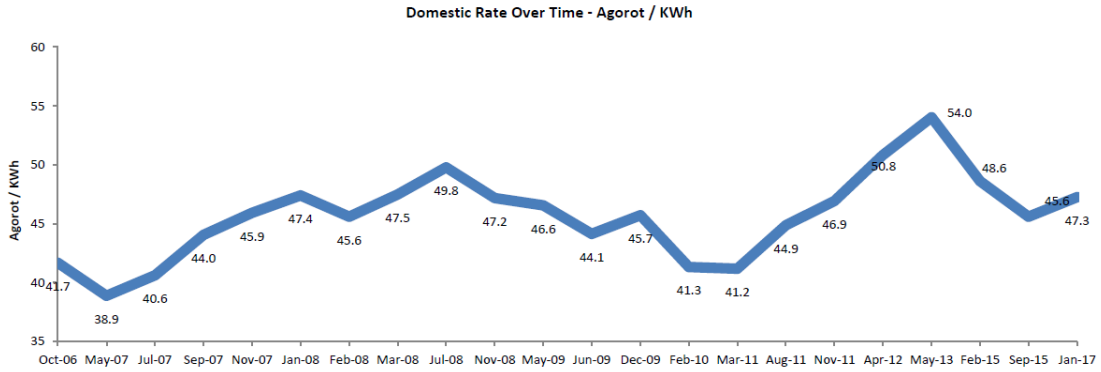
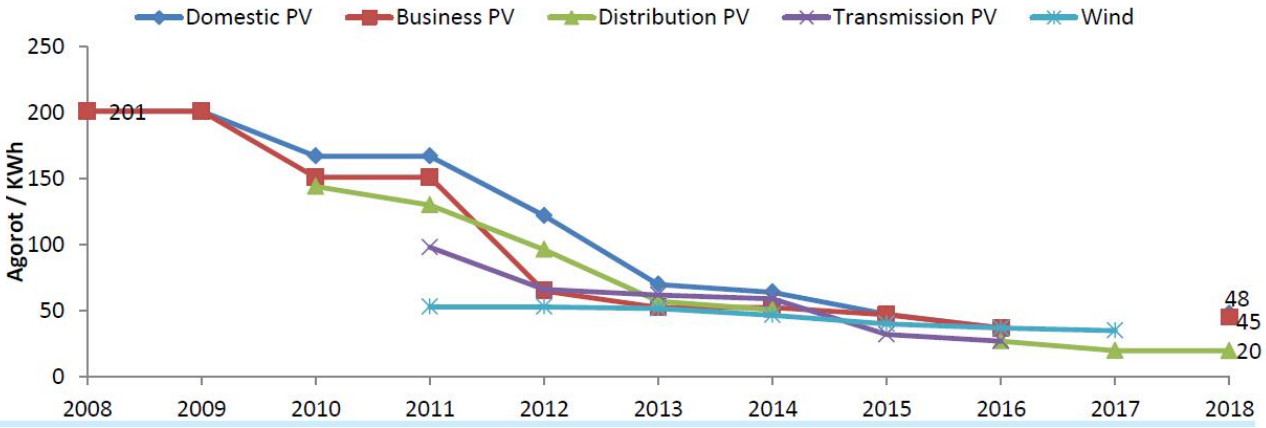
BACKGROUND – PV ONLY

