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Environmentally friendly energy production with the CHP plant with H.2.X system

Combined heat and power plants in different dimensions for:

- Private households
- Apartment buildings
- Small and medium-sized companies

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The H.2.X Turbines

Benefit and advantages

- Power and heat generation
- The main difference to comparable turbines is that our H.2.X system works with explosion force. Conventional turbines only have one flame for combustion. Thus, the H.2.X system is able to provide double the force output.
- Long service life of at least 20 years
- Easy to maintain
- No explosion or fire hazard
- Smaller dimensions in comparison to conventional turbines and motors
- Our turbine is 50 % lighter than an equivalent, comparable unit.
- Very environmentally friendly since there is no emission of pollutants during operation of the turbine. The turbine is operated by environmentally friendly fuel which is obtained from renewable resources (such as sugar cane) (when ethanol is used).
- Our CHP plants with the H.2.X turbines are extremely quiet - only 28 dB (this is less noise than the ticking of a quiet clock¹), measured at 10 m distance.
- The CHP plant with H.2.X turbines is available in different dimensions: 15 kW, 30 kW, 100 kW - these meet the requirements of a single-family house up to the requirements of medium-sized companies.
- Due to the turbine's design, it is possible to install this high-tech power unit in any position. The function of the unit will not be affected by this.
- Thanks to the unique technology, the CHP units with H.2.X turbines have a high efficiency of 70% that is not provided by any other unit currently on the market.
- The ethanol-water mixture ensures an absolutely pollutants-free operation.






Figure 1: Symbol icon CHP plant H.X.K 100

¹ please compare:
<http://www.bmu.de/themen/luft-laerm-verkehr/laermschutz/laermschutz-im-ueberblick/was-ist-laerm/>



Overview

Basic data	H.2.X 15 kW	H.2.X 30 kW	H.2.X 100 kW
	 (Symbol icon)	 (Symbol icon)	 (Symbol icon)
Weight	25 kg	295 kg	760 kg
Dimension L x W x H	40 x 40 x 60 cm	165 x 65 x 120 cm	240 x 95 x 195 cm
Combustion air	765 m ³ /h	1530 m ³ /h	2520 m ³ /h
Air temperature	20°C to 50°C	20°C to 50°C	20°C to 50°C
Electrical power	15 kW/h	30 kW/h	100 kW/h
Noise	28 dB	28 dB	28 dB
Degree of efficiency	70%	70%	70%
Fuel consumption l/h	3 l/h	6 l/h	10 l/h
Tank size in litres	"Depends on the use (for personal energy consumption only or supply of excess energy)"		
Revolutions per minute	46,000/min.	42,000/min.	36,000/min.

Fuel	H.2.X 15 kW	H.2.X 30 kW	H.2.X 100 kW
Natural gas	✓	✓	✓
Biogas	✓	✓	✓
Ethanol (contaminant-free)	✓	✓	✓
Rapeseed methyl ester (bio-diesel)	✓	✓	✓

Exhaust system	H.2.X 15 kW	H.2.X 30 kW	H.2.X 100 kW
Exhaust gas temperature	309°C	315°C	310°C
Gas flow	12.75 m ³ /min	25.5 m ³ /min	42 m ³ /min
Chimney diameter	125 mm	150 mm	300 mm

Field of application	H.2.X 15 kW	H.2.X 30 kW	H.2.X 100 kW
Single-family house	✓		
Apartment building and up to small businesses		✓	✓



