The ValueFlex tool for unlocking industrial flexibility

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8 November 2023
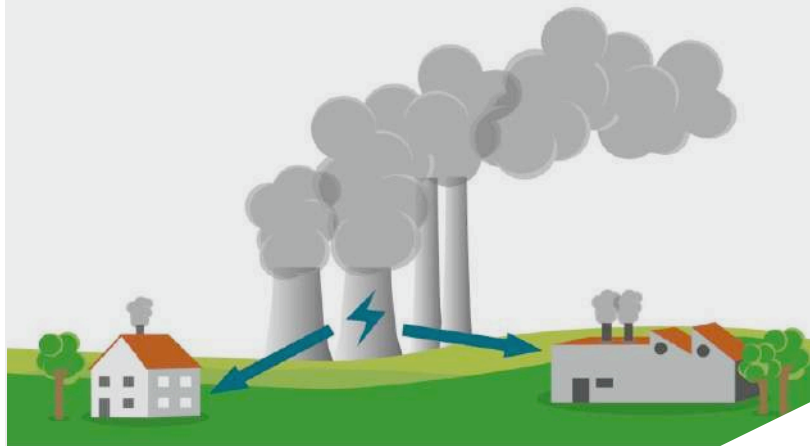
The changing electricity landscape

Renewables fundamentally change how power grids work

From
- Central, predictable production
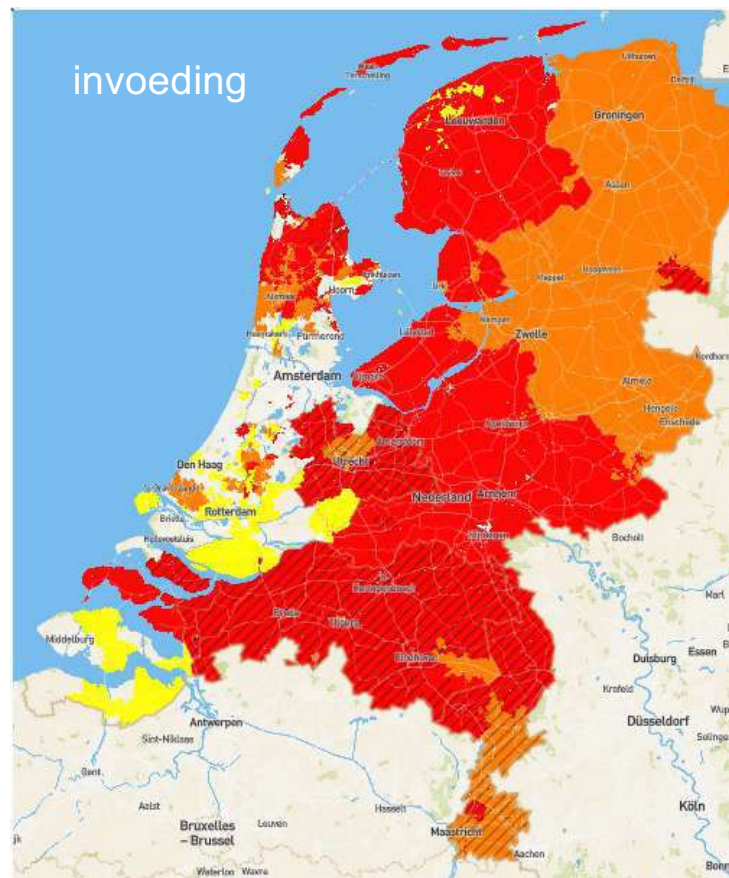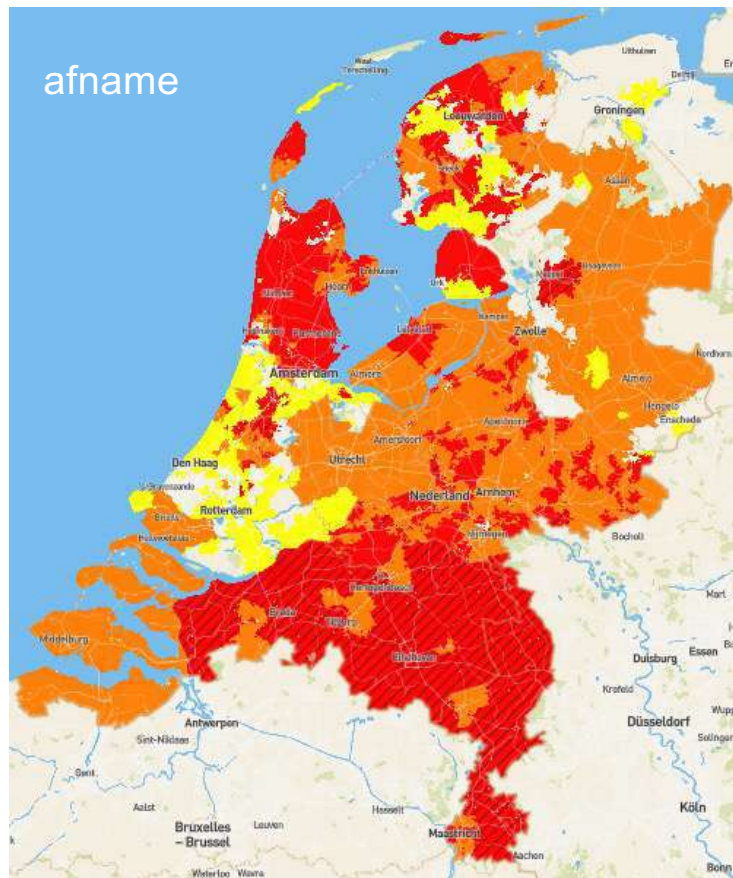- Central, predictable loads/ consumption

