Flexibilities: because you're worth it!

Scaling up renewables through local flexibilities

September 2022

Enedis operates 95 % of the French distribution network (LV and MV)

GENERATION

Activity open to competition

Various energy sources, including nuclear, fossil fuels, and renewables such as water, wind and solar power.

TRANSMISSION

RTE

operates HV networks
400, 225, 90 and 63 kV

DISTRIBUTION

Enedis

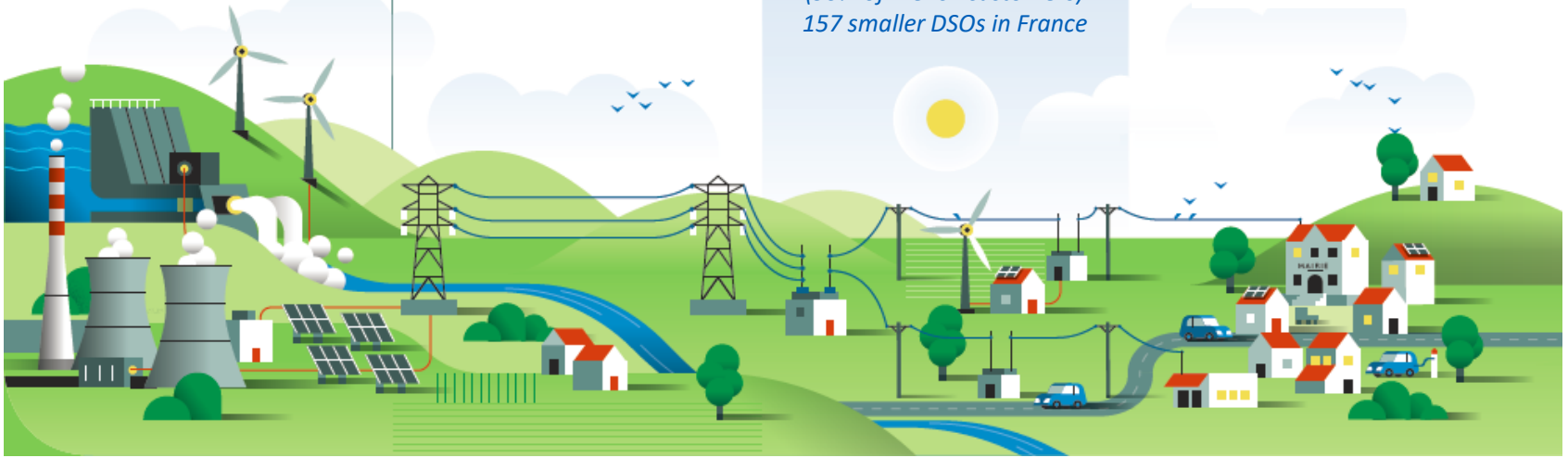
operates MV and LV networks (20 kV and under) and *serves*
37 millions customers
(95% of French customers)
157 smaller DSOs in France

ELECTRICITY SUPPLY

Activity open to competition

Fully open to competition since July 1, 2007

About 70 suppliers in France

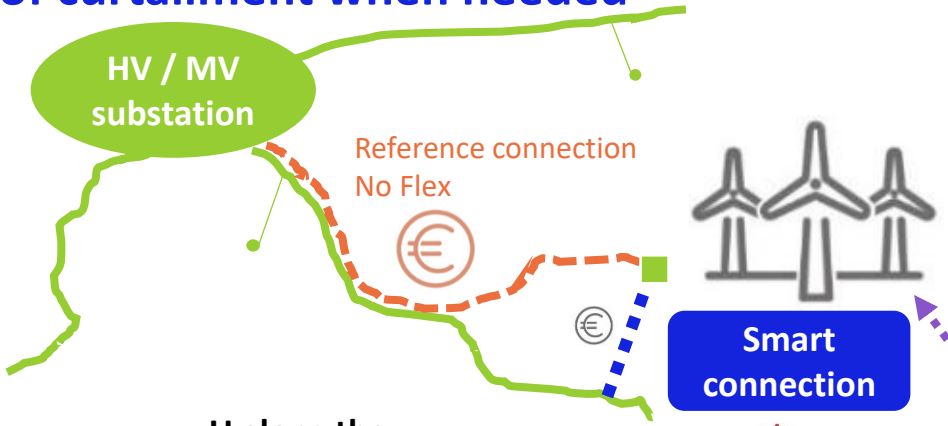


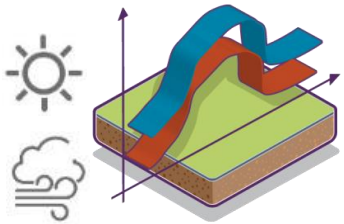
Flexibilities challenge “historical” solutions: the best cost-effective solution will be implemented