Layout of the combined heat and power unit with H.2.X turbines

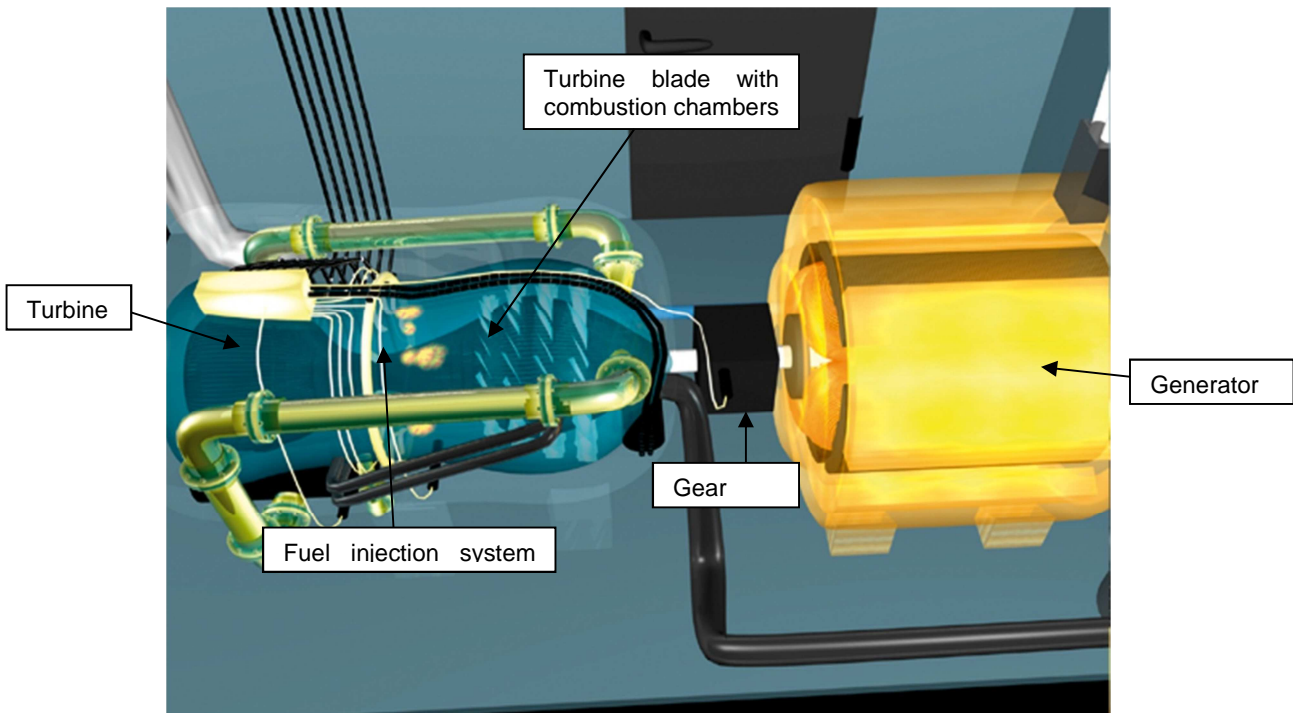


Figure 2: Configuration of a CHP unit

Fuel injection system "HIGS"

The water-fuel mixture is injected into the combustion chamber at a very high pressure (173 psi² = 11.93 bar). The patented injection nozzle uses the effect of the "blue flame", i.e. the temperature of more than 2000°C at the ignition of the ignition plug is considerably higher than that of the ignition of a conventional turbine. Due to the generated explosion force and the aerodynamic heat recovery, the H.2.X turbine has double the force impact and the degree of efficiency increases to 70%.

The injection system "HIGS" is registered and protected national and international by several patents.

Maintenance/Service

Operating hours	Operation	Period
Every 4,500 hours	<ul style="list-style-type: none">• Filter replacement• Checking the injection system	2 hours

² psi = pounds per square inch



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Installation

Due to the special design, the CHP unit with H.2.X turbine can be mounted in any position, whether hanging, lying down or in an inclined position. The function of the unit will not be affected by this.

Equipment

1. Turbine H.2.X 15/30/100 kW
2. Generator
3. Heat coupling (heat recovery - for heat exchanger)
4. Gearbox
5. Sound-proof hood/cover/fire protection (according to EC directive)

Prior to installation

We deliver the CHP unit to the designated interface of the indoor installation site (inside Austria: delivery free domicile).

Exhaust pipe (chimney) has to be provided by the customer.

After the installation

The technicians and electricians assigned by the client connect the CHP unit to the control centre in the heating plant in compliance with our plans.

