

BALANCING SOLUTIONS

The bridge to the future

Towards a 100% renewable energy future

Issues involved in the energy transition have real consequences for everyone on the planet. Current market trends show the energy landscape is transitioning towards more flexible energy systems with a rapidly increasing share of renewable energy, a declining inflexible baseload generation, and a wider application of storage technology.

The declining costs of renewables have begun to reduce new investments into coal and other inflexible baseload technologies; a transition that will eventually cause renewables to become the main source of energy.

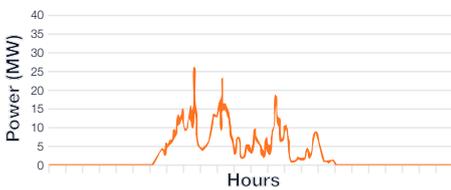
Wärtsilä aims to accelerate this transition towards a 100% renewable energy future. We have the experience to maximise the transition for our customers by analysing customer requirements and building optimal energy systems with lowest total cost of ownership.







An illustrative example of a high irradiation day generation from a solar plant



An illustrative example of a low irradiation day generation from a solar plant

Balancing power

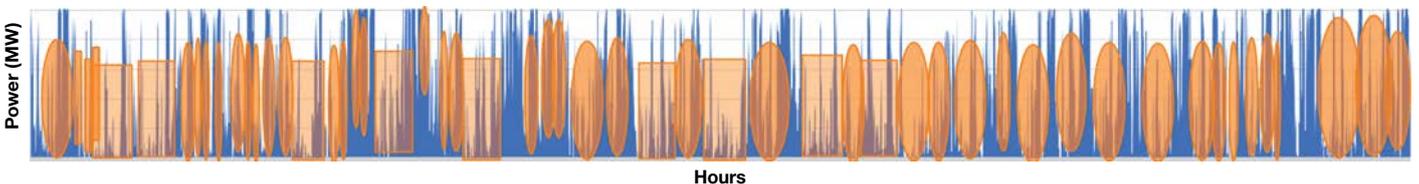
As renewables increasingly displace traditional baseload generation the greater the need becomes to shore up the grid's stability with balancing capacity.

Energy producers need to invest in flexible technologies that provide fast-ramping balancing power that can be scaled up as the share of renewables in the power system increases.

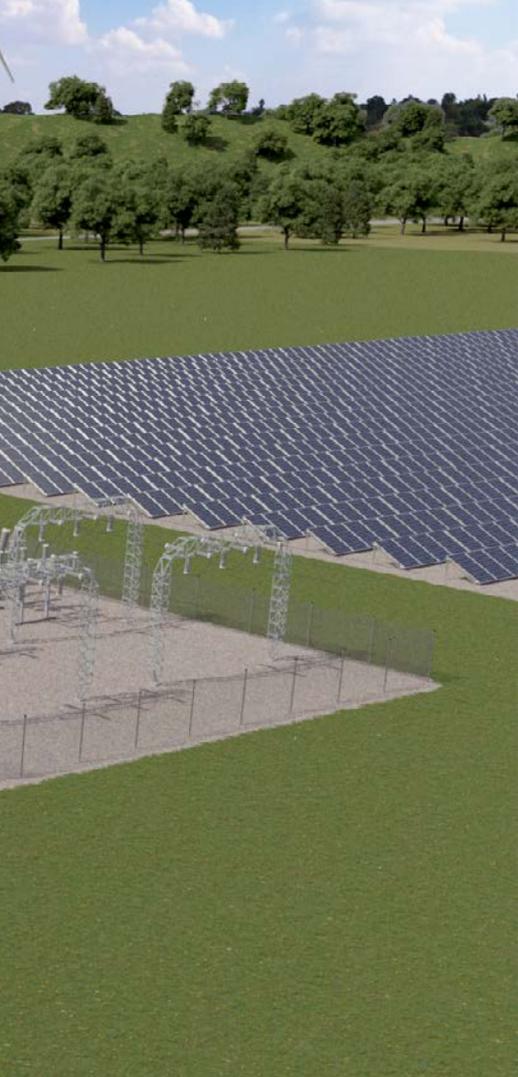
Wärtsilä's flexible and scalable balancing solutions quickly ramp up

whenever renewables aren't generating enough electricity – providing the necessary balancing power to keep the grid stable.

Energy storage solutions help with hour-level firming and dispatchable gas engines for unlimited periods of firming. This protects operators and grids from the peaks and dips of renewable energy, balancing technology makes it easier for them to decarbonise – without jeopardising stability.



An illustrative example of annual wind generation from Southeast Asia (MW). The wind can be 100% generation and reduce to zero within 20 minutes.



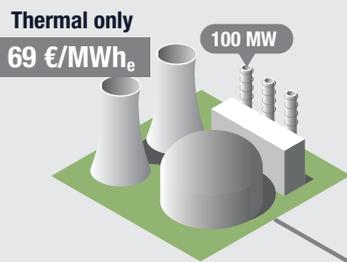
Wärtsilä knows energy

Thanks to our years of experience in global energy systems, Wärtsilä can accurately model the optimal path to 100% renewables for any country or customer. The data shows just how important the role of balancing solutions will be in making the transition as affordable and reliable as possible – all the while slashing greenhouse gas emissions and air pollution, and alleviating land-use and grid construction pressures.

energy sources, gas engines, and energy storage solutions. While the details vary, the goal is always the same: to minimise emissions of CO₂, NO_x, and particulates, maximise the use of renewables, and choose the most profitable and cost-efficient solution.

