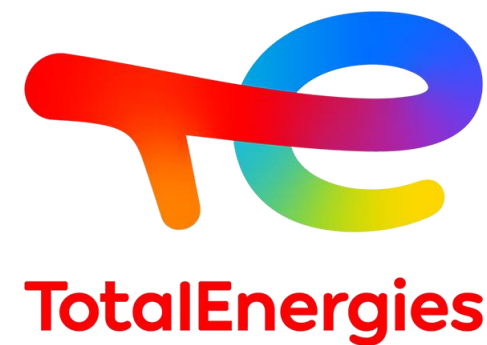




Conférence Stockage Electricité

ATEE

10 May 2022 –

Maximilien Pary – Business Developer BESS

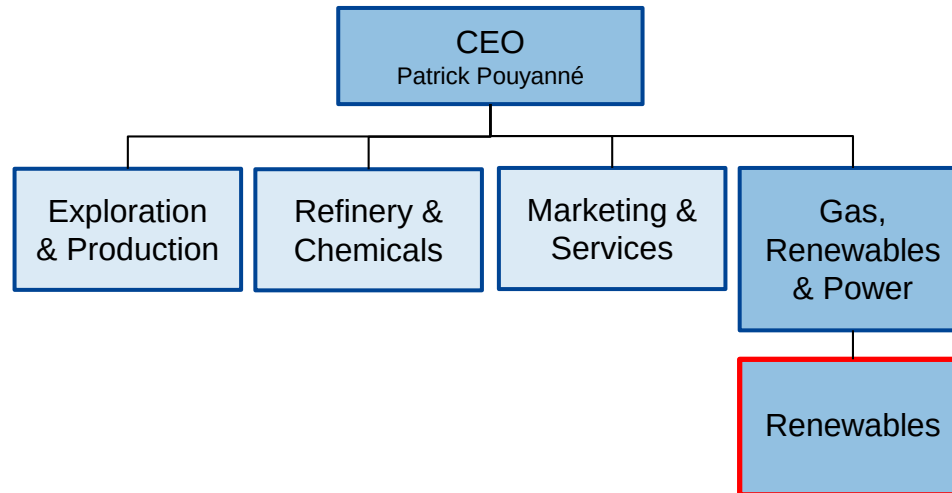
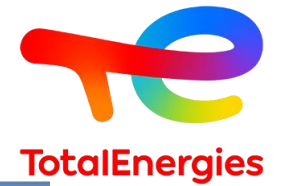
Florent Gibet – Project manager BESS

01.

BESS development overview : Dunkerque project



TotalEnergies organisation



EXPLORE AND PRODUCE

- 1 OIL AND GAS
- 2 GAS, RENEWABLES AND POWER
- 3 BIOMASS

PROCESS AND MONETIZE

- 4 SPECIALTY CHEMICALS
- 5 POLYMERS
- 6 REFINING & PETROCHEMICALS

TRANSPORT AND MARKET

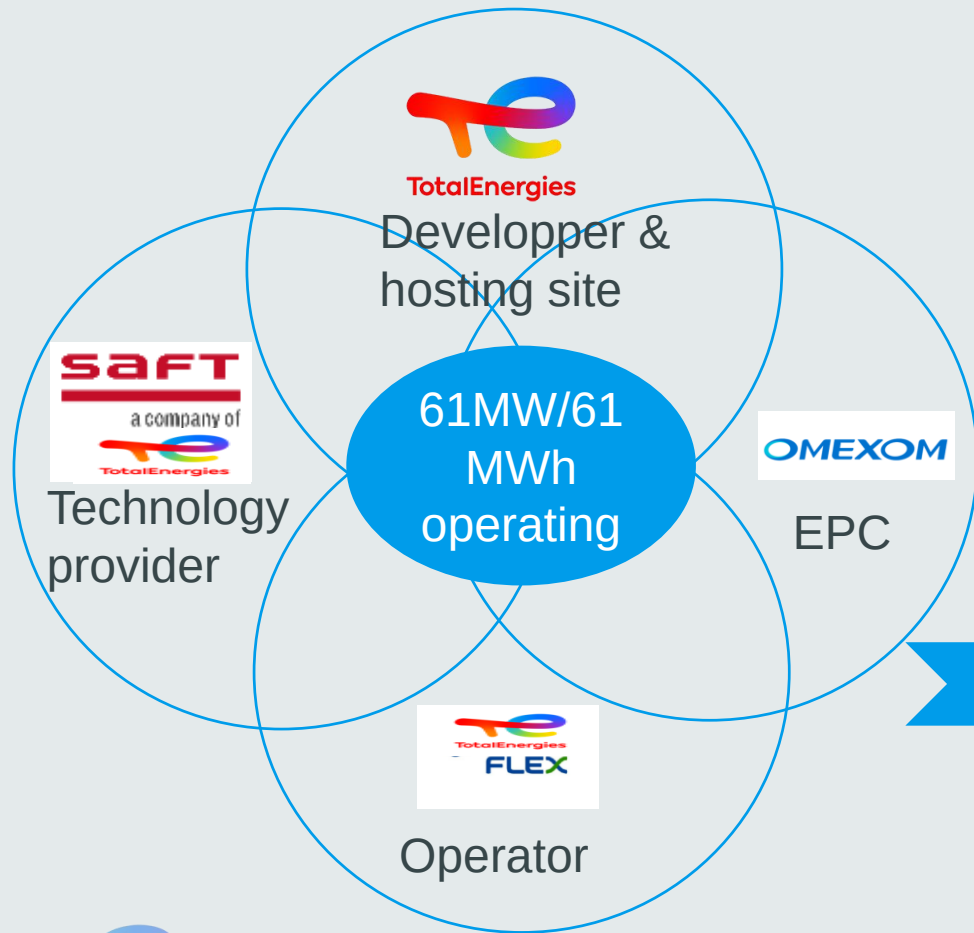
- 7 TRADING & SHIPPING
- 8 PRODUCTS & SERVICES