Typical CHP connection in the building

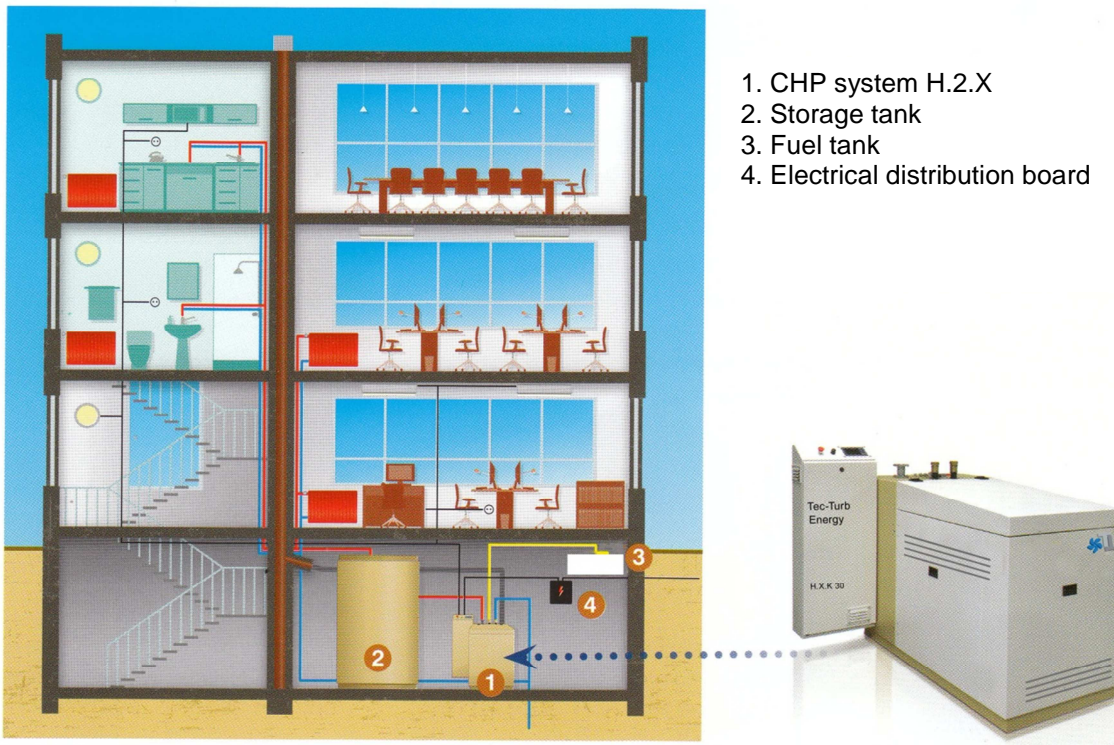


Figure 3: Connection of CHP unit



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Environmentally friendly energy production with the CHP plant with H.2.X system

For hospitals

Institutions

Industries

Factories

Public institutions

Schools

Municipalities

Hotel businesses

Tourist enterprises



The H.2.X container power plant 3.5 MW

Benefit and advantages

- Long service life of at least 30 years
- Easy to maintain (2 maintenance intervals with reduced expenditure of time)
- Our turbine is 50% lighter than an equivalent, comparable turbine.
- Very environmentally friendly since there is no emission of pollutants during operation of the turbine. The turbine is operated by environmentally friendly fuel which is obtained from renewable resources (when ethanol is used).
- Reduced CO₂ emission (0.0026 C-values)
- Our container power plant with the H.2.X turbine is extremely quiet - only 28 dB measured at 10 m distance.
- No explosion or fire hazard
- No environmental risk, therefore, the product can also be installed in protected landscapes and nature reserves.
- Through the additional installation of a heat recovery system, this container power plant with 3.5 MW can be converted to a CHP unit.
- Thanks to the unique technology, the container power plant with 3.5 MW has a high efficiency of 70% that is not provided by any other unit currently on the market.
- The ethanol-water mixture ensures an absolutely pollutants-free operation.
- The main difference to comparable turbines is that our H.2.X system works with explosion force. Conventional turbines only have one flame for combustion. Thus, the H.2.X system has a higher thermal force expansion.




Figure 4: Symbol icon for container power station 3.5 MW



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Overview

Basic data	H.2.X 3.5 MW
	 <p>(Symbol icon)</p>
Weight	approx. 18 tons
Dimension L x W x H	12.20 m x 2.45 m x 2.60 m
Air temperature	20°C to 50°C
Electrical power	3.498 MW
Noise level, distance measurement at 10 metres	26 dB ³
Degree of efficiency	70%
Fuel consumption l/h	150 l/h optional
Tank size in the container, included in the delivery	24,700 litres
Turbine's revolutions per minute full load/partial load	24,000/18,000

Fuel	H.2.X 3.5 MW
Natural gas	✓
Biogas	✓
Ethanol (contaminant-free)	✓
Rapeseed methyl ester (bio-diesel)	✓

Exhaust system	H.2.X 3.5 MW
Exhaust gas and hazardous substances	0.0026 C-values
Exhaust gas temperature	390°C
Chimney diameter	750 mm
optional: with heat recovery	1000 mm

Field of application	H.2.X 3.5 MW
Hospitals	✓
Food companies	✓
Energy suppliers	✓
Industry/factories	✓
Public institutions such as schools, authorities	✓
Military facilities	✓
Communities/municipalities	✓
Tourist resorts	✓

³ measured at 10 m distance to the container power plant



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Layout of a container power plant 3.5 MW