To
- Distributed, weather dependent (intermittent) production
- Decentral, less predictable consumption and prosumers
- Electrification throughout different sectors
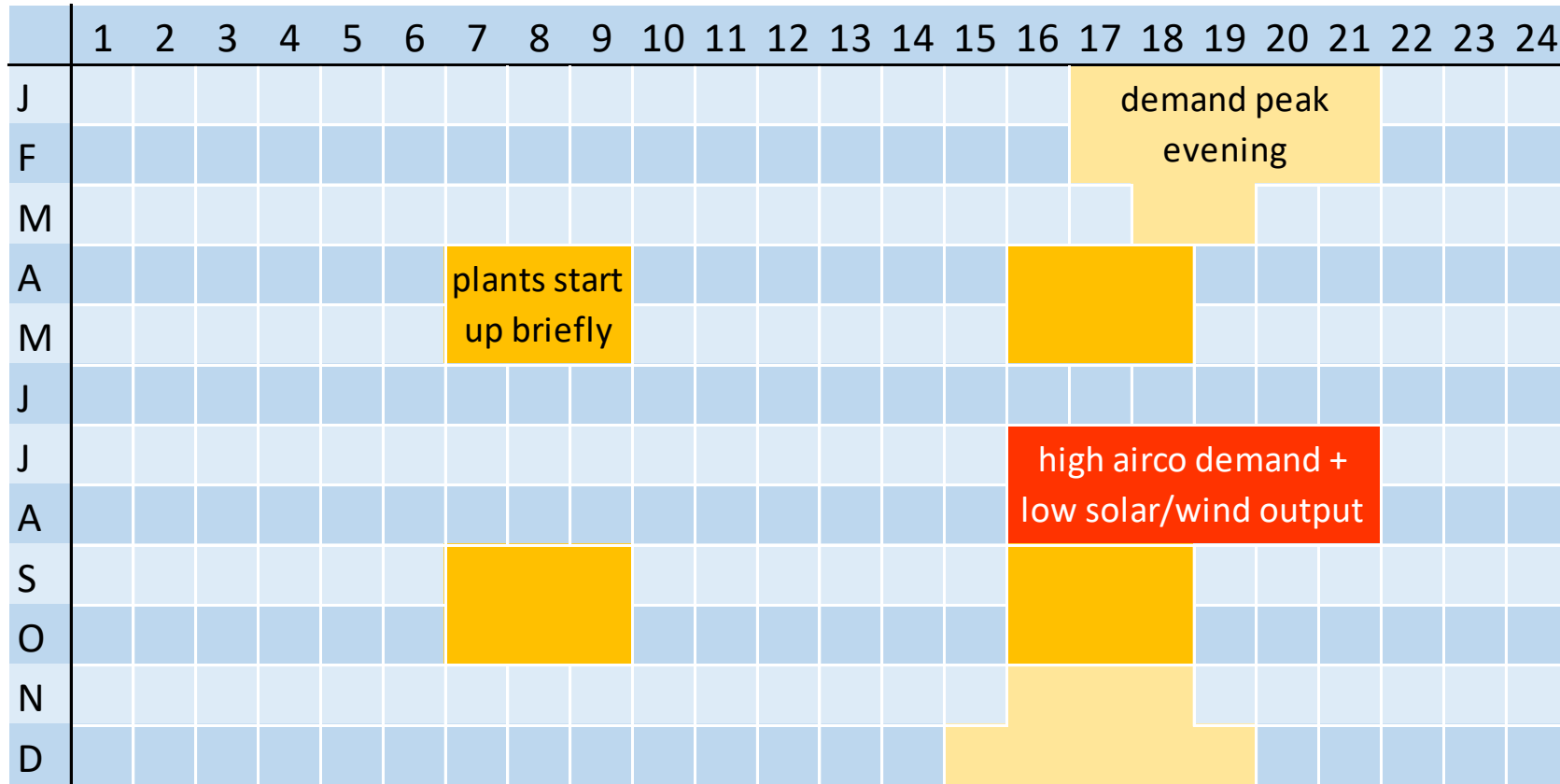
Congestion will be a reality for many years to come

