

**FLEXICYCLE™  
POWER PLANTS**

ENERGY  
ENVIRONMENT  
ECONOMY





Seboard, Dominican Republic, 110 MW Flexicycle power plant.

# FLEXICYCLE™ POWER PLANTS COMBINING UNIQUE OPERATIONAL FLEXIBILITY WITH OPTIMUM COMBINED CYCLE EFFICIENCY

The challenge of serving the energy market with competitive baseload power, while also supporting the dynamic power market with quick start peaking power, has now been solved. With Wärtsilä Flexicycle plants you can choose both high efficiency and agility, enabling competitive operation on both energy and capacity markets.

Flexicycle plants range from 60 MW up to 600 MW, and are thus perfect for both municipal power generation and the larger utility market.

Traditionally, the baseload generation capacity has consisted of large, centralised coal and/or nuclear power plants alongside combined cycle gas turbine (CCGT) plants, with long ramp-up and ramp-down times. The intermediate load is often handled by combined cycle gas turbines, while the reserve and peaking capacity is often based on smaller, less efficient generating units, which are expensive to operate. The

introduction of the Flexicycle power plant solution makes the concept of using different dedicated power plant technologies for different load ranges and operation profiles obsolete.

The Flexicycle power plants are based on gas or multi-fuel combustion engines and a steam turbine combined cycle. Each engine is equipped with a waste heat recovery steam



## QUISQUEYA I & II, DOMINICAN REPUBLIC

Customer: ..... IPP  
 Type: ..... Flexicycle 50DF multi-fuel power plant  
 Operating mode: ..... Flexible baseload  
 Gensets: ..... 2 x 12 x Wärtsilä 18V50DF  
 Total output: ..... 430 MW  
 Fuel: ..... Natural gas, HFO & LFO  
 Scope: .... EPC (Engineering, Procurement & Construction)  
 Delivered: ..... 2012 & 2013

## SEABOARD, DOMINICAN REPUBLIC

Customer: ..... IPP  
 Type: ..... Flexicycle 50DF multi-fuel power plant  
 Operating mode: ..... Flexible baseload  
 Gensets: ..... 6 x Wärtsilä 18V50DF  
 Total output: ..... 110 MW  
 Fuel: ..... Natural gas, HFO & HFO  
 Scope: .... EPC (Engineering, Procurement & Construction)  
 Delivered: ..... 2012

Cover:  
Aliaga, Turkey, 270 MW Flexicycle power plant.

## WÄRTSILÄ FLEXICYCLE POWER PLANTS

Two operation modes: dynamic simple cycle and highly efficient combined cycle. Combined cycle operation extends plant electrical efficiency past 53%, whereas in simple cycle 49% can still be exceeded, providing even further operational flexibility.

- Efficient baseload and intermediate load capacity
- Excellent load following and peaking power capabilities
- Superior part load performance
- Quick start and shut down, fast ramp-up capability without restrictions or influence on maintenance schedule and costs
- Grid black-start without external power
- Size range 60–600 MW, additional investments can be done in 10 or 20 MW blocks
- Compliance with the strictest international and local emissions legislation
- Easy siting in grid nodes even within city limits
- Low impact of ambient conditions on plant performance
- Low water consumption, no water consumption in simple cycle mode
- Fast-track equipment or EPC delivery
- Wide range of operations and maintenance agreements available
- 24/7 service from more than 160 Wärtsilä points of service worldwide

## GAS GENSETS

Wärtsilä 34SG	20V34SG
Power, electrical (50 Hz/750 rpm) kW	9730
Power, electrical (60 Hz/720 rpm) kW	9340
Genset dry weight (tonne) ±5%	130
Wärtsilä 50SG	18V50SG
Power, electrical (50 Hz/500 rpm) kW	18 320
Power, electrical (60 Hz/514 rpm) kW	18 760
Genset dry weight (tonne) ±5%	360
Reduced transport weight (tonne) ±5%	285

## MULTI-FUEL GENSETS

Wärtsilä 34DF	20V34DF
Power, electrical (50 Hz/750 rpm) kW	8730
Power, electrical (60 Hz/720 rpm) kW	8440
Genset dry weight (tonne) ±5%	130
Wärtsilä 50DF	18V50DF
Power, electrical (50 Hz/500 rpm) kW	16640
Power, electrical (60 Hz/514 rpm) kW	17080
Genset dry weight (tonne) ±5%	369
Reduced transport weight (tonne) ±5%	297

## LIQUID FUEL GENSETS

Wärtsilä 46	18V46
Power, electrical (50 Hz/500 rpm) kW	17080
Power, electrical (60 Hz/514 rpm) kW	17080
Genset dry weight (tonne) ±5%	368
Reduced transport weight (tonne) ±5%	296

generator. The power plant has a common steam turbine with condenser. The power plant cooling is typically arranged so that the combustion engines are cooled with closed loop radiators, and the steam cycle with cooling towers.