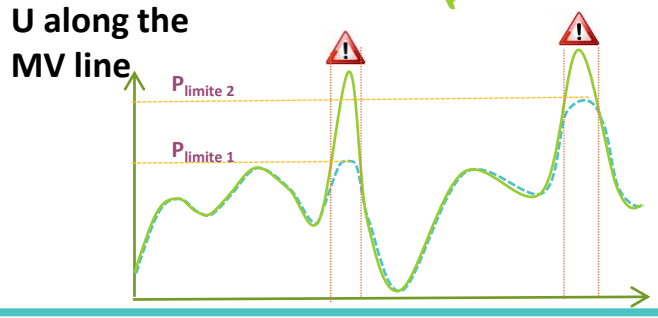
Fostering renewable connection → | **Optimize network design and operations** →

Smart connection Dedicated assets	**Regional scheme to host renewables** Shared assets	**Connection before completion of reinforcements**	**Investment deferral**	**Resilience**	**Works planning**
For MV producers (ie >250 kW) Experimentation for LV producers and EV charging stations	Test on 10 primary substations 210 MW increased connection capacity 6 transformers addition or upgrade avoided	New Work in progress	Systematic challenge of all MV reinforcements	Tenders since 2020 Several contrats awarded	
Savings: ~ 90 k€/MW for MV DER connection	30 % CAPEX savings with less than 0,06 % energy curtailment	Connection several years faster with limited curtailment	Savings: From 0 to 24 k€ / MW / year	Savings: up to the cost of alternate « traditional » solution	

Smart connections save cost and delays by avoiding reinforcements in exchange of curtailment when needed







Consumption & generation forecasts

Detecting incoming voltage rises along the line
Assessing the need for to curtail géneration

Activating the limitation order

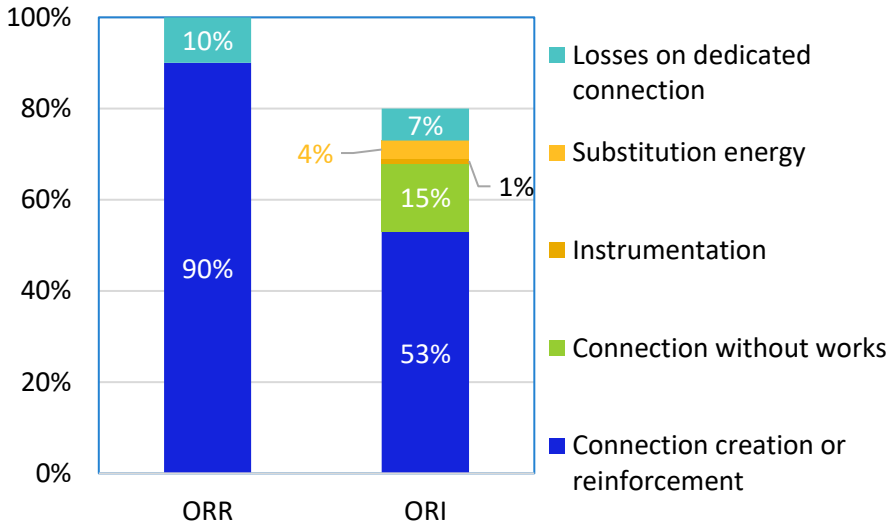
Conditional connections for MV producers (ie > 250 kW) are part of Enedis' Reference Technical Documentation since October 21st, 2021

Flex on the short-term, everywhere, for the ecological transition

- Target ~ 50 à 80 MW / year - ~ 10 projects / year
- Collective benefit ~ 90 k€ / MW
- Embodies Enedis Industrial and Human Project

The result of a 7-year collaboration with the Ministry of Ecological Transition, the French Regulator (CRE), producer federations, and the Union Française de l'Electricité (UFE)

Cost breakdown of regular vs. conditional connection



Source : Smartgrids economic assessment, ADEeF 2017

In France, connection of DER renewables is TSO-DSO jointly optimized on the medium term through regional DER hosting schemes

Schémas Régionaux de Raccordement au Réseau des Energies Renouvelables (S3REnR)

TSO surveys potential renewable DER pool on the medium term

TSO-DSO jointly optimize the network design to connect the whole potential pool

→ Regional DER hosting schemes

Project applies for connection of a Y MW generation capacity

- Localized within a 20*20 km grid
- Detailed by technology (solar, wind …)

