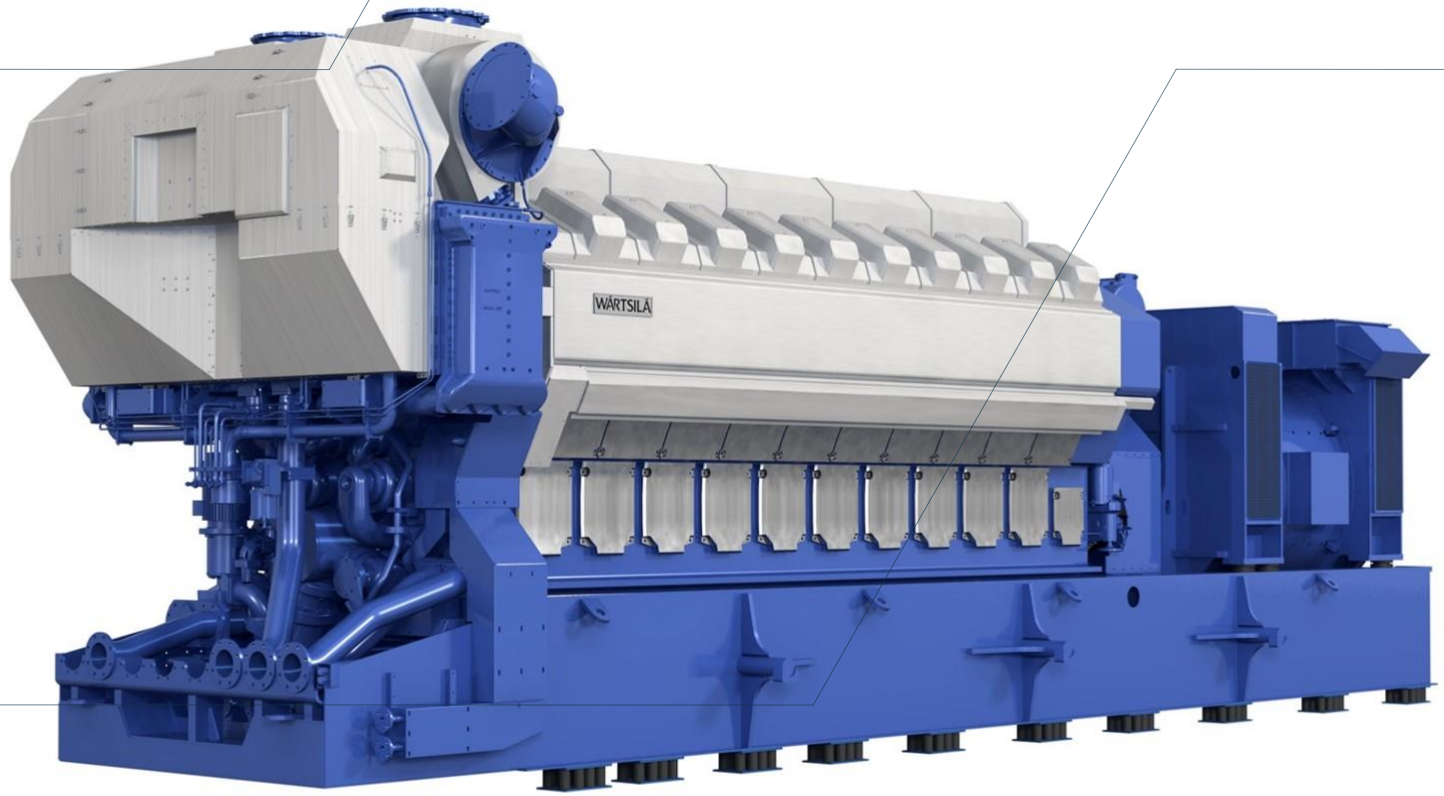
Wärtsilä 32 Generating set



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Content

Introduction

Wärtsilä flexible baseload power plants