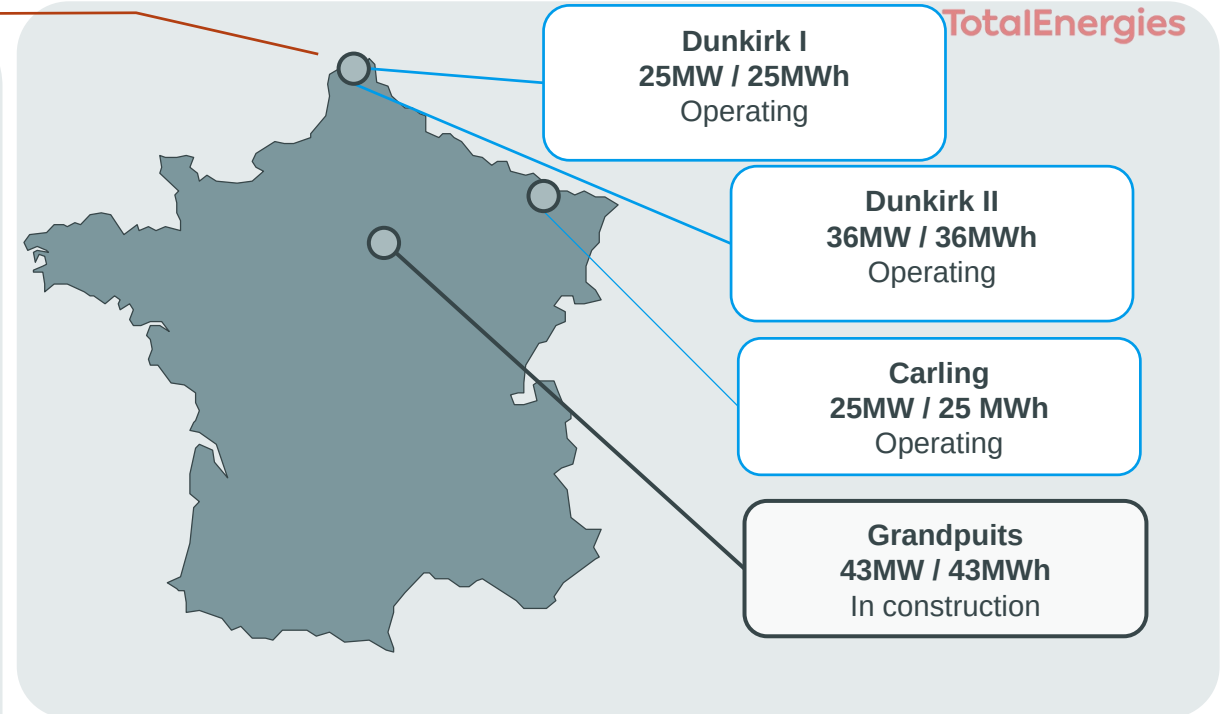
Project located in Metropolitan France overview



- Project in 2 phases: DK1 + DK2
= 25MW/25MWh + 36 MW/MWh = 61MW/61MWh



Supporting



Revenue streams :
Ancillary services (70%)
Capacity market (30%)

Primary reserve : FCR

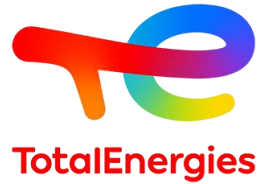
Largest utility-scale battery in Europe operation on grid services...

...Constructed during COVID crisis...

...with 0 safety incident...

...Strong synergies with TotalEnergies integrated model...