## MULTIMODE OPERATIONS

The Flexicycle solution combines the advantages of a flexible simple cycle plant with the superb efficiency of a combined cycle plant in a unique way. The combined cycle mode, with an optimum efficiency in excess of 53%, is ideal for baseload operation. In the Flexicycle concept, the dynamic features of simple cycle combustion engines are maintained as

the combined cycle can be shut on and off individually for each generating set.

With quick synchronisation and start-up to full load as little as five minutes, without restrictions or impact on maintenance schedules, the Flexicycle plants can be dispatched immediately when imbalance between supply and demand begins to occur.

The multi-unit design of combustion engine power plants offers optimized flexibility for dynamic load following with independent units, high efficiency at any plant load (by switching units on and off), as well as optimized plant sizing throughout the lifecycle.

## TWO-IN-ONE

The Flexicycle power plant solution's two-in-one characteristic makes it a very competitive solution for taking care of a grid system's intermediate load. Thanks to its high combined cycle efficiency, the Flexicycle power plant can also be the best choice for baseload generation, depending on the power system's capacity mix. Features like fast synchronisation and ramp times, as well as the flexibility of multiple independent units, make the power plants outstandingly well suited to support grid systems requiring flexibility due to daily load fluctuations, or having a significant installed base of wind or other non-dispatchable power.



### ARKAY, INDIA

Customer: ..... Utility  
 Type: ..... Flexicycle 34 gas power plant  
 Operating mode: ..... Baseload  
 Gensets: ..... 14 x Wärtsilä 20V34SG  
 Total output: ..... 127 MW  
 Fuel: ..... Natural gas  
 Scope: ..... ED & EEQ (Equipment Delivery and Engineered Equipment Delivery)  
 Delivered: ..... 2006, 2011 & 2013



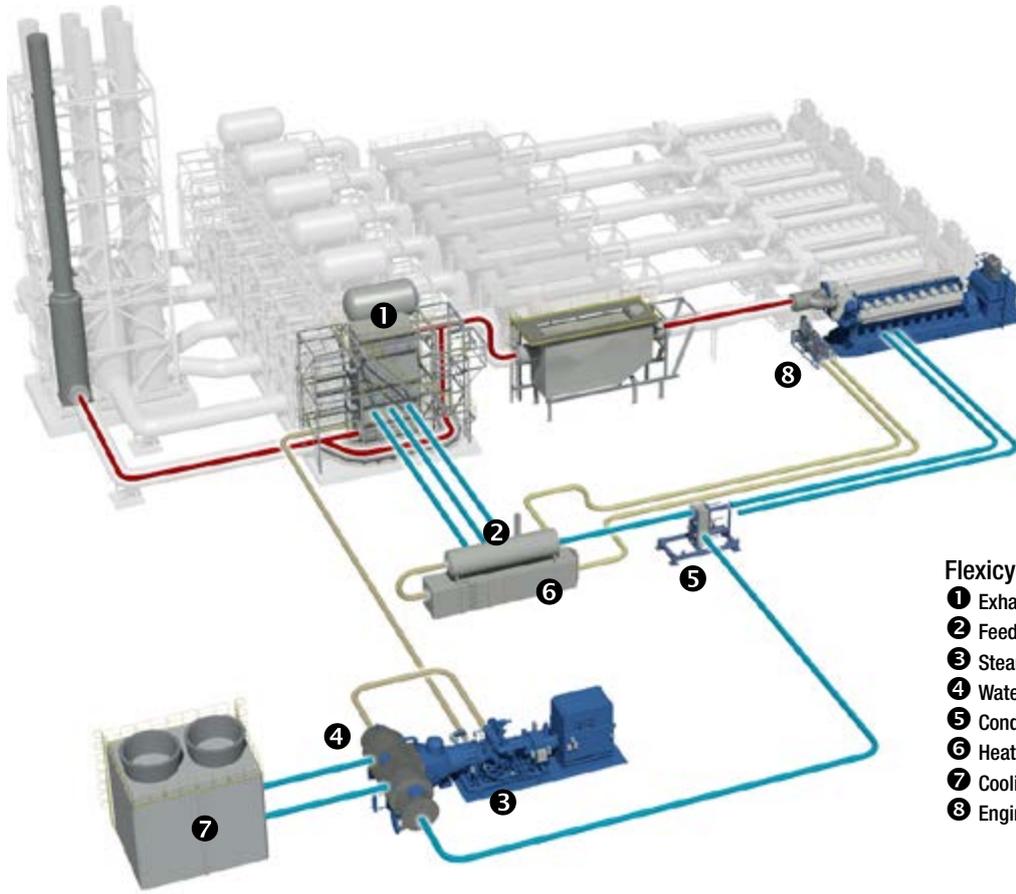
### ALIAGA, TURKEY

Customer: ..... IPP  
 Type: ..... Flexicycle 34 gas power plant  
 Operating mode: ..... Baseload  
 Gensets: ..... 28 x Wärtsilä 20V34SG  
 Total output: ..... 270 MW  
 Fuel: ..... Natural gas  
 Scope: ..... EPC & EEQ (Engineering, Procurement & Construction and Engineered Equipment Delivery)  
 Delivered: ..... 2007, 2010 & 2011