For cost conscious independent power producers

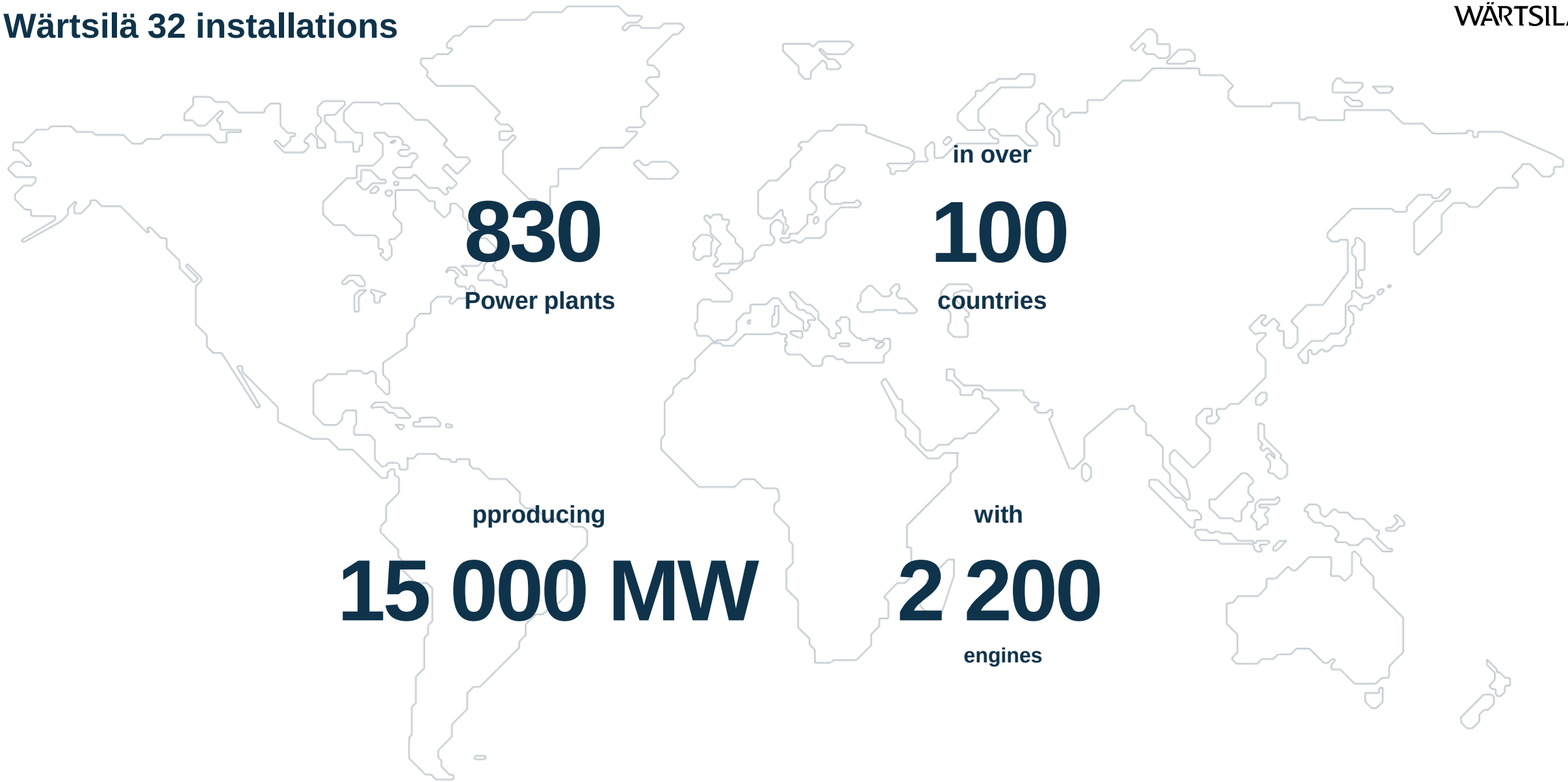
Wärtsilä solutions help to provide an efficient, reliable and cheap source of energy