Figure 5: H.2.X container power plant 3.5 MW

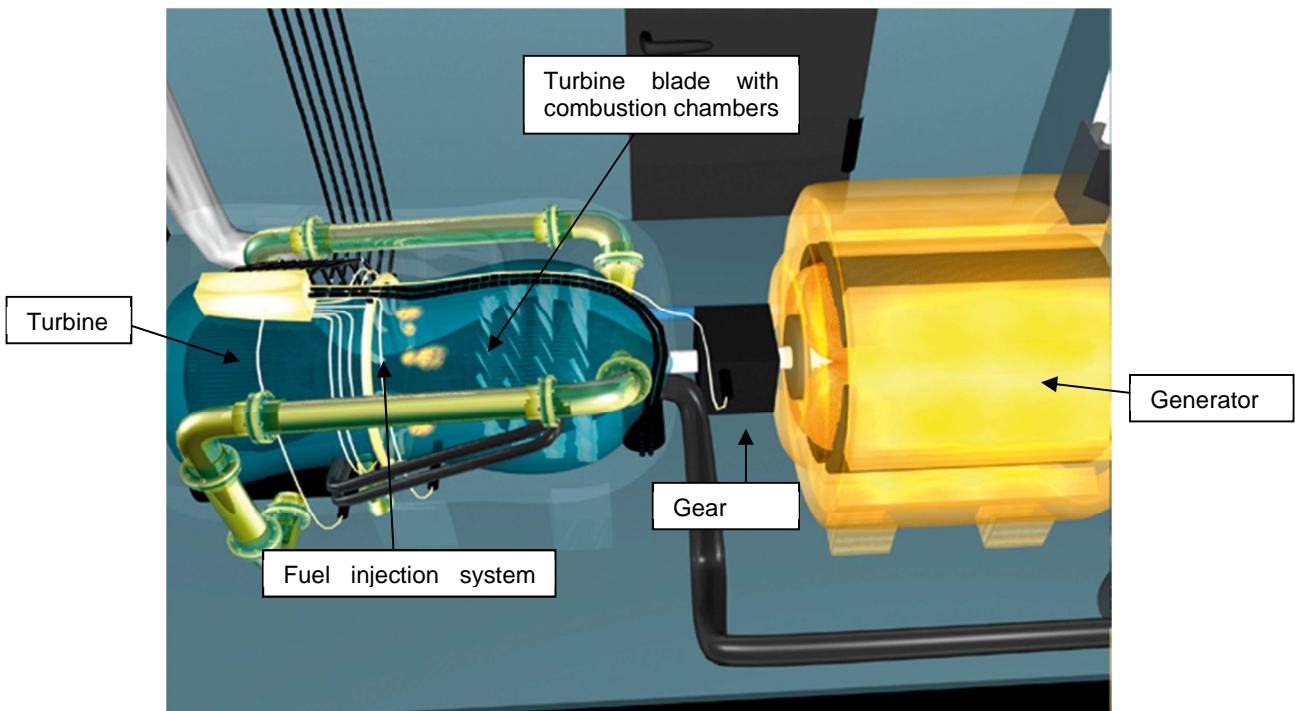


Figure 6: Layout of a container power plant 3.5 MW

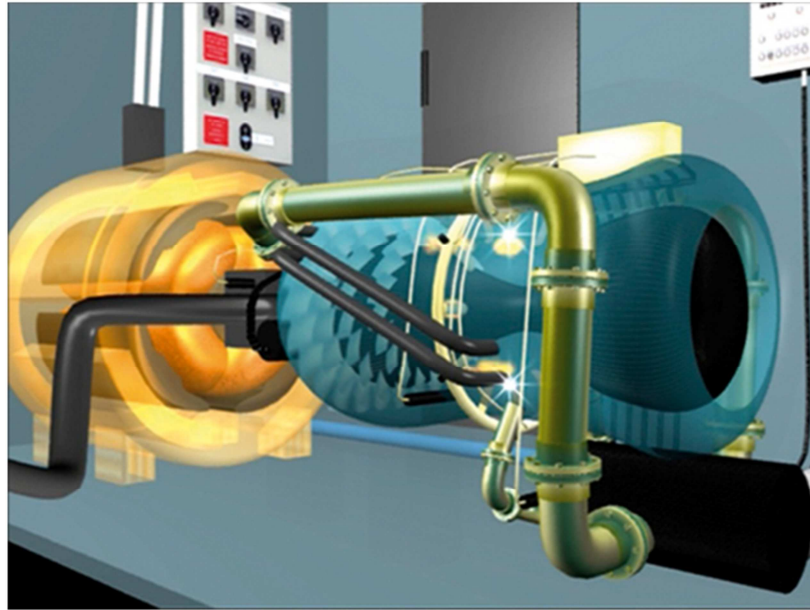


Figure 7: Layout of a container power plant 3.5 MW

Fuel injection system "HIGS"

