Flexibility in Uniper Asset Operations

Michael Rahilly, Head of Service, Uniper Asset Operations

ESKOM – Siemens – VGB Flexibility Knowledge Exchange

Overview

Uniper’s European generation portfolio

European market changes and the need for flexibility

Uniper’s successes in flexibility improvement

Uniper’s decarbonisation, evolving our assets

Michael Rahilly

Head of Service
Asset Operations

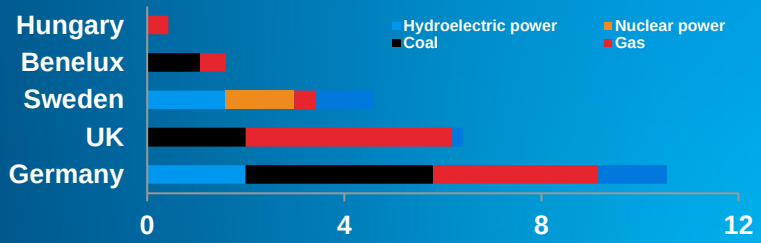
Uniper Kraftwerke GmbH

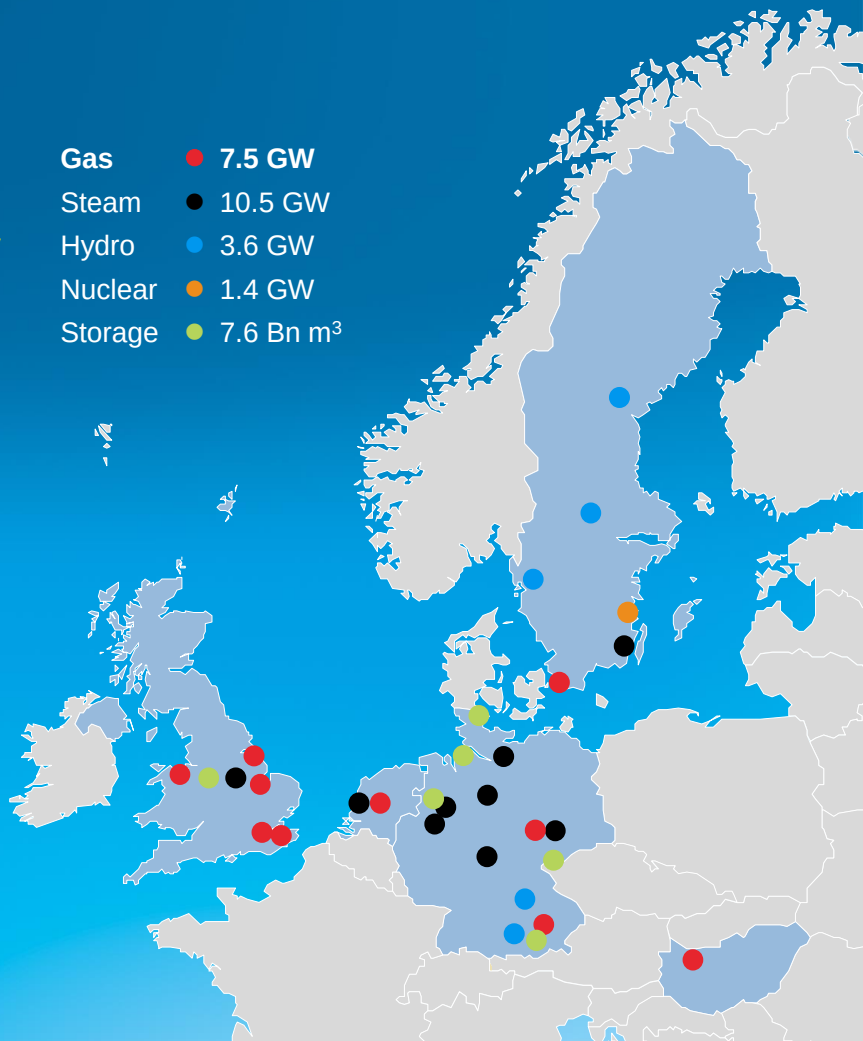
Our European asset portfolio

Our highly flexible and adjustable power plants and storage sites ensure a sufficient and reliable power supply