For factories, industries and the grid

Enough spinning reserve for balancing whenever needed

Wärtsilä 32

Wärtsilä 32 installations



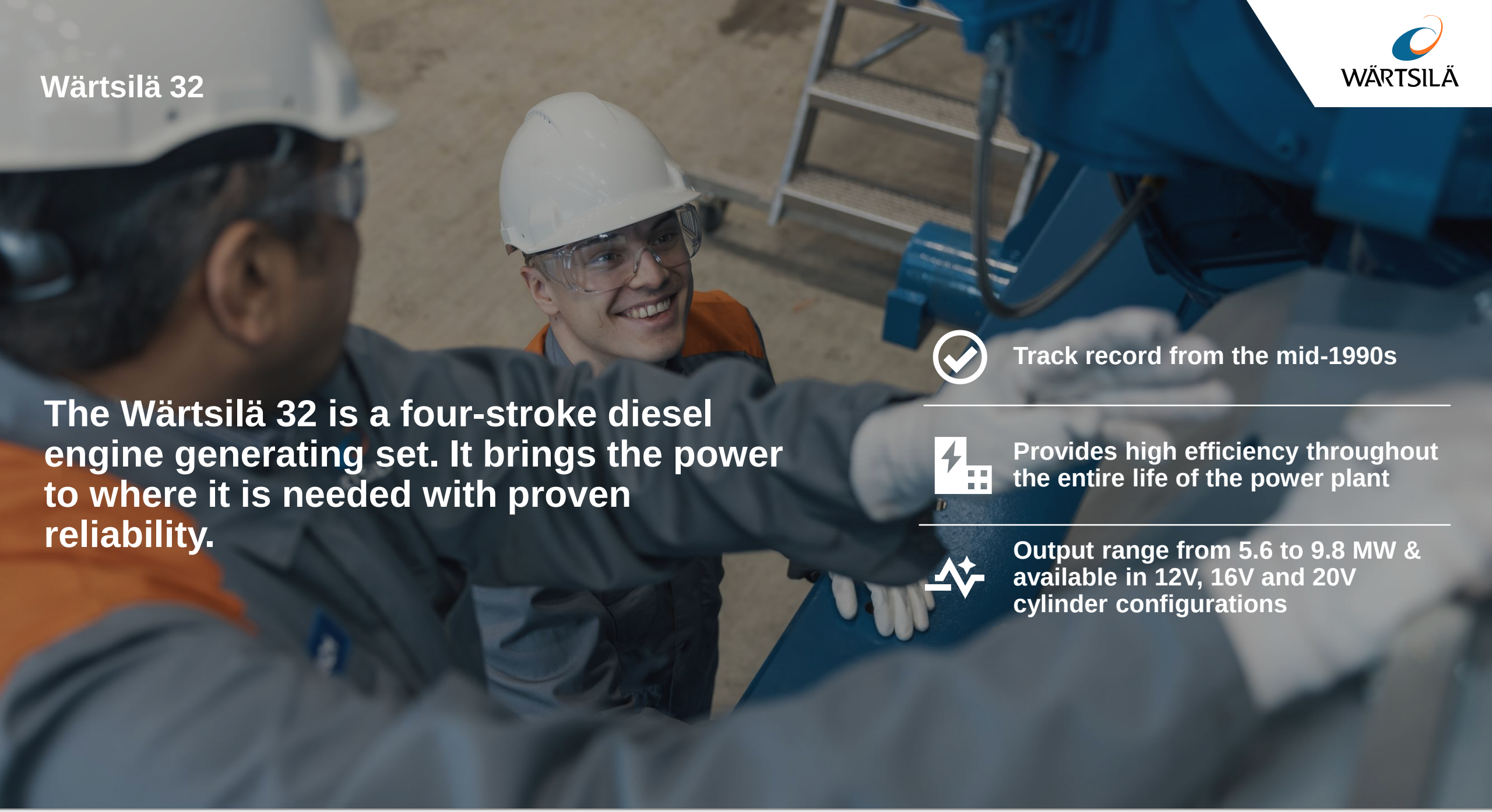
830
Power plants

in over
100
countries

pproducing
15 000 MW

with
2 200
engines

Wärtsilä 32



The Wärtsilä 32 is a four-stroke diesel engine generating set. It brings the power to where it is needed with proven reliability.

- Track record from the mid-1990s
- Provides high efficiency throughout the entire life of the power plant
- Output range from 5.6 to 9.8 MW & available in 12V, 16V and 20V cylinder configurations