Project DK : Zoom on Construction

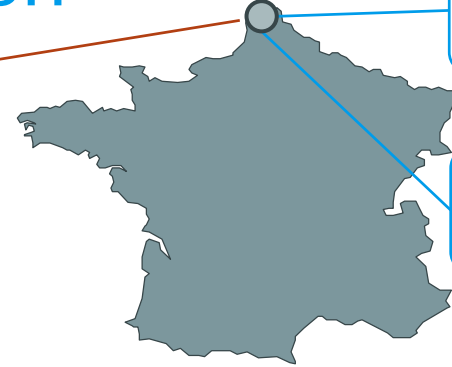


PROJECT : DK1

- 25MW/25 MWh
- 11 Li-Ion SAFT Max 20 High Energy (126 modules per containers)

PROJECT : DK2

- 36MW/ 36MWh
- 16 Li-Ion SAFT Intensium Max 20 High Energy (126 modules per containers)



Dunkirk I
25MW / 25MWh
Since January 2021

Dunkirk II
36MW / 36MWh
Since November 2021



Mars 2020
Start

COVI D19

Mid-May 2020
Restart

August 2020
installing components

Oct.2020
Powering up

Nov.2020
First injection tests

Dec. 2020
RTE
Certifications process

15 January 2021 :
First utility-scale battery supporting the grid in France

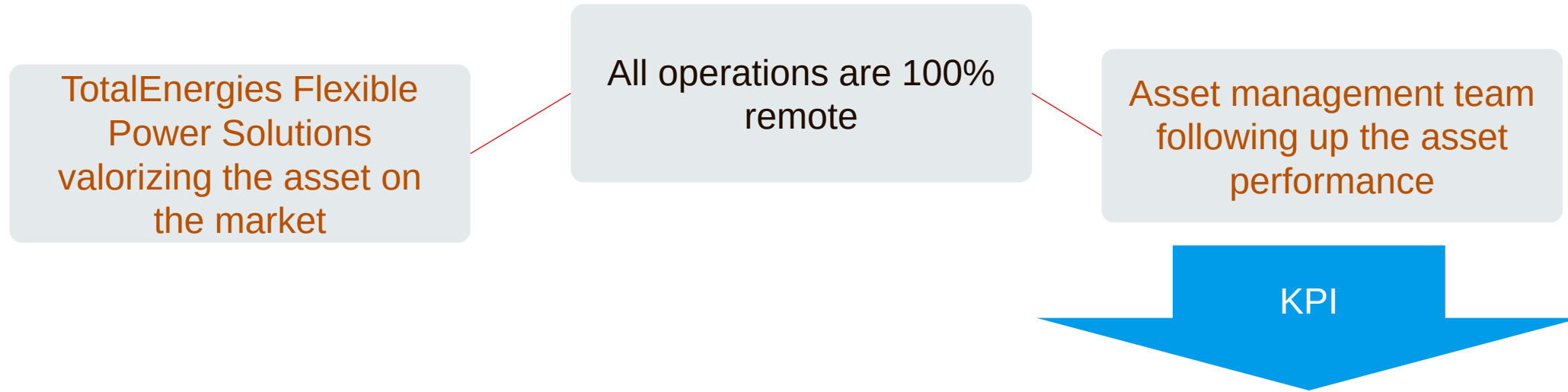
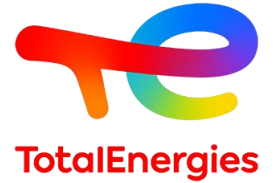
Construction : 6 months (2 months stop)

Tests & Certifications : 3 months

- COVID19 had an important impact on planning for DK1 and DK2.
- Integrated TotalEnergies model saved a lot of time (TotalEnergies site, Saft batteries ...)
- "Plug and Play" solutions and technology that can be replicated on other locations
- Many technical challenges for this very first utility-scale batteries of 61MW/61MWh
- Technical interaction with the aggregator (data collection, live connexion with TSO...)



Project : DK1 : Zoom on Operation



Financial

- Valorization on the FCR market
- Evolution of OPEX
- Costs of downtime
- Penalties

HSE

- Anomalies detected
- Number of alarms by types and categories
- Safety indicators

Technical

- Energy withdrawn / injected
- Auxiliary consumption
- Active power
- SOC Management Indicators

Availability

- Availability on FCR market
- Power availability
- IT availability

A few pictures

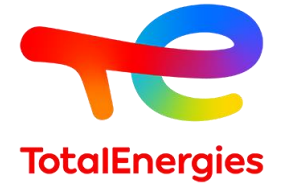


02.