The Electricity Authority
Electricity Market Report for 2017

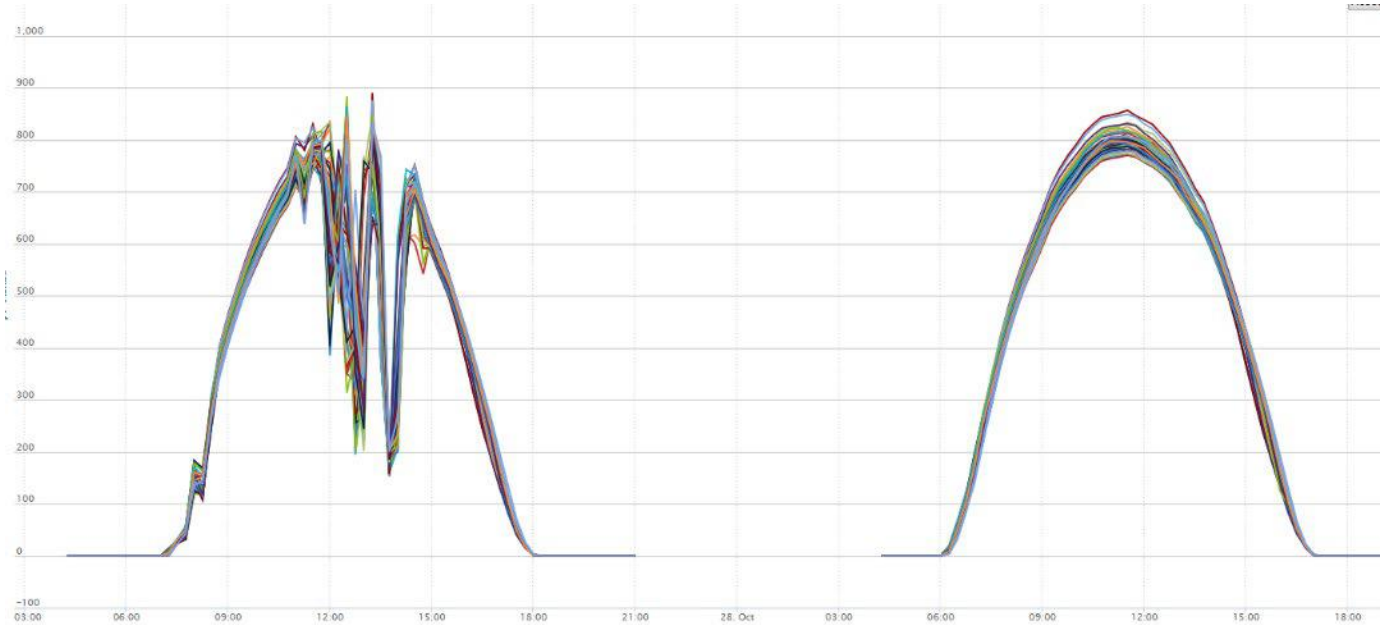
Development of the Domestic Rate



Development of Renewable Energy Rates



Zmorot – A Cloudy and a bright day



ADDITION OF STORAGE TO A PV PLANT

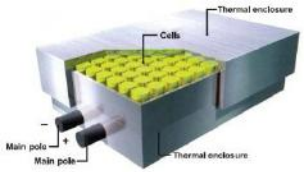
- Output stabilization
- Peak management:
  - Shift energy to evening / night
  - Overcome grid bottlenecks
- Ancillary services :
  - Frequency regulation,
  - Voltage control

THE CHALLENGE: THE BATTERIES

Lead acid (Pb, VRLA…)

Alkaline (NiCd, NiMH, NiZn ..)

Sodium (Zebra Na-NiCl2, NaS)



Lithium (Li ion, Li Métal Polymer…)