Main benefits

Low operating cost

Compact sizing enables transportation to demanding locations

Proven in service for decades

Operates on liquid biofuels, crude oil, light fuel oil and heavy fuel oil

Optimised performance and efficiency supported by Wärtsilä Lifecycle solutions

Key figures

2

Minutes to full load

47.6

% Electrical efficiency

Over

60

Million running hours

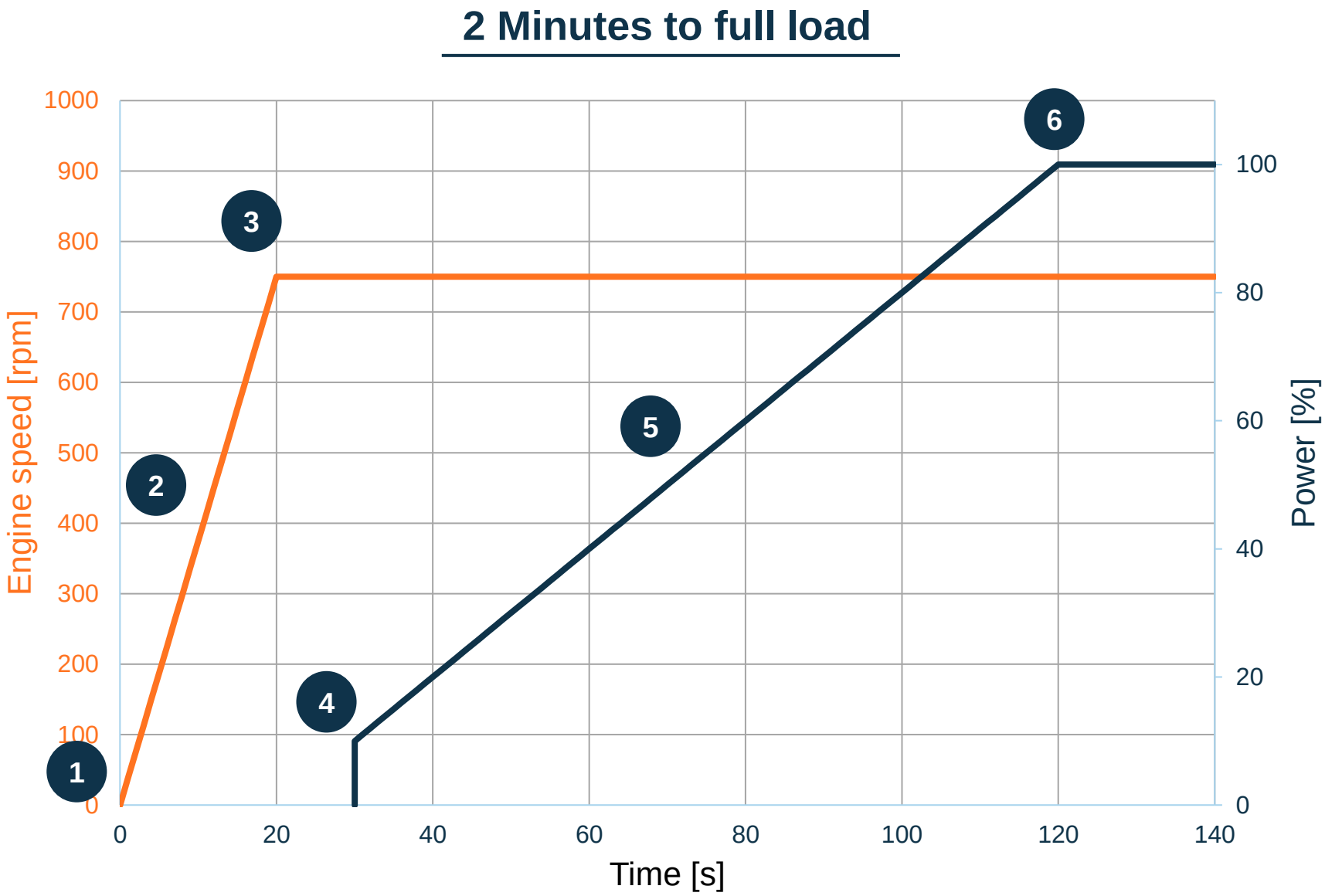
Technical data

PARAMETER	Wärtsilä 32 5% tolerance without pumps 50Hz / 60Hz	Wärtsilä 32 0% tolerance and with engine driven pumps 50Hz / 60Hz
Output (MW_e)	5.6 – 9.8	
Engine speed (rpm)	750 / 720	
Electrical efficiency (%)*	HFO: 47.2 / 47.4 LFO: 47.4 / 47.6	HFO: 44.5 / 44.6 LFO: 44.6 / 44.8
Heat rate*	HFO: 7 622 / 7 592 LFO: 7 599 / 7 563	HFO: 8 097 / 8 066 LFO: 8 073 / 8 035
Bore / stroke (mm)	320 / 400	
BMEP (bar)	24.9 – 28.9	
Piston speed (m/s)	9.6 / 10.0	
Cylinder configurations	12V, 16V, 20V	
NO_x Optimisation (ppm) (@ 15% O2, dry)	710 (LFO) & <900 (HFO)	

Rated electrical power, heat rate and electrical efficiency are given at generator terminals at 100kPa ambient pressure, 25°C suction air temperature and 30% relative humidity. Power factor 1.0 (site). Fuel consumption with 5% and 0% tolerance according to ISO 3046-1. Site conditions, fuel and applicable emission limits have an impact on performance figures. Please contact Wärtsilä for project-specific performance data. Catalyst systems are designed based on project specific requirements. Certain fuel components are poisonous for catalyst elements. Maximum amount of these components to be limited in the fuel in applications where catalyst system is installed.