The water-fuel mixture is injected into the combustion chamber at a very high pressure (173 psi⁴ = 11.93 bar). The patented injection nozzle uses the effect of the "blue flame", i.e. the temperature of more than 2000°C at the ignition of the ignition plug is considerably higher than that of the ignition of a conventional turbine. Due to the generated explosion force and the aerodynamic heat recovery, the H.2.X turbine provides a higher thermal force expansion and the degree of efficiency increases to 70%.

The injection system "HIGS" is registered and protected national and international by several patents.

Maintenance/Service

Operating hours	Operation	Period
Every 4,500 hours or 2 x annually ⁵	<ul style="list-style-type: none">• Filter replacement• Checking the injection system	2-3 hours

⁴ psi = pounds per square inch

⁵ after 2,250 h the condition of the unit will be checked via GPS and via the control system



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Installation of the container power plant 3.5 MW

Equipment of the container power plant 3.5 MW

1. Noise-reduced and heat-insulated container housing
2. H.2.X turbine
3. Generator
4. Gearbox
5. Integrated tank
6. Computer-controlled GPS/GSM control and monitoring station
7. Switch cabinet: tariff strategist (tariff regulator)
8. Switch cabinet according to norm
9. Ventilation system (aeration/de-aeration)
10. Fluorescent lighting
11. Grid coupling cable
12. Exhaust pipe

Prior to the installation - provided by the customer

Building notification and building permit

Ideally, the mounting location should be close to a transformer or voltage transformation substation.

Foundation plate in accordance with structural engineer and with manufacturer's regulations

Connection for network coupling point

If required: Installation of underground fuel tanks

After the installation

The container is connected to the network coupling point provided by the customer. We recommend all customers to lay the cables into the ground after they have passed grid coupling point. No damage through wind, storm, hurricanes or floods.

H.2.X container power plant 3.5 MW compared to other units

H.2.X 3,5 MW versus conventional turbines

Overview	H.2.X 3.5 MW	Conventional turbine
Weight	approx. 18 t (entire power plant) 2.1 tons (turbine only)	approx. 4.5 t (turbine only)
Dimension L x W x H	12 m x 2.5 m x 3 m	specific
Electrical power	3.498 MW	specific
Noise	26 dB ⁶	specific
Degree of efficiency	70%	48%
Fuel consumption l/h	150 l/h optional	450 l/h
Service interval	4,000-4,500 h ⁷	2,000-2,500 h
Service - downtime	2-3 h	12-18 h
Service costs	4,000-5,000 €	10,000-150,000 €

⁶ measured at 10 m distance to the container power plant

⁷ after 2,250 h the condition of the unit will be checked via GPS and via the control system



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Benefits:

- **Installation**
The container is connected to the grid coupling point only. We recommend all customers to lay the cables into the ground after they have passed grid coupling point. No damage through wind, storm, hurricanes or floods.
- **Construction**
The only construction work to be carried out is the concrete slab in accordance with the indications of the structural engineer and of our company in order to mount the container onto this slab. There is no need for supply roads or expensive overhead power lines with high kV power output.
- **Transport**
The H.2.X container can be transported by helicopter, truck, ship or train.
- **Grid coupling**
If several containers are used in one city, the power requirement is controlled via a tariff strategist. Should one container fail, the tariff strategist compensates and distributes this loss to the other containers. This ensures a reliable power supply.
- **Noise level**
Since the walls of the power plant are insulated against heat and noise, the noise level measured at distance of 10 m outside is very low (26 dB).
- **Contaminants**
Due to the use of an ethanol-water mixture, no contaminants or hazardous substances are created during the combustion process. This means the H.2.X power plant can be installed at any location.

Exhaust gas value: 0.0026 C-values



Technical description of the H.2.X Container

- A.) The sequence of the container's assembly starts with the **container base plate**. This is the base of the container, a so-called double-floor, designed to hold all installation equipment and fixtures of both the turbine and the generator.

These attachment points are important because they constitute the required fixed attachment to the container on the one hand, and a stable connection of drive and generator on the other hand. A smooth operation of the turbine is ensured.

Furthermore, the fuel supply lines, all cable harnesses, the control systems and cable bus are laid into this floor plate in a safe manner.

Afterwards, a **cover** is mounted onto this floor plate. This cover both protects all laid lines and cables and is used as accessible floor.

