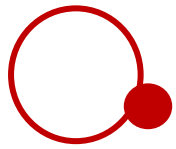




## Efficient dynamic grid balancing by power plants with self-synchronising clutches

ENTSO-E GC ESC  
27 June 2024



# The Challenge

## Grid Stabilisation

for systems dominated by inverter-based generation



**Capacity provision**  
(adequacy problem)



## Dynamic grid balancing

(inertia, voltage & power control, short circuit power)

### FREQUENCY STABILITY IN LONG-TERM SCENARIOS AND RELEVANT REQUIREMENTS

03 December 2021

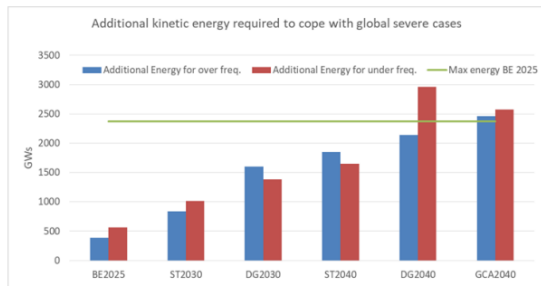


Figure 4: Total kinetic energy demand per scenario to control global severe splits in all hours (sum of maxima of Figure 3).

“ To provide an indication of the amount of additional inertia needed to cope with the consequences of global severe splits, the inertia values above can be broadly translated into the inertia provided by hypothetical conventional power plants. This would correspond to 400 additional units (100 GW of installed capacity) in 2025 and 2000 units (500 GW of installed capacity) in 2040, each hypothetical unit having an exemplary power of 250 MW and an inertia constant of 5 seconds. ”

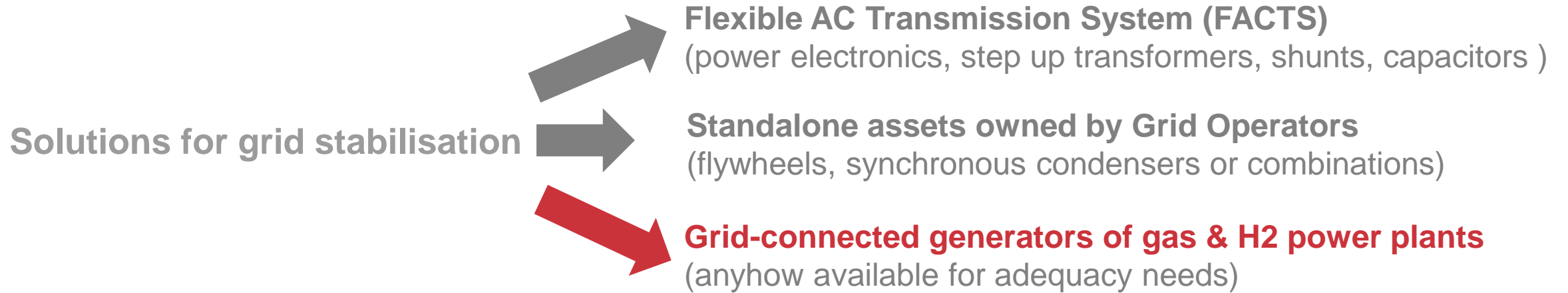
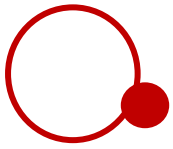
Source: ENTSO-E Report “FREQUENCY STABILITY IN LONG-TERM SCENARIOS AND RELEVANT REQUIREMENTS” (Dec 2021)

## PAST:

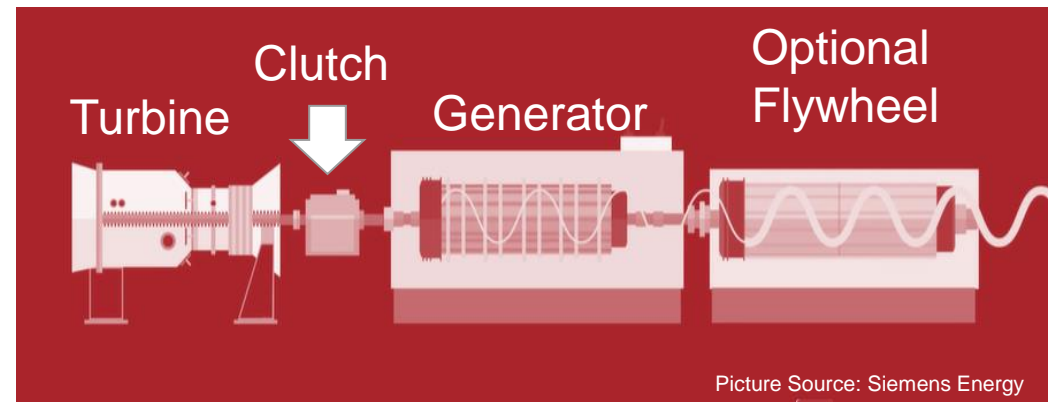
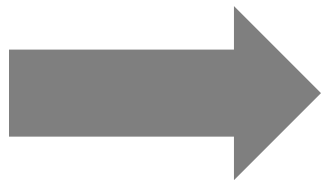
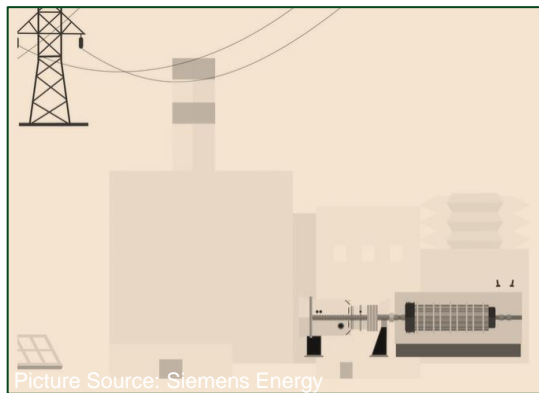
“free” grid stabilisation from rotating masses of thermal power plants operating in baseload

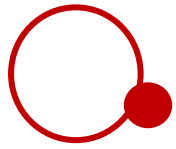
## FUTURE:

coal power plants retire; most gas power plants only cover residual loads  
-> inertia not available constantly

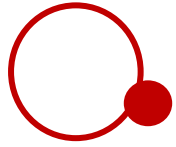


## Installing a self-synchronising clutch between turbine and generator





- 🕒 Use of anyhow existing generators instead of new dedicated synchronous condensers
- 🕒 Grid operators can focus on core competences
- 🕒 New power plants often built at locations with existing grid connections and transformers
- 🕒 Costs compared to separate stand-alone synchronous condenser or FACTS plants:
  - lower one-time investment costs
  - lower additional operating and maintenance costs
- 🕒 Power plants with limited income from operating hours can benefit from additional reliable revenue streams from selling grid services – easing plant investment decisions
- 🕒 Many governments remunerate the power plants for “being available” with capacity payments – using the available technology and bundling capacity and grid service payments increases system efficiency
- 🕒 Technology is available and installed globally already in hundreds of applications
  
- 🕒 *For “old plants” not delivering active power or lacking space, permanently disconnecting turbine and generator is possible – but as plants have not been optimised for synchronous condensing, the operating costs are higher*



**Using decoupling-capable gas and hydrogen power plants for providing grid stabilisation as an alternative to separate, dedicated solutions, reduces the overall electricity system costs borne by energy consumers and governments.**

More info at our website: [Spotlight on: Using Power Plants for Grid Stabilisation | EUTurbines](#)