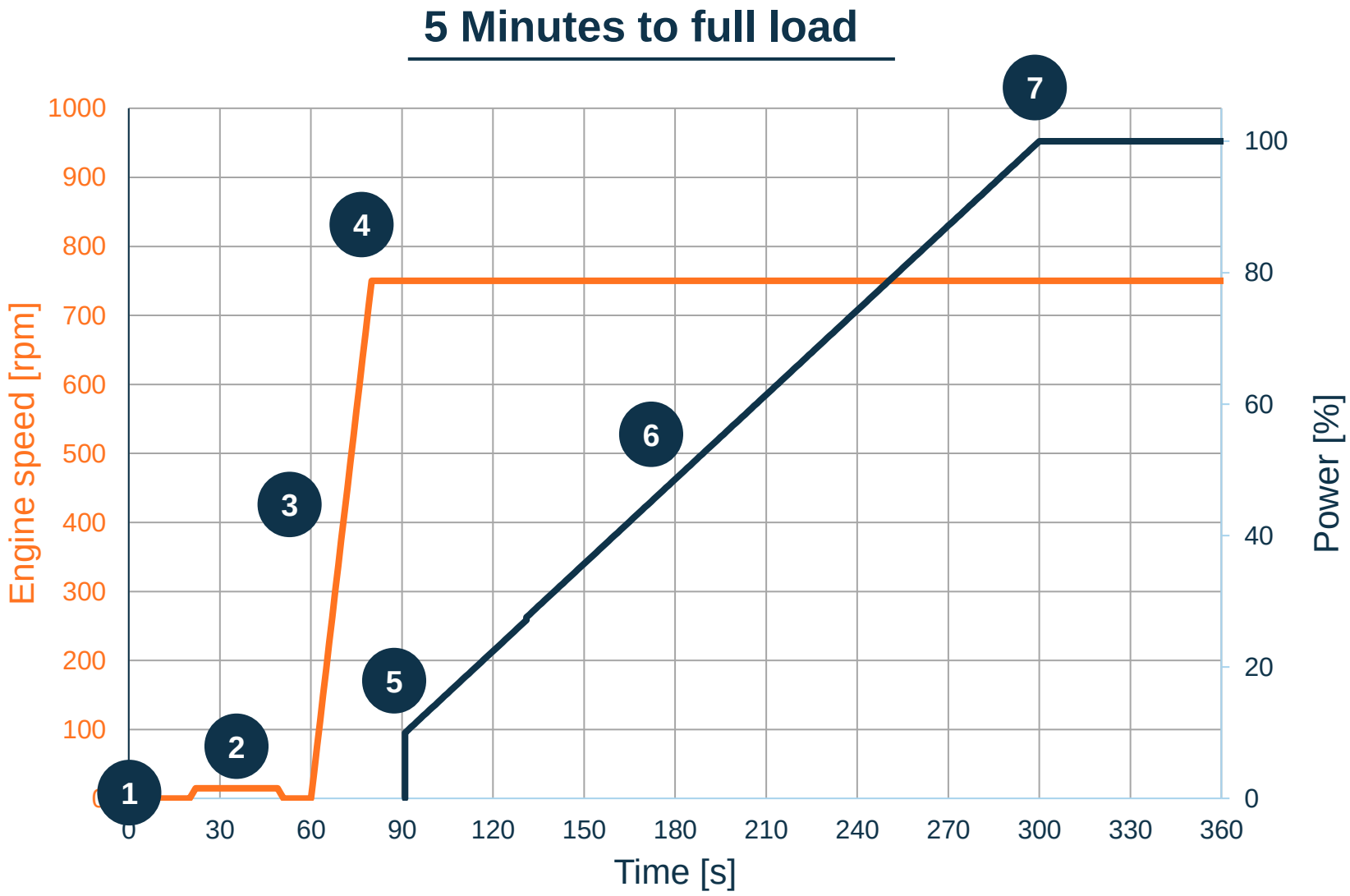
Loading capabilities

1. **Start-up command**
2. **Speed acceleration within 20s**
3. **Synchronization within 10s**
4. **Generator breaker close command**
   - Initial load 10%
5. **Loading at rate of 1%/s**
6. **Full load reached within 120 s**



Loading capabilities

1. **Start-up command**
2. **Start-up preparations**
   - Activation of prelubrications
   - Slow turning
3. **Speed acceleration**
4. **Synchronization**
5. **Generator breaker close command**
   - Initial load 10%
6. **Loading at rate of 0,5 %/s**
7. **Full load reached within 5 min**