afname

invoeding

Legenda
Transport capacity
- limited availability
- congestion assessment, no availability for a while
- no availability

20-9-2023

Avoiding price peaks may reduce bills by >30%

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
J																	demand peak evening							
F																								
M																								
A							plants start up briefly																	
M																								
J																								
J																high airco demand + low solar/wind output								
A																								
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(based on Gleam, 2030)

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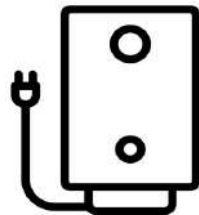# How may industry capitalize on flexible capacity?
System functions and basis for business models

Dynamic production
reduce demand at lows
avoid high e-prices
by shifting production

Load shifting
reduce demand at lows
avoid high e-prices
by shifting electricity use

Hybrid heating
shave supply peaks
buy at low e-prices

Electricity storage
1 shave supply peaks,
   buy at low e-prices
2 feed-in at short supply,
   sell at high e-prices

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Good reasons for more industrial flexbility

- Peak demand may grow until 2030 by a factor of 4. Industrial flexibility may limit this to a factor of 2.

- Industrial flexibility may lower energy bills by (much) more than 30%.

- Industrial flexibility supports business models for electrification and renewable energy production.

- Search for options requires serious efforts from industry in collaboration with grid operators.

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Operational challenges

Industrial ValueFlex tool

- **Objective**
  - to evaluate business cases for investments in industrial demand side response and energy storage

- **Rational**
  - TenneT has an interest in unlocking potentials for iDSR and storage to
    - stabilize grid frequency
    - manage congestion
    - ensure resource adequacy

- **Output**
  - potential revenues (EUR/yr) at five markets:
    - FCR, aFRR, mFRR
    - Day ahead
    - Intraday
  - No co-optimization
  - No revenues from redispatch

Industrial ValueFlex tool

- **7 modules**
  - Load shifting
  - Continuous process
  - Batch process
  - Heat generation
  - Combination of adjustments to process volume & temperature
  - Battery
  - Airconditioning

- **Availability**
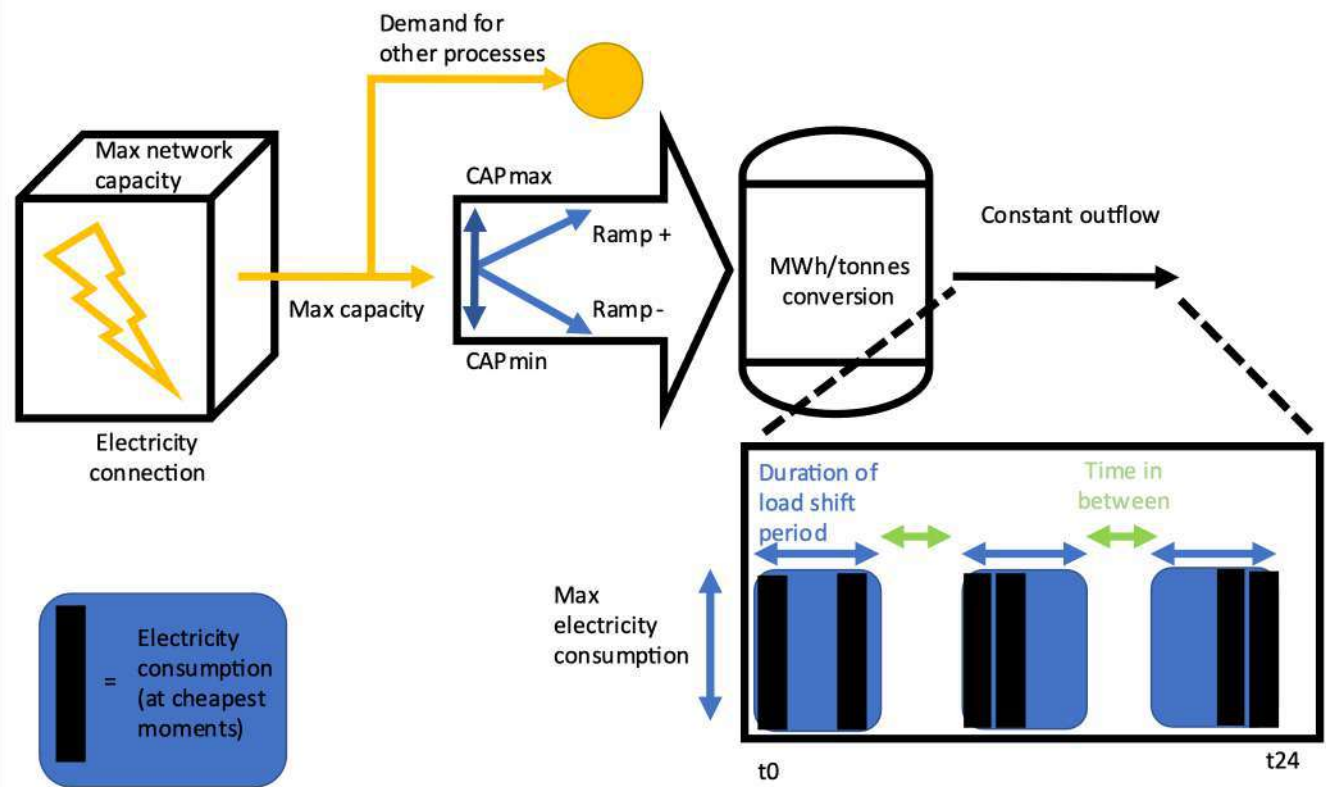 - free download from TenneT website for local use (no confidentiality concerns)