- List and cost of forecasted reinforcements
- Reserved capacity per primary substation
- Unitary proportionate share X €/MW

- Payment of connection fee X * Y regardless of actual reinforcement work
- DSO & TSO trigger investment when needed

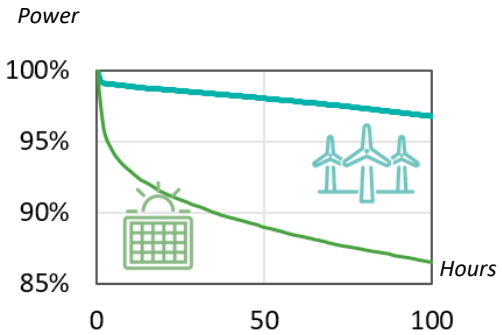
The French S3RENR framework constitutes a medium term global optimization to connect DER, which enables

- ✓ to reduce overall cost to connect renewables DER
- ✓ to anticipate needed work to connect DER
- ✓ to provide an even playing basis for each DER project

Flex could help optimize regional RES hosting schemes

30 % collective savings (total 250 M€ till 2035) : 825 → 575 M€
< 0,06 % average production curtailment for new RES

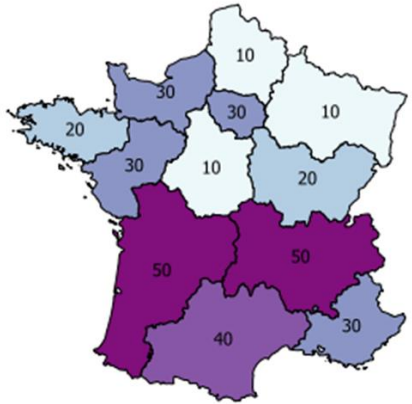
Load duration curves



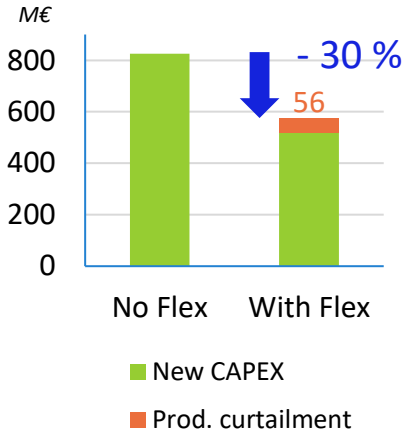
Combine PV, wind and demand

Consider production curtailment

Possible Flex-related capacity increase (in %) by region



Total cost of new RES hosting by 2035



Average production curtailment < 0,06 %
Capacity released : 2.5 GW in the short term, 7.5 GW by 2035

Enedis seeks market-based flexibilities as “plan A”, with direct producers curtailment as back-up “plan B”

Source UFE 2019 : « Valoriser les flexibilités de production pour intégrer les EnR aux réseaux électriques »

The ReFlex experiment has started in 2 experimental zones, increasing DER connection capacity of over 200 MW on 10 primary substations

Without flexibility

- Losses through transformers
- HV and HV / MV primary substation reinforcements

With flexibility

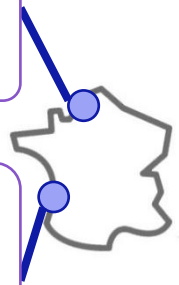
- Curtailed energy
- Losses through transformers
- HV and HV / MV primary substation reinforcements

Somme

- **4 primary stations**
- **82 MW capacity increase**
- **1 TR (80MVA) potentially avoided**

Landes

- **6 primary stations**
- **134 MW capacity increase**
- **1 TR 80MVA + 2 TR 36MVA + 2 upgrades to 36MVA potentially avoided**



Target
Average production curtailment < 0,06 %
Capacity released : 2.5 GW in the short term, 7.5 GW by 2035

2021
Kick-off pilot experiment in Landes and Somme

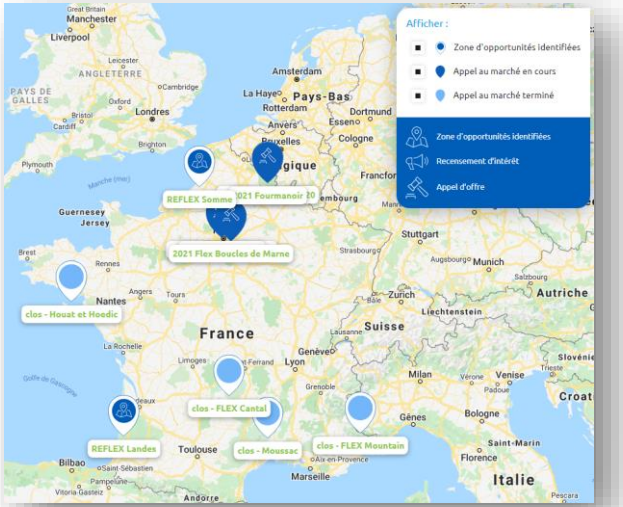
2024
Industrialization according to feedback and legislation