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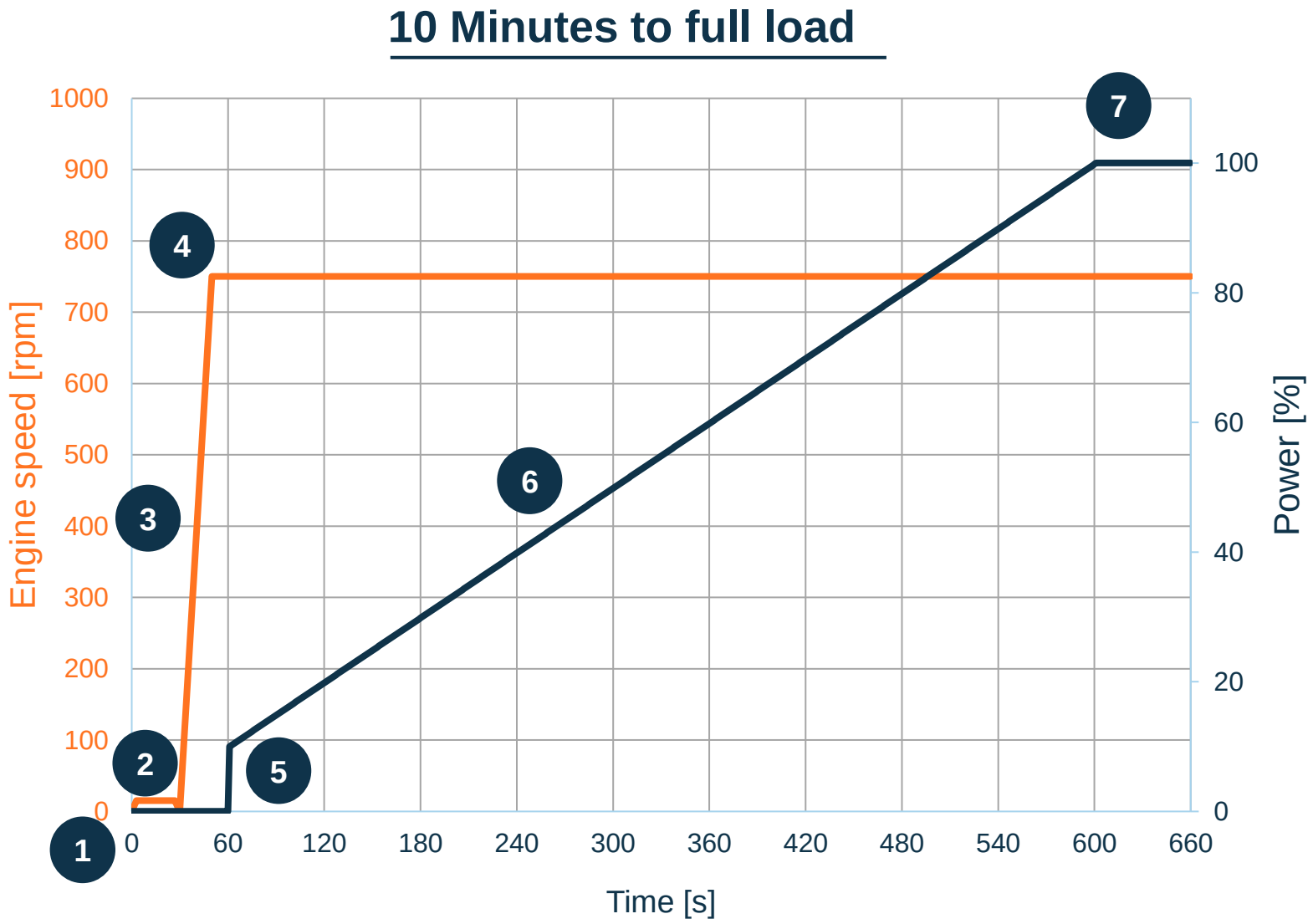
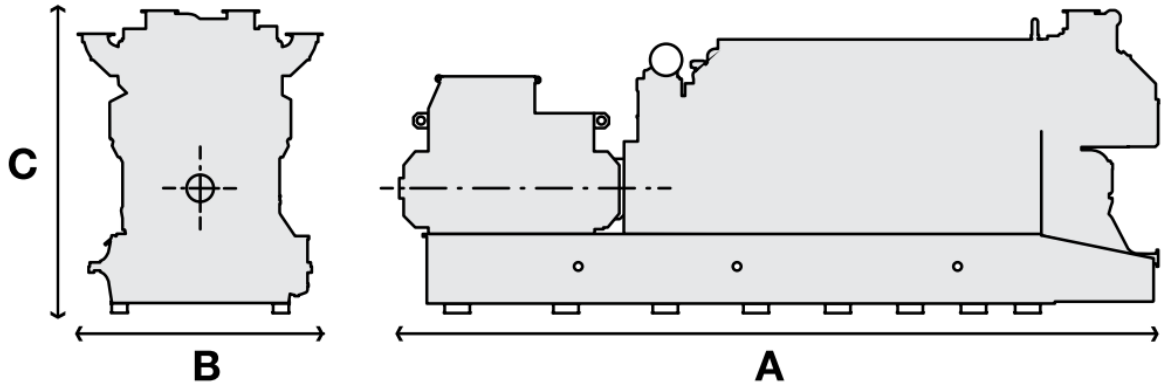