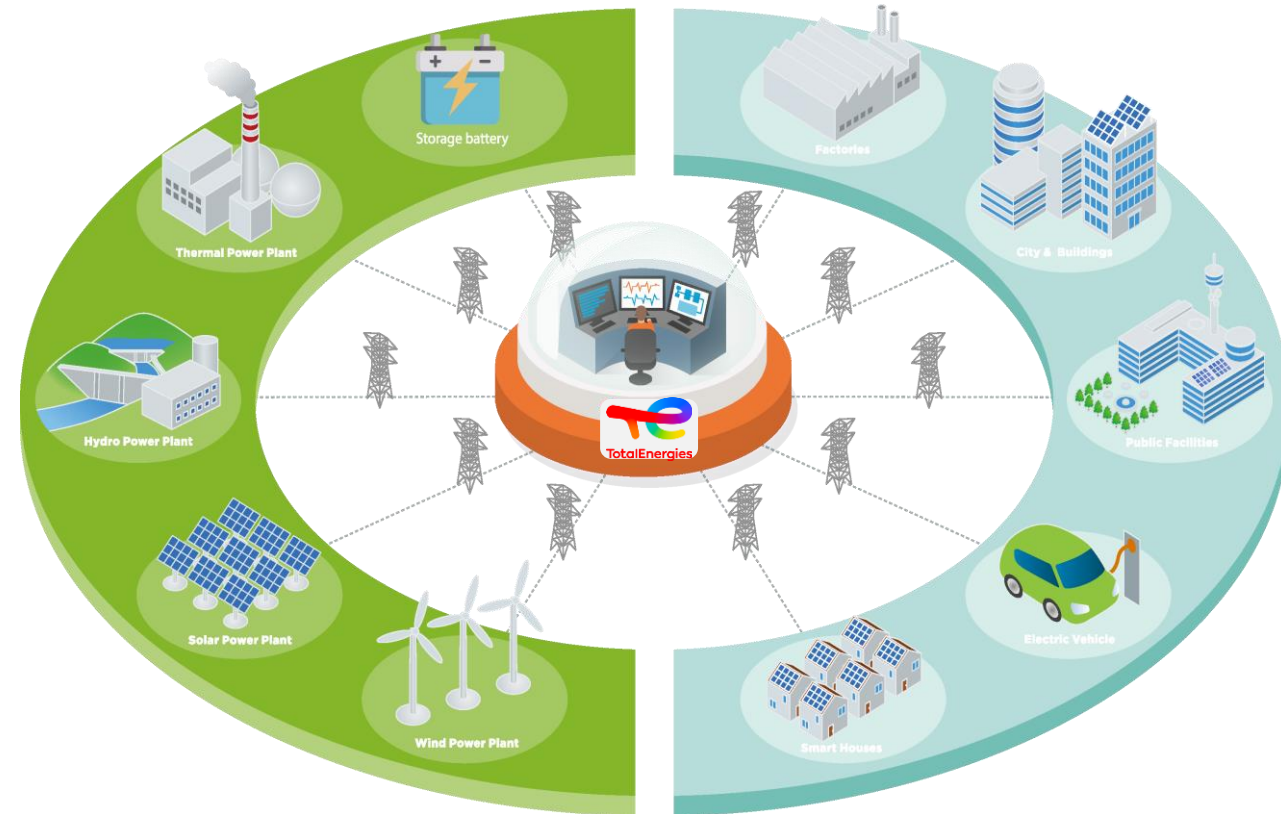
BESS Access to market Overview



UNE CENTRALE ÉLECTRIQUE VIRTUELLE - VPP POUR RELIER PRODUCTION ET CONSOMMATION

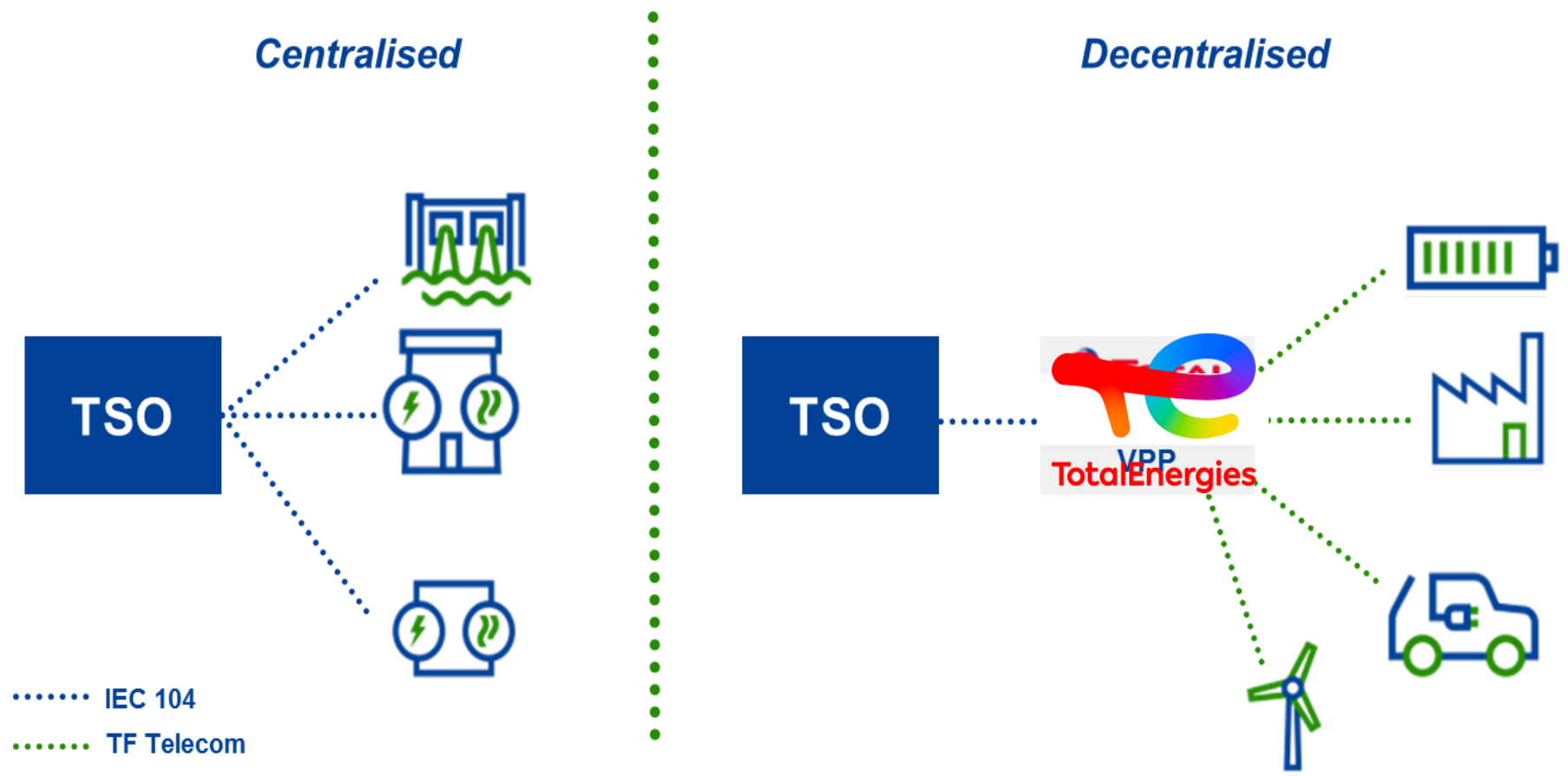
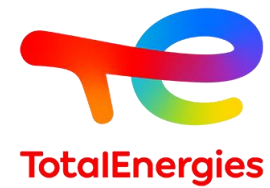