Enedis seeks market-based flexibilities as “plan A”, with direct producers curtailment as back-up “plan B”

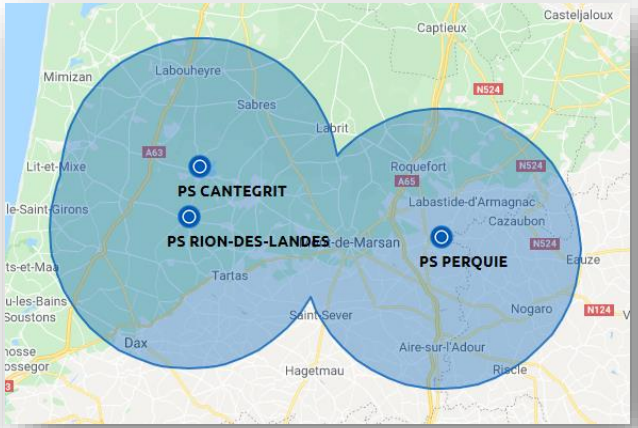
Enedis regularly updates its Flex opportunities map: www.flexibilites-enedis.fr

Enedis seeks market-based flexibilities as “plan A”, with direct producers curtailment as back-up “plan B”

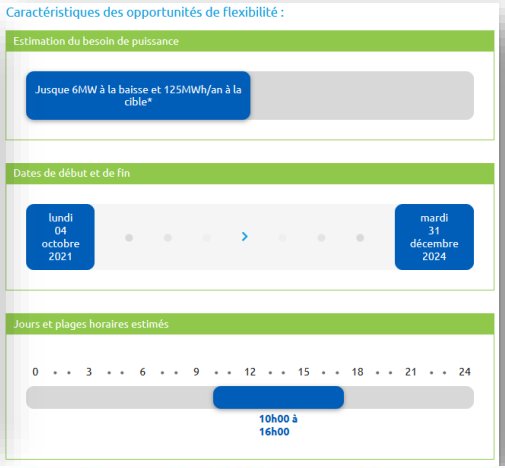
Opportunity map



Eligible sources of flexibility



Needed service



Enedis analyses the network constraints and publishes the flexibility opportunities (where, when, how much?) it has identified, wherever they can be useful for the network

Besoins de flexibilités à la baisse à la cible du gisement*
(produits attendus par tranches de puissance de 500kVA et pas de 30min)

		TOTAL en MWh	Espérance d'activation en nombre d'heures par tranches de puissance			Puissance max activable (MW)
			[0MW – 1MW]	[1MW-4MW]	>4MW	
PS CANTEGRIT	TR1	15	-	10	-	2
	TR2	20	-	10	-	3
PS PERQUIÉ	TR1	8	12	1	-	2,5
	TR2	8	12	1	-	2,5
PS RION-DES-LANDES	TR1	125	25	35	10	6

Local flexibilities for network congestions become an operational reality for Enedis and its stakeholders

Embedding flexibilities in Enedis industrial model : a new lever to foster the ecological transition and to increase the performance of the distribution network, sustained by CEP transposition in French Energy code

Enedis "Industrializing Flexibilities" roadmap provides the expected visibility to players in the electrical system, with priorities aligned on volume assessment, value and accessibility

- MV Production smart connections: business as usual since oct 2021, savings 90 k€ / MW where possible and relevant
- RES regional hosting scheme “ReFlex project”: experiment 2021-2024, target of 30 % CAPEX savings until 2035
- LV PV connection, before completion of MV and HV reinforcements: targeted experimentation as soon as 2023
- Market-based flexibilities: 1st tender mid-2020 (2 contracts signed), next-step : tender to support RES hosting schemes

The essence of flexibility is improvement of the network cost / efficiency via risk transfer

- Risk transfer from network development to real-time operations and from DSO assets to flexibility service provider
- Flexibility reliability is constitutive of the service value

Thanks for your attention !

Direction Technique

Département Flexibilités

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