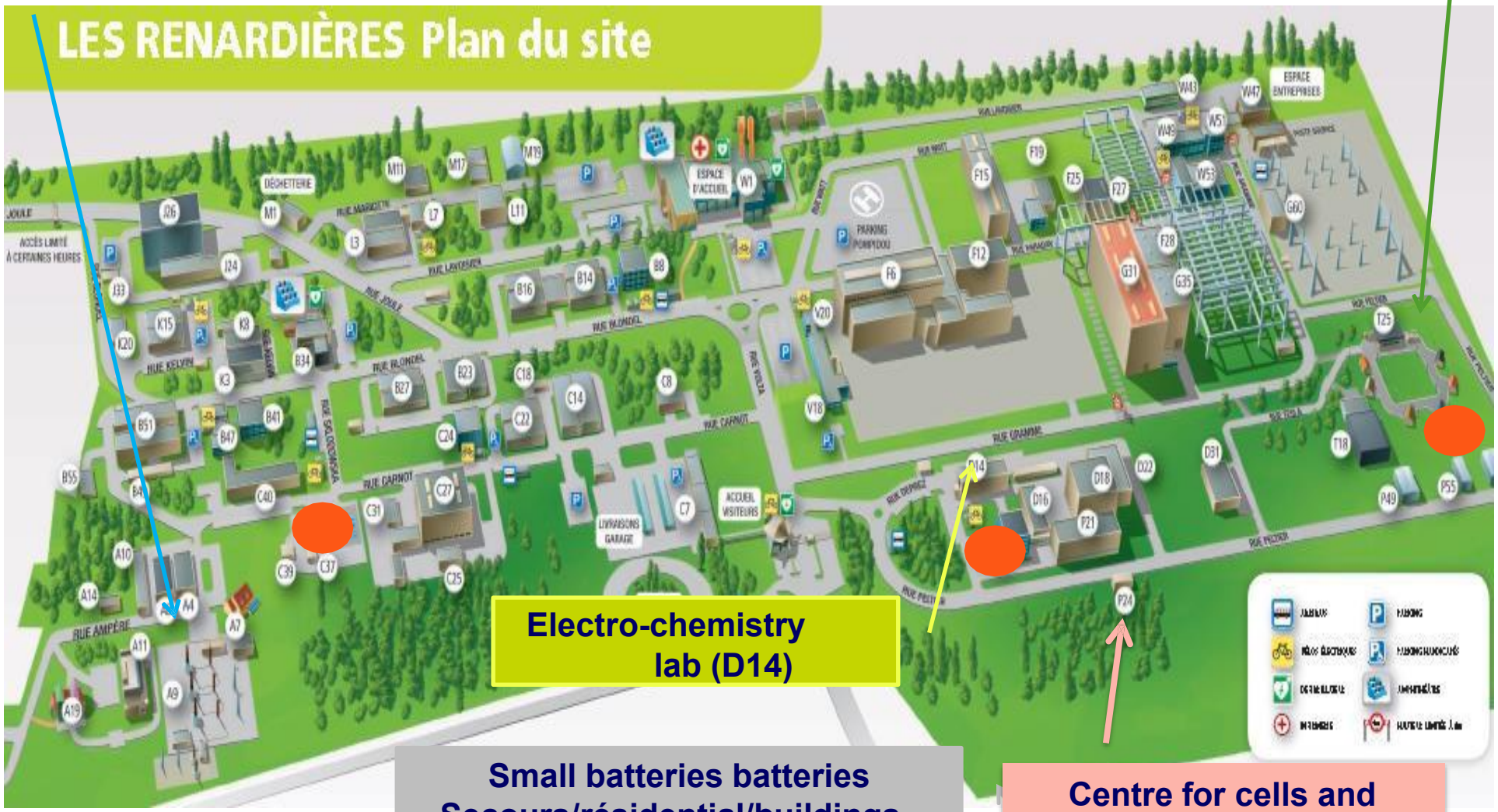
Redox-flow

Super capacitors

BATTERIES TEST PLATFORM @ EDF LAB

Large battery Tests *Concept Grid*

EVs packs test center (A10)