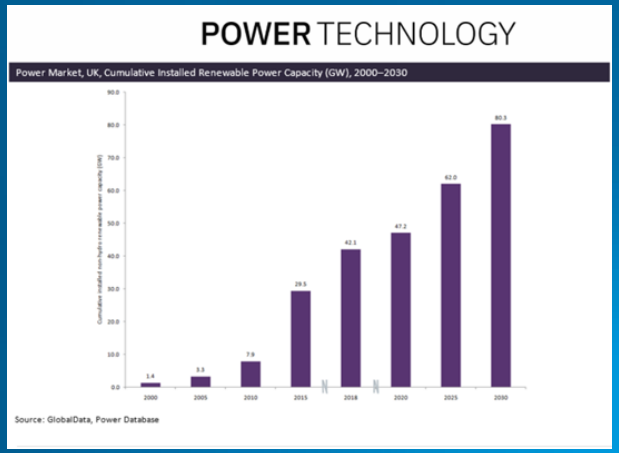
- With around 34 GW of installed generation capacity, we are among the largest global power generators.
- Thanks to our high proportion of hydroelectric and gas plants, our power plant complex is especially environmentally friendly.

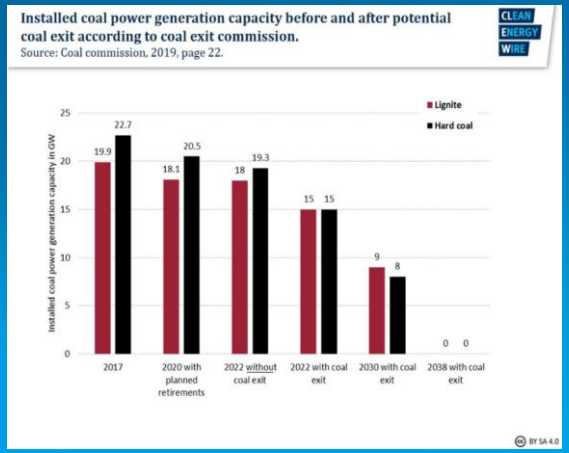
23 GW power Generation in Europe[1]





European markets continue to change rapidly





- → Reduction in absolute MWh & increase in starts from coal and gas units
- → Gas & remaining coal switch on short run marginal costs (fuel)
- → Change in operating regime for coal and gas power plants from base load to flexible
- → Grid Stability Services
- → Ultimately Coal Phase - Out

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Understanding Market Requirements

What the market rewards now & what it will reward in the future?

Competitive position in the market, competitor activity & aspiration?

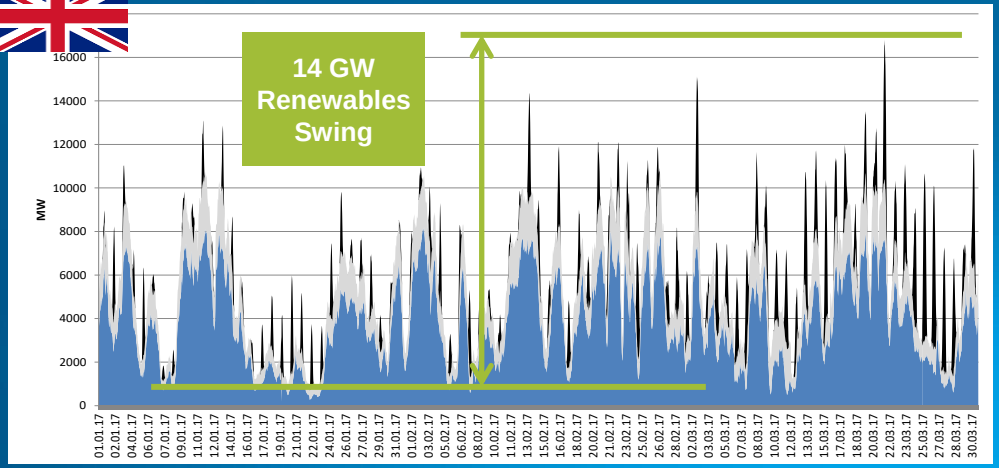
Role in market & potential role for future?