Un VPP permet d'agréger des actifs de production et de consommation pour les monétiser, en optimisant les revenus de la vente d'électricité ou des services de réseau.

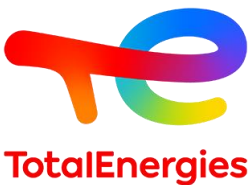


Les batteries jouent un rôle clé dans la construction d'un VPP !

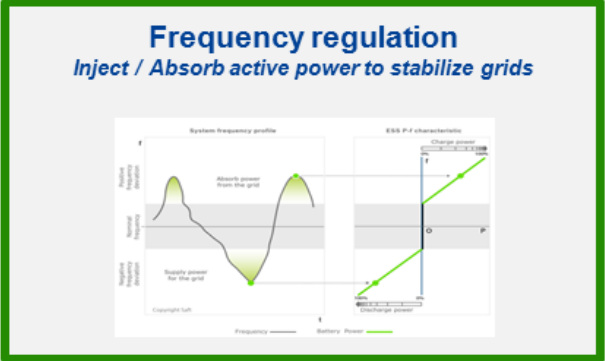
UNE ARCHITECTURE DE TÉLÉCOMMUNICATION PERSONNALISÉE POUR FONCTIONNER



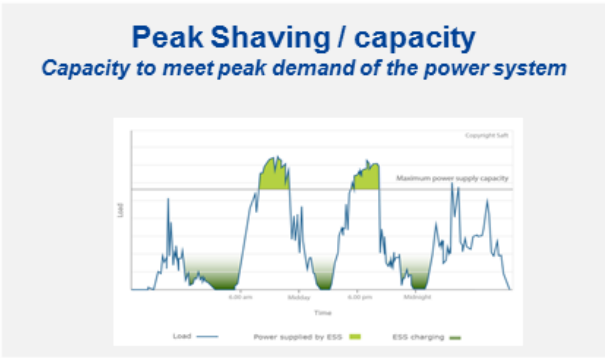
SERVICES ET MARCHÉ À ADRESSER AVEC UNE BATTERIE



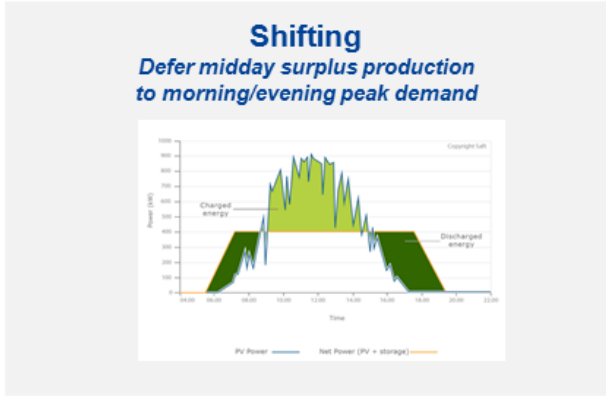
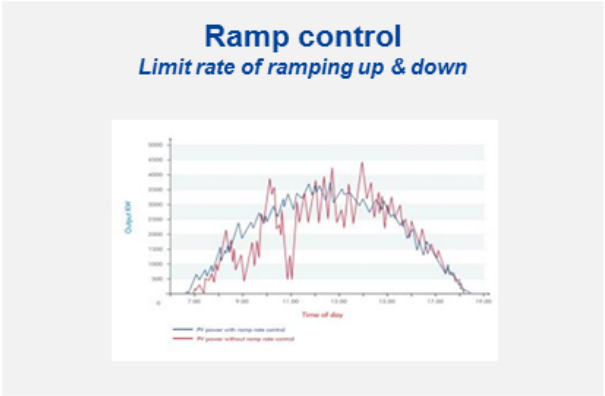
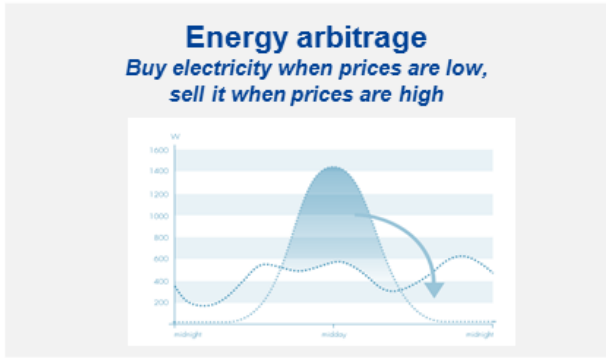
Short-Tem Services



Mid-term services

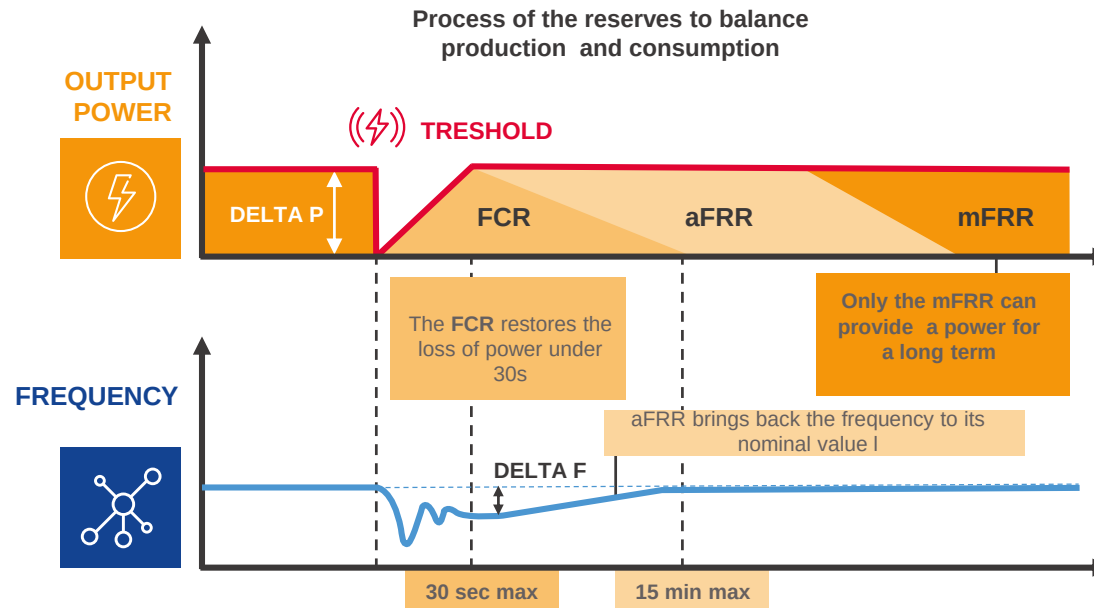


Long-term services



MÉCANISMES D'ÉQUILIBRAGE DU RÉSEAU

Trois type de réserves pour équilibrer le réseau