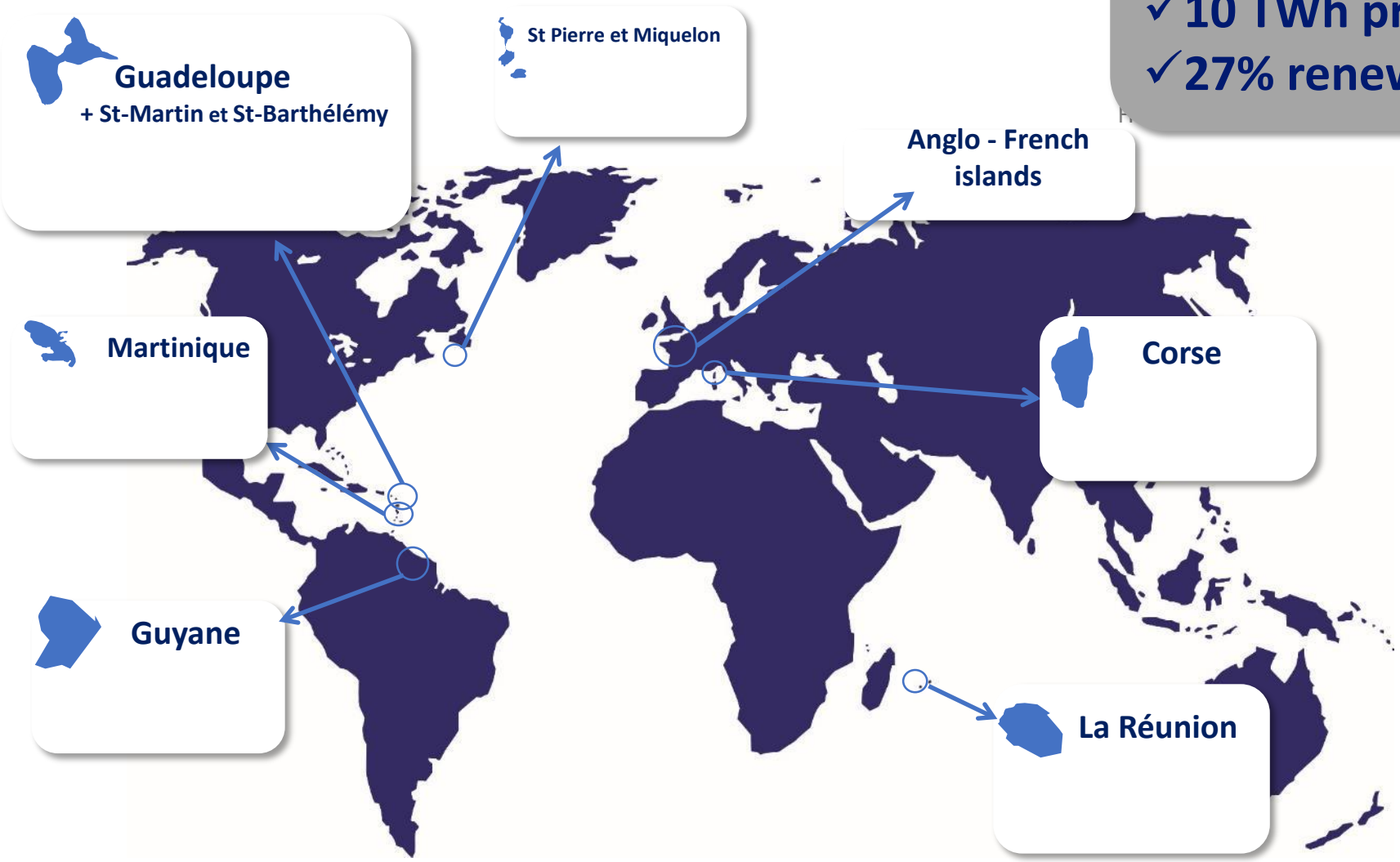
Electro-chemistry lab (D14)

Small batteries batteries Secours/résidential/buildings..
(CIMA 3/D14/TREE/CG)

Centre for cells and modules *(P24)*

EDF ISLANDS ENERGY SYSTEMS

- ✓1,14 million customers
- ✓3200 MW installed capacity
- ✓10 TWh production
- ✓27% renewables