- B.) In the next step, the **generator** is connected to the mounting fixtures that are to be placed onto the floor plate.

This generator is a **three-phase generator** with an output power of 3.5 MW.

Subsequently, three-phase generators with an output of 1.5 MW, 2.0 MW and 5 MW are also planned.

The voltage is between 4 and 11 kV, adjusted to customer-specific requirements. The possible rotational speed of the generator is approx. 1,500 rpm.

Due to the turbine's high rotational speed (18,000 revolutions per minute), a **gear** is interconnected between the turbine and the generator.

Through reduction of the turbine's high rotational speed to the admissible revolutions of the generator, the power torque increases simultaneously.

- C.) In the next step, the **turbine** is installed as drive unit of the generator.

The capacity of the turbine is a nominal power rating of approximately 5,000 horsepower/3,650 kW at a rotational speed of approx. 20,000 rpm. 3,498 kW are specified as continuous output. The shaft to the gear runs on ceramic bearings. The pressure ratio is 4 bar. The values of the exhaust gas reach a temperature of 390°C.

The **injection system** is manufactured in cooperation with Bosch International.

As already mentioned, a gear is interconnected between the turbine and the generator to be able to equalise the different rotational speeds of the two units. This in turn increases and amplifies the torque.

In normal mode, the turbine has a rotational speed of approx. 18,000 rpm.

- D.) The **fuel tank** with a capacity of 24,700 litres is located next to the mechanical mounting fixtures mounted on the floor plate. If bigger tanks are required, the use of underground tanks is possible too.

A mixture of ethanol-water is used as **fuel**. There is also the option to use natural gas.

- E.) The container consists of an insulated, sound-absorbing outer layer with the dimensions: 12.20 m length x 2.45 m width x 2.60 m height. The client has the option to choose the exterior painting.



Components

1. Drive unit type: turbine H.2.X
2. Power generator, type 3.5 MW (Siemens, Morelli, Motore or Elin)
3. Tank system including fuel pump
4. Computer controlled monitoring and control systems incl. GPS or GSM
5. Tariff strategist
6. Container modules (sound-proof and heat-insulated)
7. Connection equipment for grid coupling point

1. Technical description of drive unit type: turbine H.2.X

1. Turbine type: H.2.X
2. Length: 215 cm
3. Diameter: 147 cm
4. Rotational speed: 18,000 rpm
5. Pressure ratio: 0.4 bar
6. Rated power: 3,650 kW
7. Exhaust gas temperature: approx. 390°C
8. Ball bearings: ceramics
9. Shaft tunnel - special steel alloy
10. Guide vane apparatus - special casting alloy
11. Injection system - H.2.X system
12. Housing - stainless steel coating

2. Fuel options

1. Ethanol - water mixture
2. Rapeseed methyl ester (bio-diesel)
3. Natural gas

3. Power generator, type 3.5 MW

- a) Continuous power - 3,498 kW
- b) Nominal power - 3,500 kVA
- c) Voltage 6 kV or convertible to 10 or 11 kV, according to customer's requirements
- d) Voltage stability +/- 1 percent
- e) Voltage adjustment range +/- 5 percent
- f) Frequency 50 Hz
- g) Rotational speed 1,500 rpm
- h) Over-speed 1,800 rpm
- i) Insulation class F
- j) Degree of radio interference suppression: N



4. Tank system including fuel pump

- a) Layout in stainless steel
- b) Volume 24,700 litres
- c) Fuel pump type - Bosch
- d) Flow sensor type - Bosch
- e) Ventilation system
- f) Fuel sensor