Frequency Containment Reserve (FCR)

- **French Power Stock** : 489 MW
- **Goal** : Compensate the loss of the two largest powerplant of the group of the European Grid – 3000 MW
- **Activation** : under 30 sec. 15 min max.
- **Deregulated Market**

Automatic Frequency Restoration Reserves (aFRR)

- **French Power Stock** : 500 to 1180 MW
- **Goal** : Balance the frequency and reconstitute the FCR
- **Activation** : Under 15 min, 2 h max.
- **Specificity**: All the powerplant over 75 MW have to participate
- **Deregulated market** : Open from march 2022

MANUAL FREQUENCY RESTORATION RESERVE (mFRR)

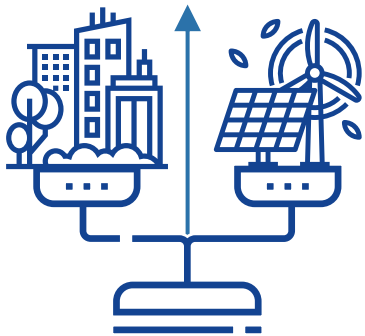
- **French Power Stock** : 1000 MW / RR 500 MW RC
- **Goal** : Balance the grid over the long term
- **Activation** : under 13 mn to 24h for at least 30min
- **Deregulated market**

