BALANCING A RENEWABLE GRID
ENGINES V. TURBINES

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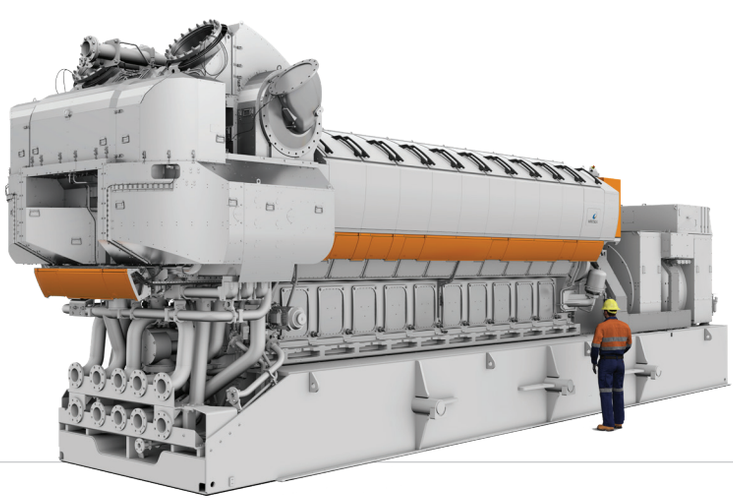
Engine power plants offer flexible, efficient, and reliable power generation; providing an ideal solution to utilities as they pursue renewable energy and decarbonization goals.

Wärtsilä engines can respond to any grid needs within five minutes, maintain high performance under extreme operating conditions and are fuel flexible — able to run on natural gas, biogas, fuel oil, LPG, other liquid fuels, and hydrogen blends



3 KEY ADVANTAGES OF ENGINES

HIGH EFFICIENCY

Highest efficiency in Open Cycle mode

NO COST FOR STARTING

Balancing application requires frequent starts and stops

FLEXIBLE DYNAMIC CHARACTERISTICS

Highest cycling capability (unlimited and fast daily cycles)

The 400 MW Power Plant

Reciprocating Internal Combustion Engine v. Combined Cycle Gas Turbine

	Aspect	Reciprocating Internal Combustion Engine	Combined Cycle Gas Turbine
Efficiency *(Conversion of Fuel to Electric Energy)*			
	Base Load	47% Open cycle - 50% (Combined cycle)	55%
	3 hour cycle	47% with 1200 MWh	46% with 770 MWh
Resiliency			
Water	Quantity per month	0 m3	500,000 m3 (cooling)
Gas	Lowest operational pressure	5 Bars	20 Bars
Temperature	40 C	3% capacity derate – 390 MW	20% capacity derate – 320 MW
O&M			
Variable Cost	Base load	5.00 $/MWh	3.0 $/MWh
(Scenario: 500 starts/stop per year & 1500 running hours)	Cycling Mode	5.00 $/MWh	21.0 $/MWh
Dynamic Characteristics			
Starting Time	Hot starting time to full load/output	5 minutes	1 ½ hours
Starting Cost ($10 MMBtu gas price)	500 starts per year	$75,000 per year $150 per start (for fuel)	$12.5 Million per year $25,000 per start ($22,000 in additional maintenance cost) + $2,400 (fuel as 1 ½ hour needed)
Minimum Stable Load	Lowest continuous output	10% of each unit capacity	50% of capacity
Cycles per Day	Maximum cycles per day	131 cycles per day (11 minutes) 5 mins start 0 min uptime 1 min stop 5 mins downtime	2 cycle per day (10 hours from hot) 90 mins start 240 mins uptime 30 min stop 240 mins downtime
Source			
Wärtsilä 18V50SG	(Wärtsilä)		
GE 7FA 2x1	(Utilizing GT Pro)		

ABOUT WÄRTSILÄ

Wärtsilä is a global leader in innovative technologies and lifecycle solutions for the marine and energy markets. We emphasize innovation in sustainable technology and services to help our customers continuously improve their environmental and economic performance. Our dedicated and passionate team of 17,000 professionals in more than 200 locations in 68 countries shape the decarbonisation transformation of our industries across the globe. In 2021, Wärtsilä's net sales totalled more than $5 billion. Wärtsilä is listed on Nasdaq Helsinki.

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