### LIBERTY POWER TECH, PAKISTAN

Customer: ..... IPP  
 Type: ..... Flexicycle 46 liquid fuel power plant  
 Operating mode: ..... Baseload  
 Gensets: ..... 11 x Wärtsilä 18V46  
 Total output: ..... 200 MW  
 Fuel: ..... HFO & LFO  
 Scope: ..... EPC (Engineering, Procurement & Construction)  
 Delivered: ..... 2011



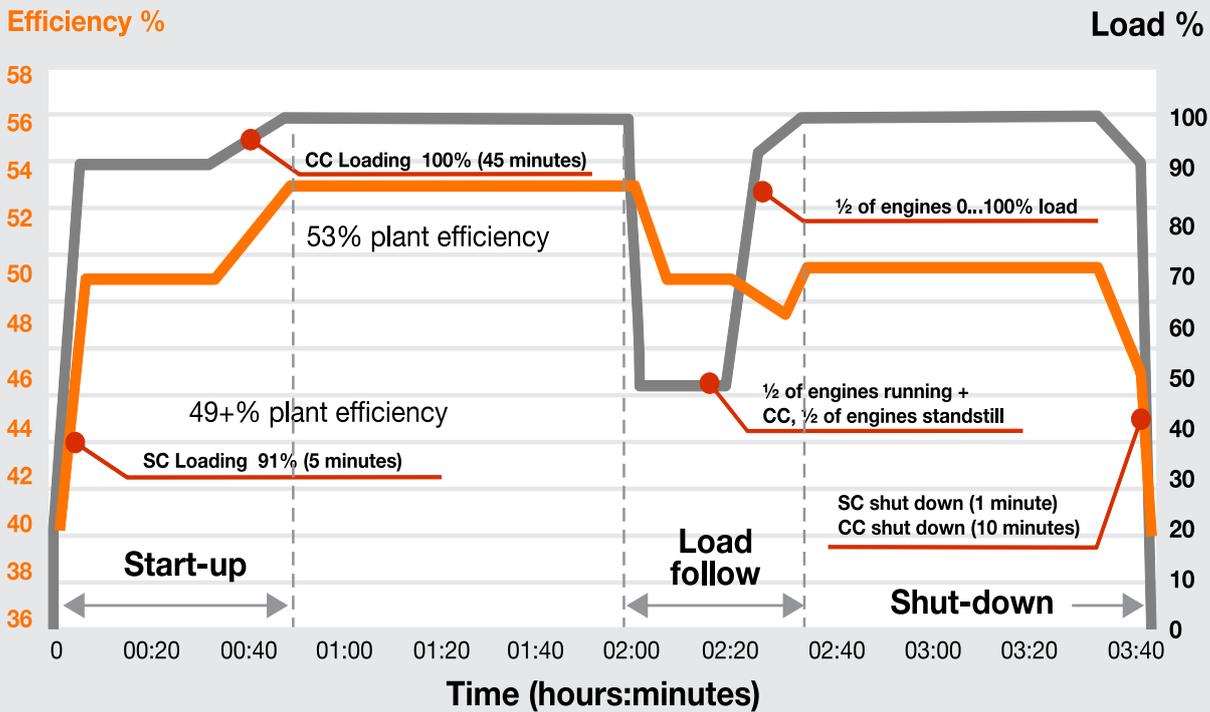
**Flexicycle Combined Cycle System**

- ❶ Exhaust gas boiler
- ❷ Feed water tank
- ❸ Steam turbine
- ❹ Water cooled condenser
- ❺ Condensate preheater
- ❻ Heat recovery container including auxiliary boiler
- ❼ Cooling tower
- ❽ Engine preheater



Control room view.

Flexicycle 50 gas power plant starting and loading in simple cycle and combined cycle mode.



# Examples of Flexicycle power plant alternatives

100+MW



Seaboard Flexicycle power plant, Dominican Republic, with 6 x Wärtsilä 18V50DF engines providing a total output of 110 MW.

200+MW



Aliaga Flexicycle power plant, Turkey, with 28 x Wärtsilä 20V34SG engines providing a total output 270 MW.

400+MW



Quisqueya I & II Flexicycle power plant, Dominican Republic, with 2 x 12 x Wärtsilä 18V50DF engines providing a total output of 430 MW.

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

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