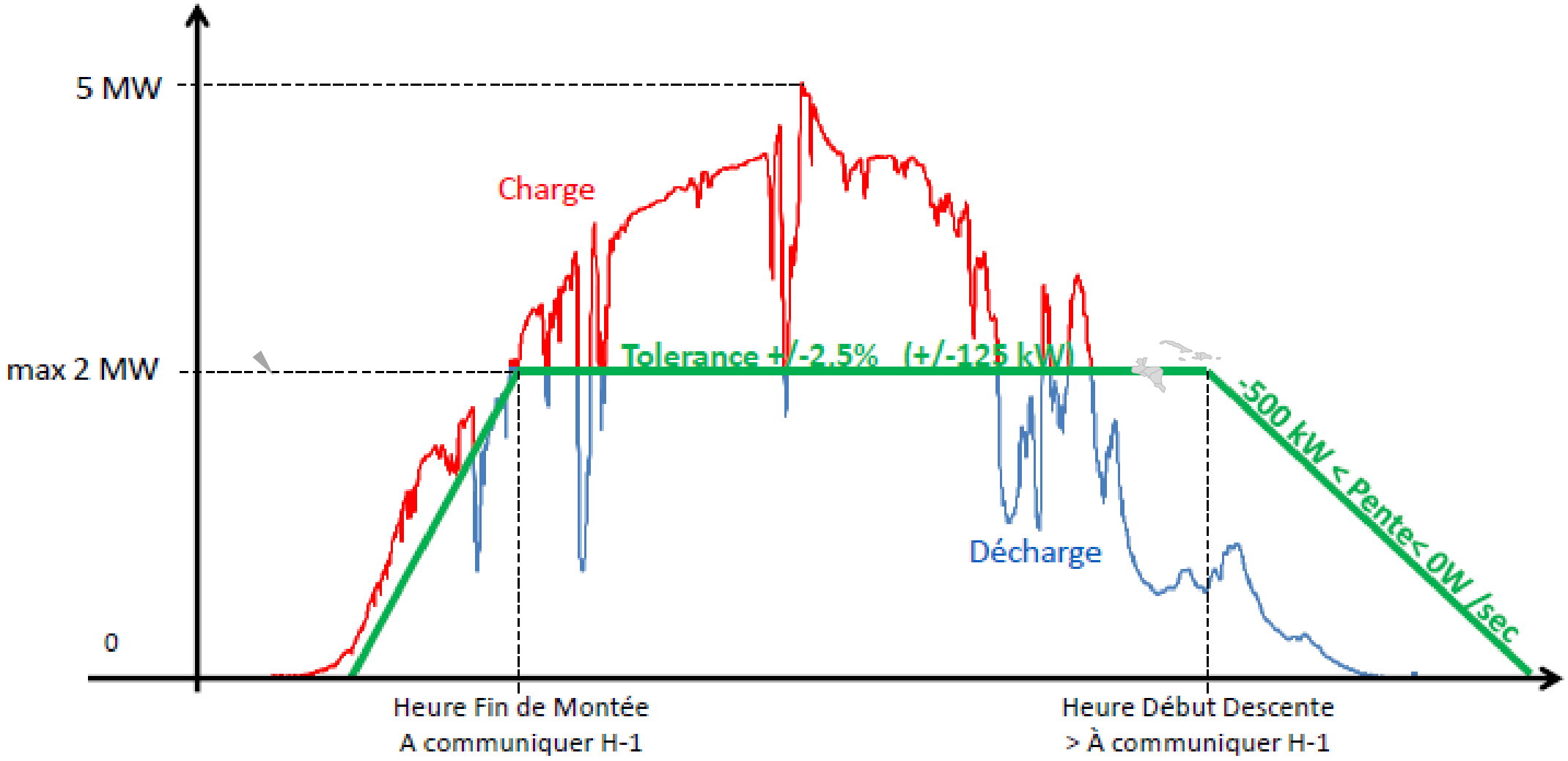


ZOOM IN: GUYANA

- 68 000 customers
- 133 MW
- **62% Renewables**
- Toucan 1: 5 MWp PV + 2 MW / 4.5 MWh batteries (2014)
- Toucan 2: Extension of 5 MWp PV + 4 MW / 10 MWh batteries (2019)