There's no one path towards a renewable energy future as it varies by location. For many energy operators, the optimal route involves a flexible power system combining renewable

0%
Renewable energy



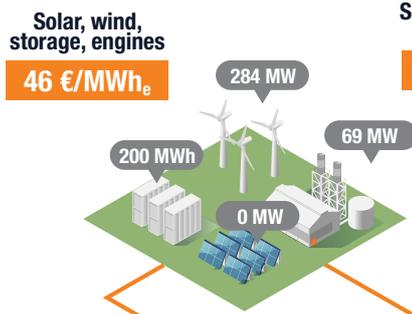
Germany

An optimised transition with the right flexibility taking sector coupling into account

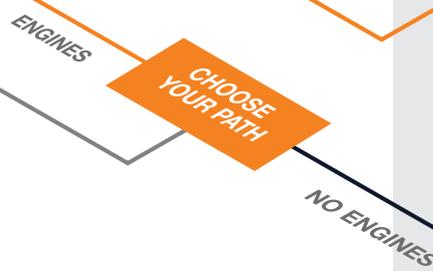
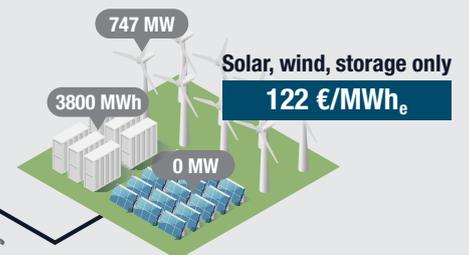
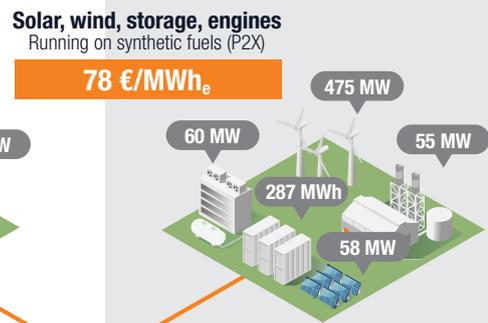
Note: 1. Heat generation assets not shown.

2. Price of heat is 33 €/MWh and derived from heat generation with gas boiler and is same in all scenarios, i.e. heat price is not changing.

76%
Renewable energy



100%
Renewable energy



Our power system modelling results showcase an example of an optimised energy transition scenario with the help of balancing technologies.

Wärtsilä's future-proof balancing portfolio

Wärtsilä's balancing portfolio is a full solution portfolio focusing on understanding the customers and their path towards optimised renewable generation in their specific locations. In order to calculate the most cost-efficient and reliable route towards 100% renewables, we rely on advanced modelling capabilities based on proven data sources.

The core aim of our work is to create a future-proof energy system where

the use of renewable energy can be maximised and the solutions formulate an entity that is greater than the sum of their parts. We test how engines and storage systems communicate, develop ramp up capabilities and optimise dispatching with advanced energy management systems.

Our balancing engines will be able to run on any future fuels, no matter which fuel type is the dominate one. Already

today, they can use natural gas, biogas, synthetic methane or hydrogen blends.

We're also actively researching hydrogen and other future fuels to eventually enable a fully decarbonised power system which still has a security of supply from flexible, dispatchable gas engines generating electricity when required.

Flexible

Our balancing power plants can be adapted to different operation profiles and running hours, so you can integrate renewables seamlessly into your energy mix as they come on-stream.

Today, our plants can already run on biogas and hydrogen blends. Our fuel-pioneering R&D is continuously working on adapting solutions to future fuel alternatives.

Profitable

With outstanding efficiency, fast start-up times and a wide load range, our balancing solutions are well poised to maximise the revenue stack in a dynamic balancing market.

Lower investment costs thanks to high power density and optimised plant designed for balancing.

Remote monitoring and control require fewer people on the ground.

Reliable

We've delivered over 74 GW power plant capacity in 180 countries – we know when a technology works. This technology has clocked over 43 million hours of run time with up to 99% year-round reliability in the plants we operate.

We provide 24/7 support from our Expertise Centres to customers with Wärtsilä Lifecycle solutions.



Maintaining and optimising power plant performance is critical for business success. No single technology, software, service, or skill can ensure optimal lifecycle performance. Having a holistic view and understanding power generation on a system level is the key to comprehensive lifecycle solutions and improved performance.

 **Wärtsilä Guaranteed asset performance**

Ensure power plant performance

- Performance guarantees
- Services and support from Wärtsilä Expertise Centres
- Maintenance by Wärtsilä

 **Wärtsilä Optimised maintenance**

Ensure safe and reliable operations

- Maintenance cost predictability
- Services and support from Wärtsilä Expertise Centres
- Maintenance by Wärtsilä

 **Wärtsilä Optimised care**

Ensure optimised lifecycle support

- Cost-optimised maintenance strategy
- Services and support from Wärtsilä Expertise Centres
- On-demand maintenance by Wärtsilä

 **The solution is customised to your operating profile:**

- Performance guarantees
- Business model
- Operation model
- Maintenance model
- Service modules

Our experts and expertise centres serve you all the way



WÄRTSILÄ ENERGY

Wärtsilä Energy leads the transition towards a 100% renewable energy future. We help our customers in decarbonisation by developing market-leading technologies. These cover future-fuel enabled balancing power plants, hybrid solutions, energy storage and optimisation technology, including the GEMS energy management platform. Wärtsilä Energy's lifecycle services are designed to increase efficiency, promote reliability and guarantee operational performance. Our track record comprises 74 GW of power plant capacity and more than 80 energy storage systems delivered to 180 countries around the world.



LEARN MORE

wartsila.com/energy/balancing