FREQUENCY CONTAINMENT RESERVE (FCR) / RESERVE DE FREQUENCE



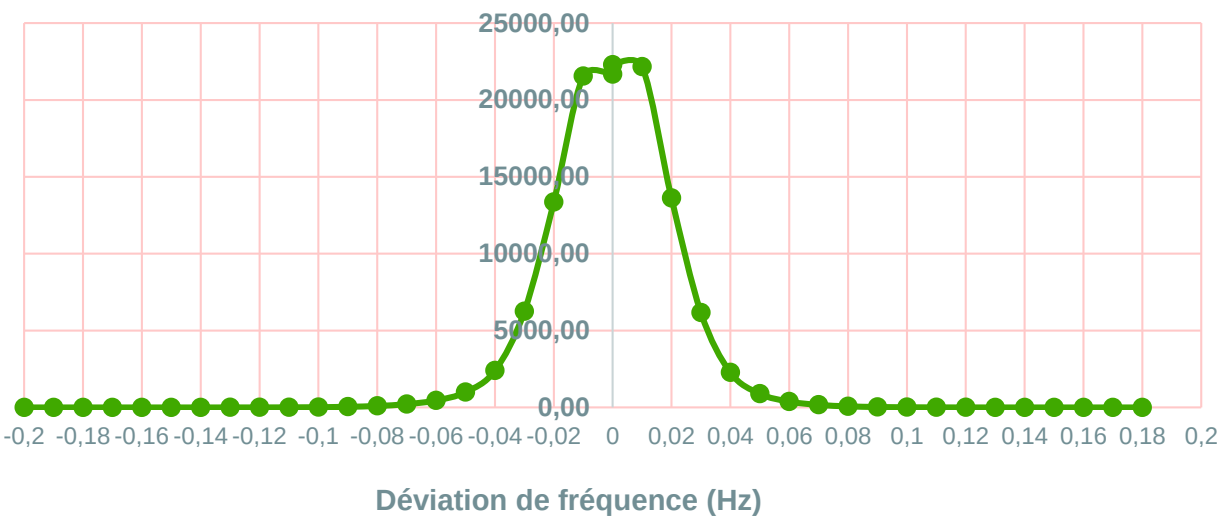
MISE EN ŒUVRE

Besoin de régulation dès que la fréquence n'est plus maintenue à 50 Hz



Durées cumulées mensuelles de déviations de fréquence supérieures à x (pour $|\Delta f| > 0$) où inférieures à x (pour $|\Delta f| < 0$)

Durée d'activation cumulée (min/mois)



FREQUENCY CONTAINMENT RESERVE (FCR)

- **Power Reserve:** ± 489 MW
- **Objectif :** Compenser la perte simultanée des deux plus grandes centrales électriques d'Europe (3000 MW).
- **Activation:** 50 % de la puissance doit être fournie dans les 15 secondes.
- **Marché européen libéralisé:** géré par Regelleistung
- **Contrainte batterie:** Réserve d'énergie de **15min (à Pmax)** et réactivité dans les **500ms**

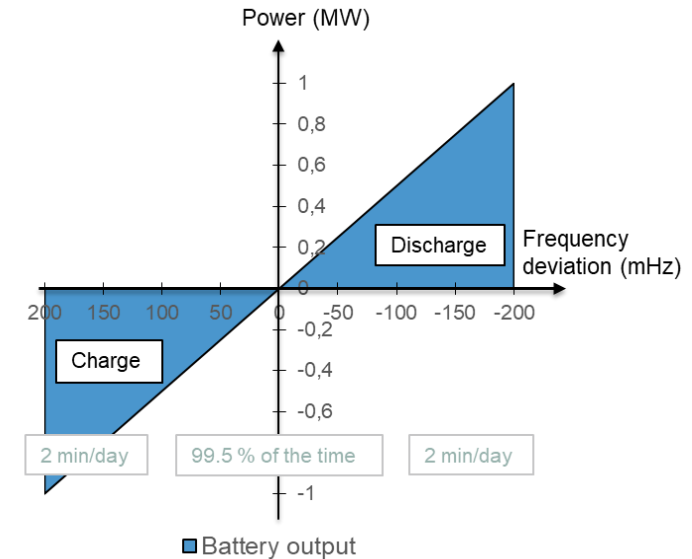
CE QUE TOTALENERGIES VA FAIRE

Initialisation du processus

- Installation d'un contrôleur local pour piloter la batterie suite à l'écart de fréquence
- Processus de certification RTE FCR
- Mise en œuvre de la stratégie de gestion du SOC, déjà testée sur la proposition technique SAFT

Fonctionnement au jour le jour

- Day-ahead FCR capacity bid on Regelleistung
- Programming of the set points for RTE on TOPASE
- Management of unplanned maintenance on the markets