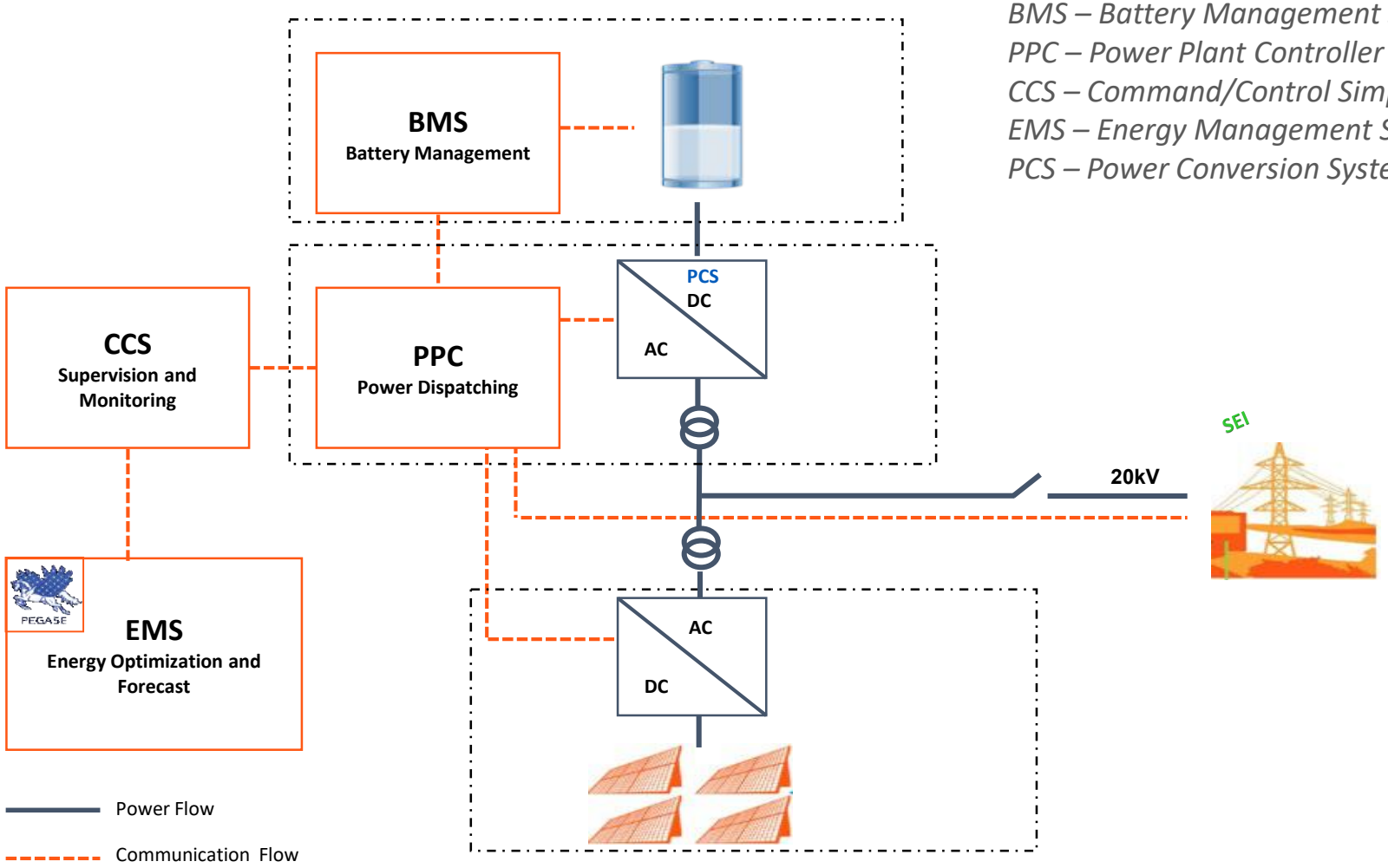
TOUCAN - 1

❖ Fixed production curve



TOUCAN1 - COMPONENTS

BMS – Battery Management System
PPC – Power Plant Controller
CCS – Command/Control Simplified
EMS – Energy Management System
PCS – Power Conversion System