5. Computer controlled monitoring and control systems incl. GPS or GSM

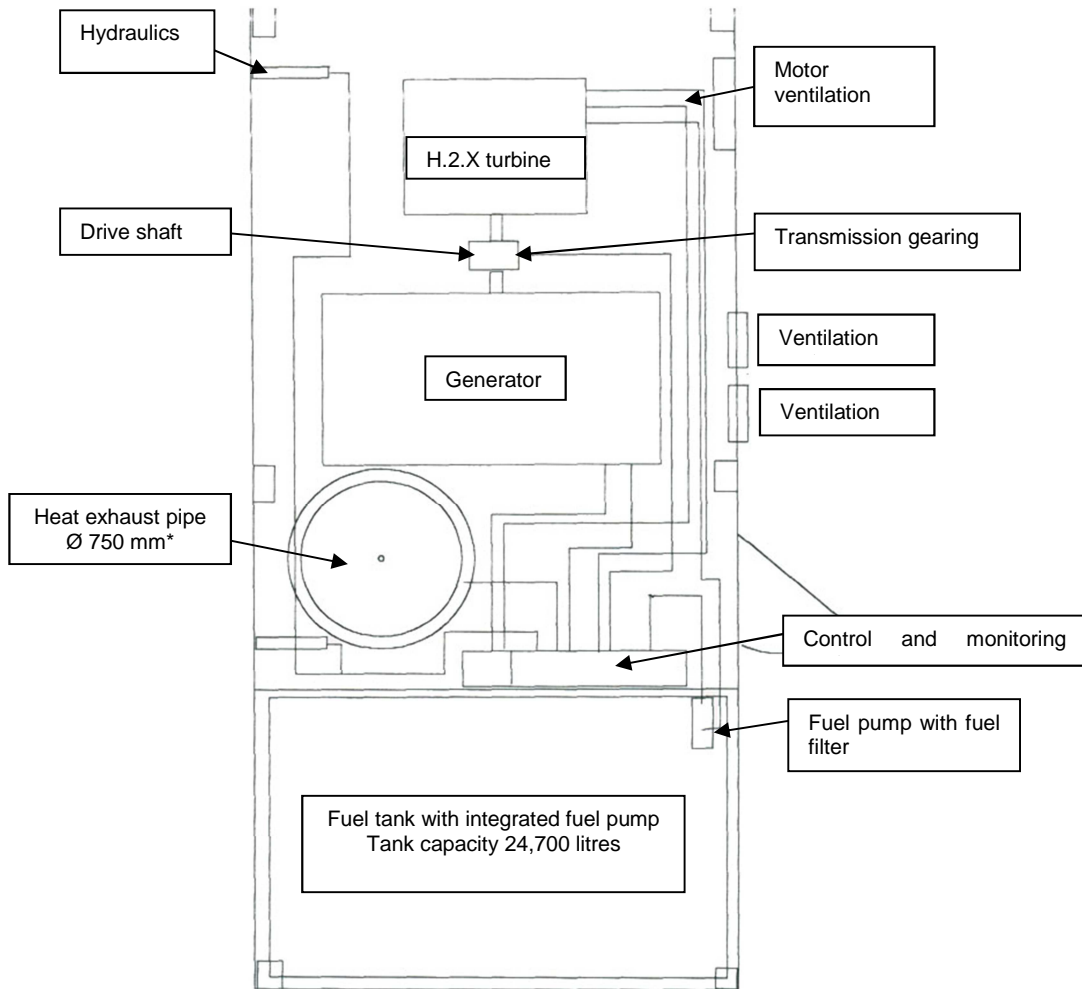
- a) Computer (LCU, LCD)
- b) Processor: 1,000 Hz
- c) Display: 2x15" TFT SXGA
- d) Voltage: 12 Volt
- e) Radio equipment
- f) GSM or GPS
- g) Control of unit: H2X
- h) Control of generator: tariff strategist
- i) Tariff strategist

6. Container modules

- a) Housing: steel frame construction
- b) Side walls in sandwich-structured design, aluminium-plastic
- c) Insulation against heat and noise (approx. 26 dB)
- d) 1 door with reinforced frame (burglary protection), 2 times lockable
- e) Ventilation 1/max. (aeration) 100 m³H
- f) Ventilation 1/max. (de-aeration) 100 m³H
- g) Lighting 2 neon lamps
- h) Aerial 1, suitable for SAT
- i) Hoisting device: 2 pulleys, mounted on rails