Maximum transportation dimensions (mm) and weights (tonnes)



Genset type	Lenght (A)	Width (B)	Height (C)	Dry weight
12V32	10 226	3 000	4 104	92
16V32	11 189	3 300	4 483	117
20V32	13 142	3 300	4 342	130

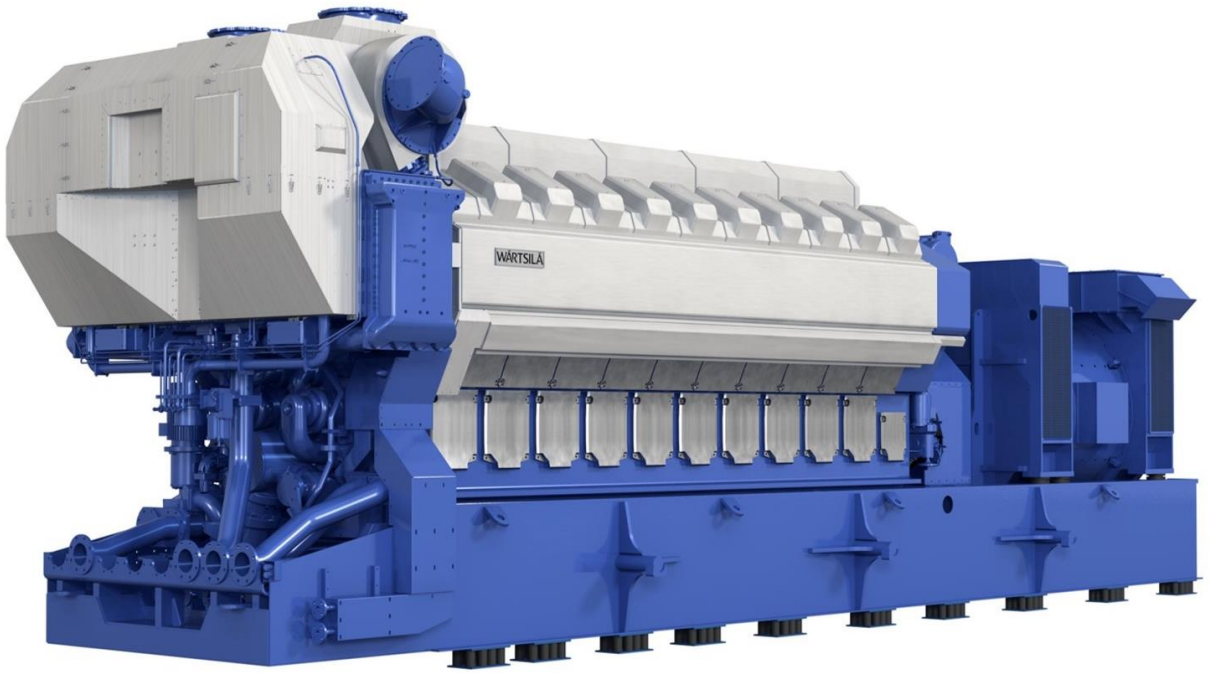
Summary

Summary

1 Operates on liquid biofuels, crude oil, light fuel oil and heavy fuel oil

2 It provides high efficiency throughout the entire life of the power plant.

3 Compact sizing enables transportation to demanding locations



References

Geita Gold Mine

Senegal

Customer	**AngloGold Ashanti**
Type	Wärtsilä 32TS based power plant
Operating mode	Baseload
Gensets	4 x W32TS
Total output	40 MW
Fuel	Light fuel oil (LFO)
Scope	Engineering, procurement & construction (EPC)
Lifecycle solution	10-year Operation & Maintenance (O&M) agreement
Delivery	2018

“When it came to building the new plant, establishing an O&M service package we could count on was integral to the solution’s overall success. Wärtsilä’s ability to provide reliable, cost-efficient power generation therefore makes them an important partner for us. An outage of just a couple of minutes can lead to an hour of lost production – so far, we haven’t suffered a single shutdown. Knowing that Wärtsilä is taking good care of our power needs means we have one less thing to worry about.”