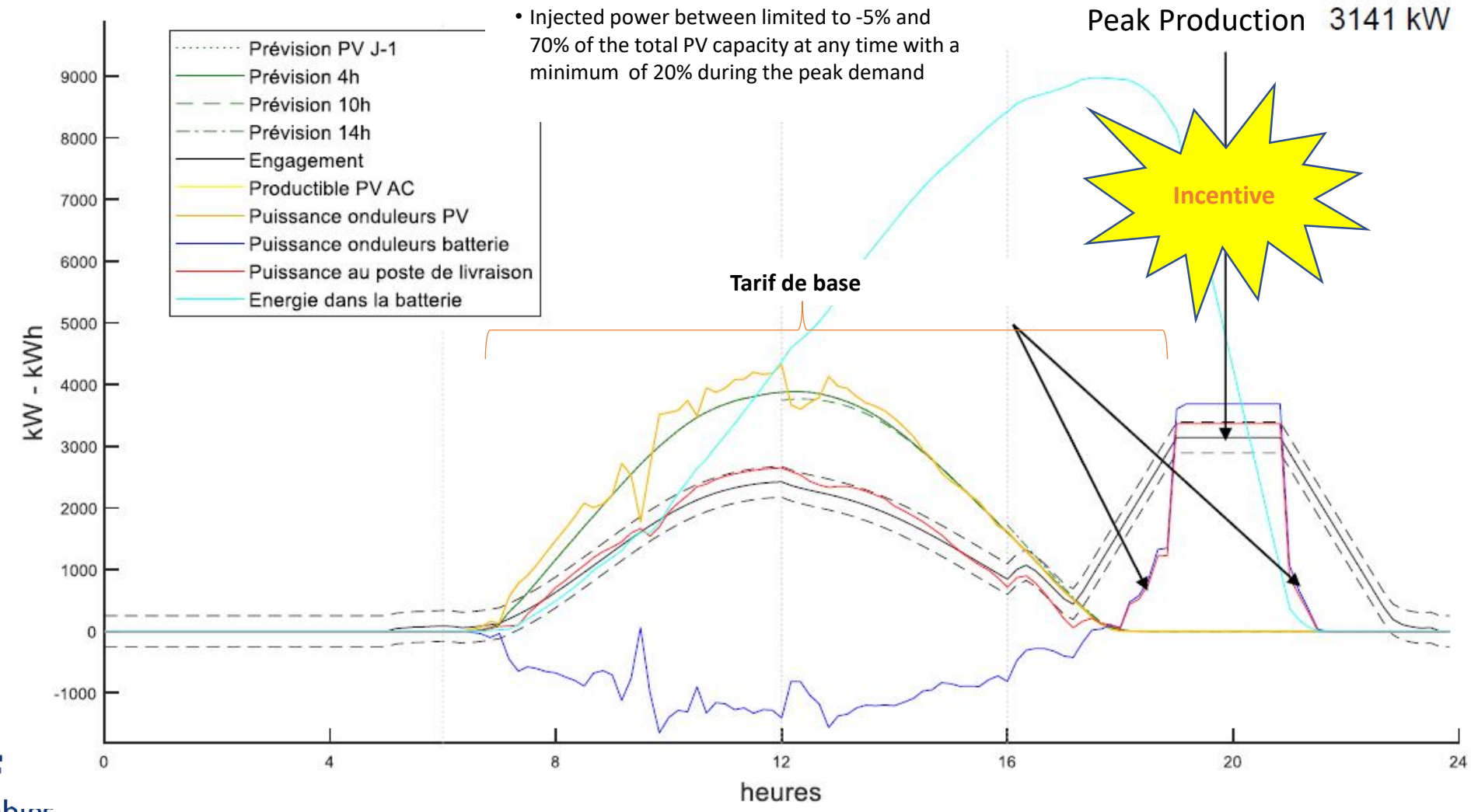
Simplified Diagram of Toucan Power Plant (AC Coupling)

TOUCAN - 2

✓ Typical daily production profile

The constraints are :

- Injected power between limited to -5% and 70% of the total PV capacity at any time with a minimum of 20% during the peak demand



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CONCLUSION

PV & Storage is likely the technology of the future. It requires:

- Clear business model – Working model before investment. What is the purpose?
  - Stabilization of PV
  - Peak shifting
  - Other Network services?
- Know-how needed:
  - Battery modelling and management
  - Battery procurement
  - Good weather forecast
- Key factors
  - Continuing Batteries cost reduction
  - Improvement in local forecast

BATTERIES: FREQUENCY REGULATION

- 49MW Battery Storage project deployed at West Burton CCGT allows EDF to benefit from favourable land, grid and network costs whilst also create a Centre of Energy Excellence.
- Lithium-ion battery cells will store energy, paired with an energy management system from EDF Store & Forecast.
- The project is electrically embedded within West Burton CCGT Power Station but as a separate generating unit.