- **Software**
  - programmed in R; input uploaded in an excel file

- **User guidance**
  - provided in the input excel sheet

Module: Load shifting

TenneT Industrial Valueflex Tool
Dashboard

Input sheets

Legend | Formula, do not fill in

Section A - Sector selection

Select the sector (used to prefill certain inputs) | Input

Chemicals - Chlorin ▼

Section B - Characterize electricity market

Day Ahead price series

Please select for which future year you want to modify the prices

Please use the following sliders to adjust the current price series:

How much do you want to add to the average price?

With which factor do you want to multiply the daily pattern

Whith which factor do you want to multiply the noisiness

Result of adjustments

Average daily spread of prices the model uses

Section C - Characterize Network Tariff

Network tariff for electricity	Input
Your selected region	Netherlands
Please select your DSO and your connection type	Stedin - LS ▼
Please specify the contracted capacity value	10.000,00
Your kWmax price is:	0,80

Network tariff for Natural gas	Input
Your selected region	Netherlands
Please specify the contracted capacity value	100.000,00

Section D - Characterize carbon costs

Carbon costs	Input
Your selected region	Netherlands
Does your installation fall under EU ETS?	No
What are the EU ETS carbon costs?	No

General	Value	Unit
What is your electricity consumption in parts of the plant not considered here?	1,00	MWh / year
	8	h
	24	
What is the amount of electricity needed for your process per period of load shifting?	0,00	MWh
	1	h
How many hours of zero electricity consumption does your process need between each period of load shifting		
What is the maximum electricity input into your process?	20,00	MW
Share of time that the plant is operating / available to operate:	75	%

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Summary output sheet

	A	B	C
	Section A - Total possible revenue on each market		
	Market	**Revenue**	**Unit**
	Day ahead market	€ 14,075,024	euro / year
	Intra day market	€ 14,375,599	euro / year
	FCR market	€ 36,666	euro / year
	aFRR market	€ 2,677,745	euro / year
	mFRR market	€ 1,065,560	euro / year
	Section B - User Inputs Overview		

⚡TenneT

TenneT is a leading European grid operator. We are committed to providing a secure and reliable supply of electricity 24 hours a day, 365 days a year, while helping to drive the energy transition in our pursuit of a brighter energy future – more sustainable, reliable and affordable than ever before. In our role as the first cross-border Transmission System Operator (TSO) we design, build, maintain and operate 23,900 km of high-voltage electricity grid in the Netherlands and large parts of Germany, and facilitate the European energy market through our 16 interconnectors to neighbouring countries. We are one of the largest investors in national and international onshore and offshore electricity grids, with a turnover of EUR 4.5 billion and a total asset value of EUR 27 billion. Every day our 5,700 employees take ownership, show courage and make and maintain connections to ensure that the supply and demand of electricity is balanced for over 42 million people.

Lighting the way ahead together.

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