Is the market rewarding “flexibility” and “reliability”?

What market and regulatory changes are on the horizon?

What market information & analysis is available to base decision making?

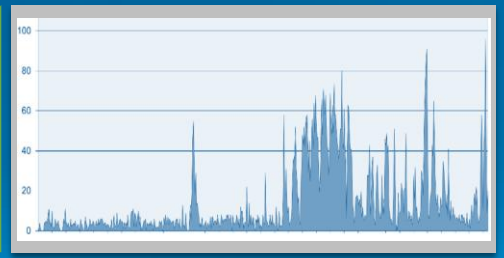
Flexibility means different things in different markets at different times



Grid Congestion

Detailed market, grid and scenario modelling Involves the whole organisation

Uniper's flexibility improvements, meeting market needs



Grid Responsive

Investment Black Start Capability

>50% reduction sync time for Hot & Cold Starts

Cheaper to start with less damage

Two simultaneous unit starts & reduced time between unit starts

Faster to full load

10% reduction in Hot Start time to full load

25% fuel oil cost reduction per Hot Start

Attractive to run

10% reduction in $/MWHr

>25% Reduction in Minimum Stable Generation

Increased Ancillary Services; Freq Response, MVAR

Faster off-load

60% reduction in time to shut down

Improved off-load pressure retention and preserving

Faster off-on load

Double & Triple Two-Shifting

Better off-load preservation

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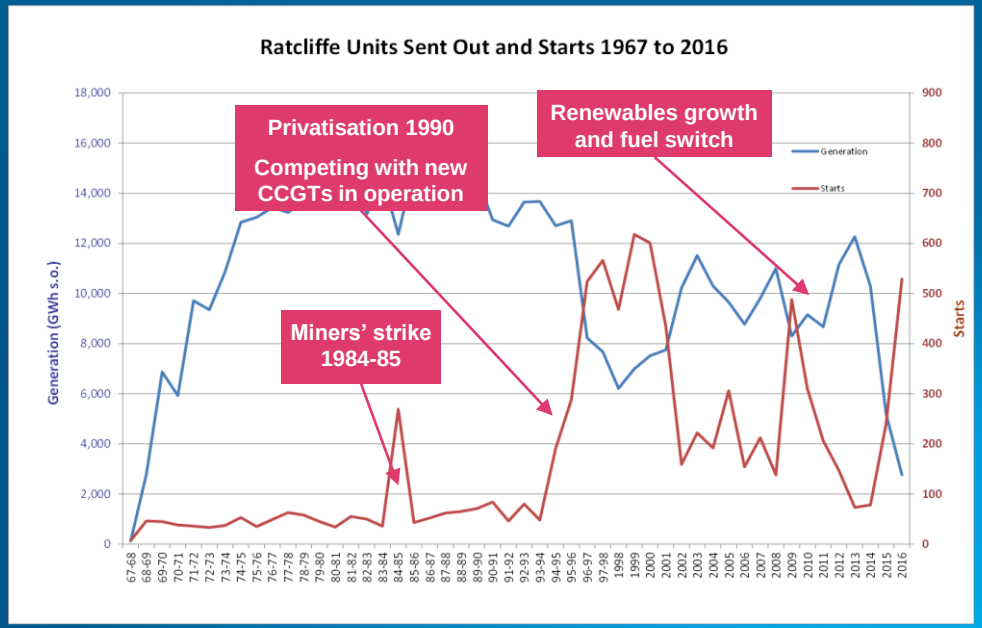
Ratcliffe, UK, Response 4 x 500MW sub-critical units



Different scenarios at different times
From baseload to two-shifting to summer cold
to non-energy services

Heyden, Germany, 875MW Supercritical unit

Single burner operating mode

Minimum load reduced to ~11%

2015: Assessment and evaluation of technical and commercial viability

2016: Planning and implementation of testing on-site

2017: Optimisation, now available as normal mode of operation since 01.06.17

But ultra low load operation is a trade-off between the need for flexibility and plant capabilities