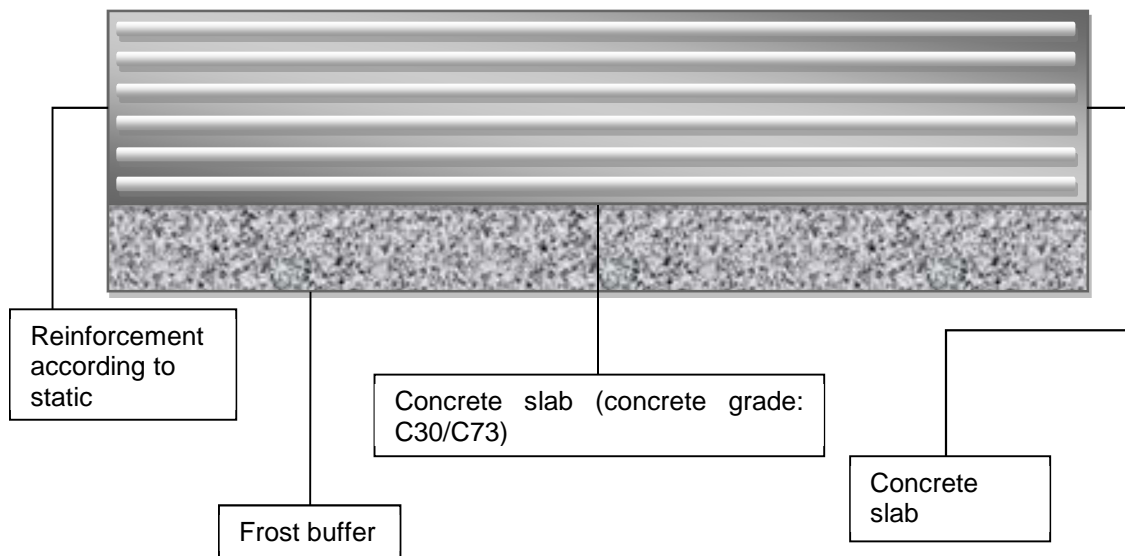
Layout of H.2.X container 3.5 MW



* optional: Installation of a heat recovery unit is possible - with an exhaust pipe of Ø 1,000 mm

Foundation plate

Dimensions of foundation slab 13.0 m x 3.0 m x 0.6 m with reinforced concrete

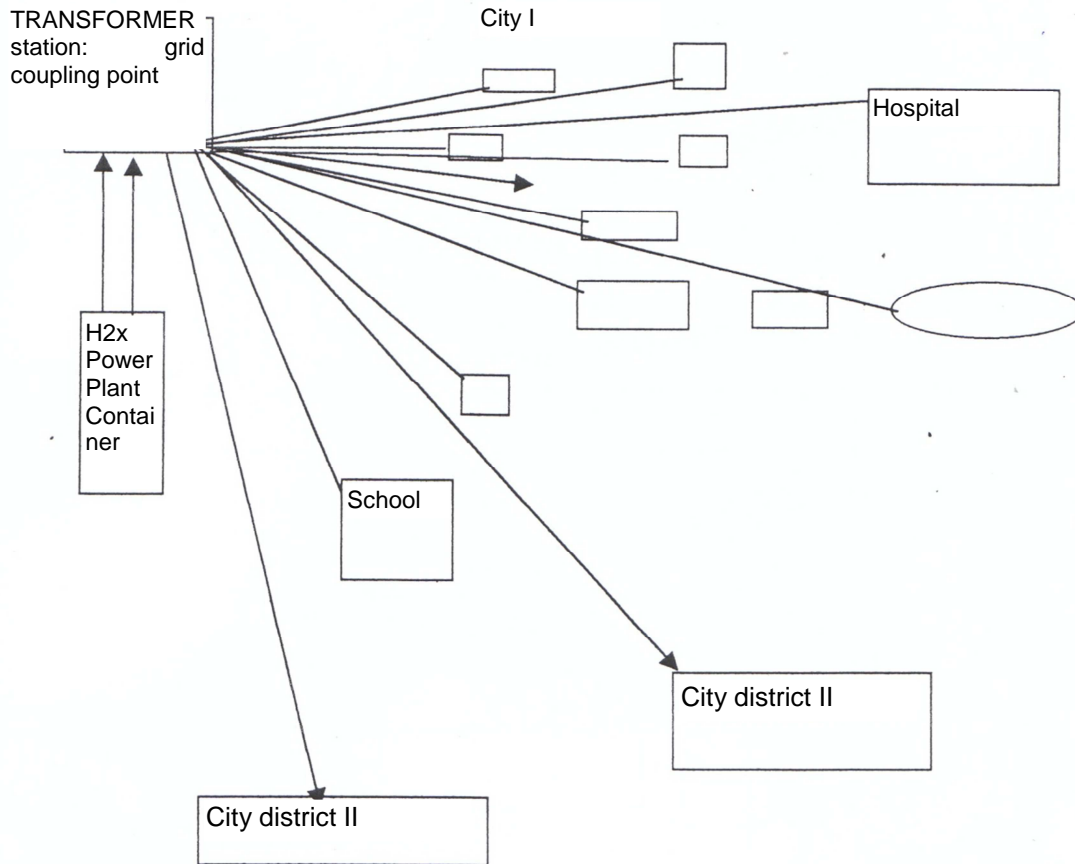


The thickness of the foundation depends on the nature and composition of the soil and on the static calculation.



Ring system

Our container power plant can also be installed as ring system, if required.



THE RING SYSTEM

THE CONTAINERS ARE PLACED IN THIS WAY TO PREVENT ANY FURTHER BLACKOUT.