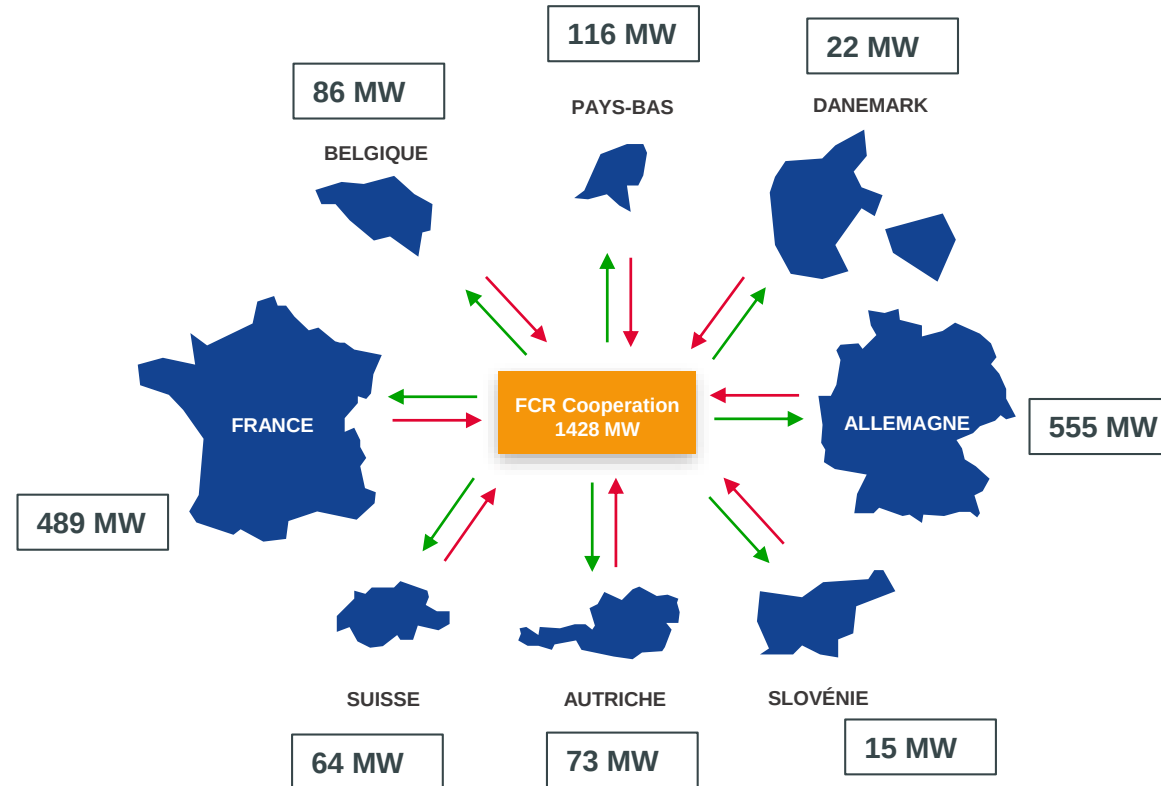
La batterie réagit à l'écart de fréquence

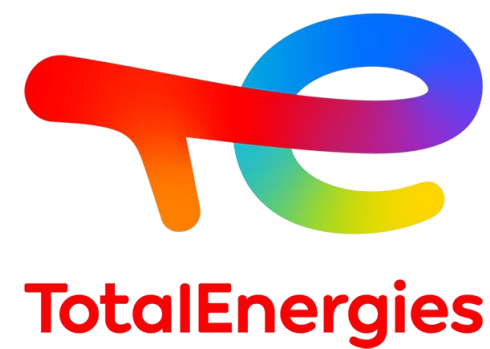
FREQUENCY CONTAINMENT RESERVE (FCR)

Assurer la stabilité des réseaux électriques

GESTION

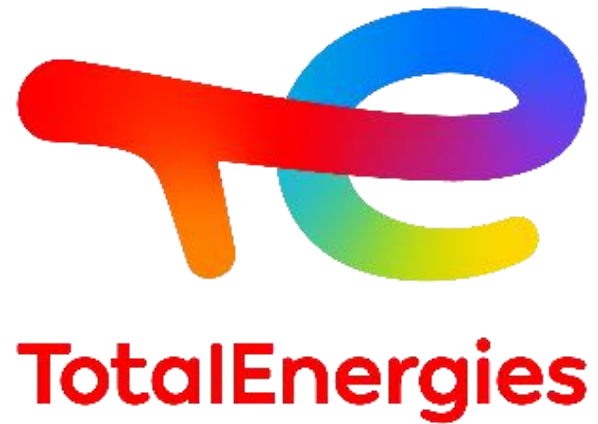
- En France, la FCR est opérée par RTE,
- Au niveau européen, les enchères sont gérées au niveau européen par la Regelleistung.





MERCI.

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