Oliver Milambo
Commodity Manager, AngloGold Ashanti

The existing power plant is running **on 4 Wärtsilä 32** engine generating sets running on light fuel oil (LFO).

All four of the plant’s **performance targets** – availability, net heat rate, power capacity and specific lubricant consumption – **have been exceeded**.

The **fuel efficiency** has **improved from 39% to around 43%,** leading to approximately **$2 million USD of fuel savings** in 2019.

ItalGreen

Italy

Customer	**ItalGreen Energy (Casa Olearia Italiana Group)**
Type	Combined Heat and Power
Operating mode	Flexible baseload
Gensets	3 x Wärtsilä 18V32
Total output	24 MW
Fuel	Biofuel
Scope	EEQ (Engineered Equipment Delivery)
Delivery	2003 & 2005

“The high level of knowledge and experience of the people involved, on both the ItalGreen Energy and Wärtsilä sides, together with a good working relationship, have been key factors in helping us reach our targets. We are happy to see that the tough work, especially at the fuel testing stage, has been well rewarded. All of us can be proud of this project and its results.”

Leonardo Marseglia
President of COI

Wärtsilä was contracted to **extend a liquid biofuel-fired plant** in Monopoli, on the southeast coast of Italy. The contract comprised a third Wärtsilä 18V32 diesel generating set fired by vegetable oil.

The three units have been at full load in commercial operation since their installation, with **an average plant availability of over 95%**.

Previously, Wärtsilä had **been selected to supply the first two generating sets** (2 x 8 MWe).

Mansourah-Massarah

Saudi Arabia

Customer	**Ma’aden**
Type	Wärtsilä 58 MW hybrid power plant
Operating mode	Baseload
Gensets	6 x Wärtsilä 20V32TS
Total output	58 MW
Fuel	Liquid fuel
Delivery	2021

“Wärtsilä’s proven track record of providing power generation solutions for mines, along with their strong presence in Saudi Arabia, made them an obvious potential choice to supply the power generation technology for this project. Wärtsilä’s solution will improve performance and provide significant lifetime cost savings for the project, which has made the decision to move away from rental generation easy.”

Muaffag Mohammed Abbas
Mansourah-Massarah gold project, Project Director, Ma’aden

The solution will comprise a hybrid concept 58 MW power plant encompassing **6 Wärtsilä 32TS engines** that enable and prioritise the use of photovoltaic (PV) solar power.

A lifecycle cost analysis also revealed that while requiring a higher initial capital expenditure, **opting for an owned power plant rather than rental generation would offer substantial savings in the longer term**.

The mine and mineral processing plant is expected to produce **250,000 ounces of gold annually**.

Syama

Mali

Customer	**Resolute Mining Limited**
Partner	Aggreko Power Solutions
Type	Wärtsilä Modular Block
Operating mode	Flexible baseload
Gensets	4 x Wärtsilä 32 medium-speed engines
Total output	40 MW
Fuel	Heavy fuel oil
Scope	Engineered Equipment Delivery (EEQ)
Delivery	Operational in 2020

The existing solution is equipped with **4 Wärtsilä Modular Block encolsures**, each equipped with a **Wärtilä 32 engine**.

The mine is the **world's first fully automated underground mining gold mine.**

This project is the **very first** order of the **Wärtsilä Modular Block** – a prefabricated, modular, configurable and expandable enclosure for sustainable power generation.

Riyadh

Saudi Arabia

Customer	**Riyadh Cement Company**
Type	Wärtsilä 32 liquid fuel power plant
Operating mode	Flexible baseload
Gensets	12 x Wärtsilä 20V32
Total output	97 MW
Fuel	HFO
Scope	Engineering, procurement & construction (EPC)
Delivery	2005, 2008, 2010

The existing power plant is running on **12 Wärtsilä 32** engine generating sets running on heavy fuel oil.

Reliability, high operational efficiency and **uninterrupted electricity flow** secures continuous cement production.

The engine generating sets are **suitable for extreme weather conditions**.


WÄRTSILÄ