Plant requirements for ultra low load

Need for reduced steam temperatures for operation	• Ramp down notification must be 1 hour prior to operation
Operation incurs boiler slagging and does not generate sufficiently pressurised steam for sootblowing	• Maximum of 8 hours continuous operation • Post ultra low load, unit runs at min 50% load for 3 hours for full soot blowing
Risk of slagging of heat exchangers during shutdown	• Unit cannot be shutdown from ultra low load operation
Single mill operation	• Risk of trips is high due to reduced redundancy • Operation depends on availability of dedicated mills

Heyden plant constraints for ultra low load

- **Rigorous Management of Change Processes**
- **Engineering expertise, modelling and due diligence**
- **Well managed risks and continued Process Safety**

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Future of our asset portfolio

Empower Energy Evolution – Towards carbon neutrality

Hydro | Nuclear | Clean Thermal Generation | Renewables | Green Gas

→ With already a strong position in Hydro and Nuclear business, we are taking joint steps to develop further activities in Clean thermal generation, Renewables, and Green gas, which will enable us to reach the carbon neutrality target in 2035.

Uniper's evolution into a profitable greener future

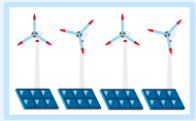
Coal Generation	Gas generation & gas midstream	Carbon-free generation
EBIT 2019	EBIT 2019	EBIT 2019
Decarbonize	Expand & decarbonize	Expand

Continuously develop assets and sites

(e.g., through Masterplans)

Decarbonize gas-fired generation

Shape Hydrogen sector



Develop renewables portfolio

Modernize power plants in Russia

Further develop commodity businesses

(e.g., Wilhelmshaven LNG)

Develop innovative business models

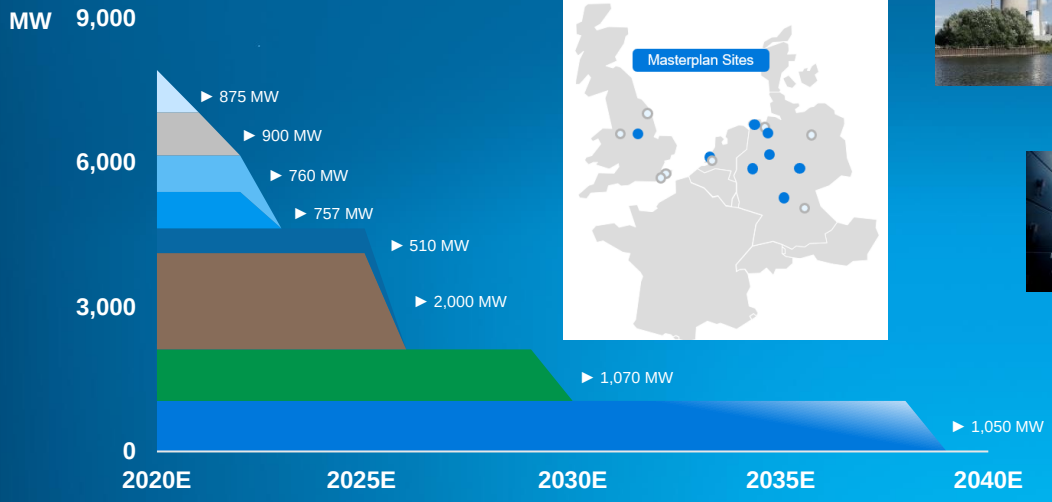
Grow & decarbonize our customer's businesses

Halmstad GT modernization and upgrade

Edsele battery project

Transformation at Uniper's brownfeld sites

De-risking our portfolio and protecting cash flows to seize new investment opportunities



New solutions

- Plans for own and 3rd party use
- Offering power assets & services for new applications or new security-of-supply solutions

Site conversion to industrial hubs

- Attract new customers to sites
- Expansion of own energy-related activities, e.g. waste-to-energy, servicing new data centers

Site conversion to gas-fired plants

- New CHP plant at Scholven site in execution mode
- Further power plant projects tailored to specific needs in advanced planning mode

Thank you!

If you need any further information, please contact us:

Michael Rahilly
michael.rahilly@uniper.energy

Uniper Kraftwerke GmbH
Holzstrasse 6
40221 Düsseldorf
Germany
www.uniper.energy