The COGEN-CCHP/CHP Process

Gas Turbine
Gas Engine

HKD International
Engineering & Consulting

ONSITE GENERATION
COGEN CCHP / CHP SYSTEMS

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Cummins
Gas Engines

ANSALDO ENERGIA
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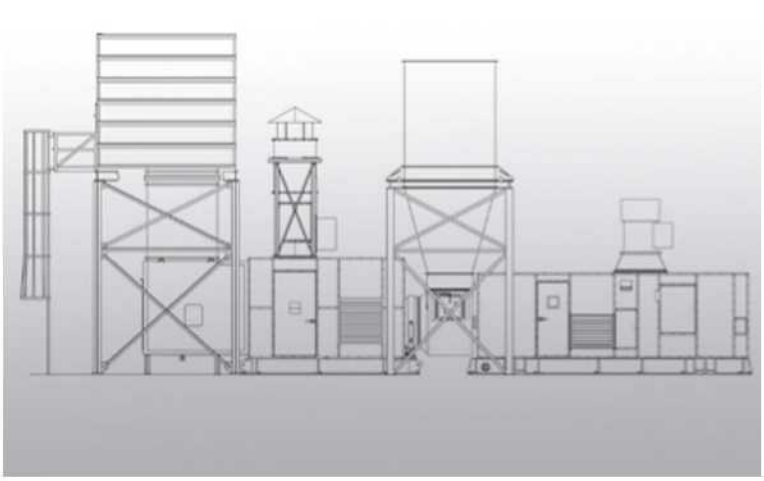
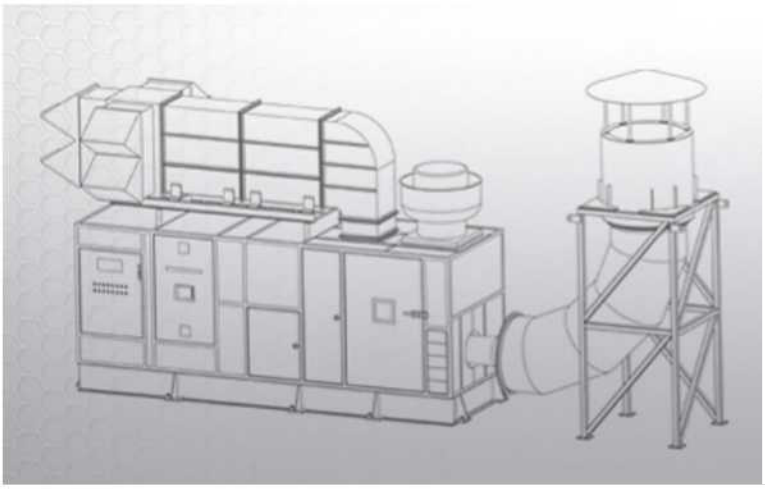
HKD is pleased to be Ansaldo Micro Turbines sale representative office in Turkey.

HKD offers its customers a wide variety of local generation solutions ranging from renewable resources driven to gas-fired energy resource technologies for commercial (schools, shopping centers, hotels, swimming pools, airports, hospitals, etc.) and multi-family buildings as well as industrial applications. In the end of the day, end -users become partners sharing responsibility for more green energy supply in this way. Lastly, we do commercialization for distributed generation (DG)-related technologies developed by our staff, partners, and customers.



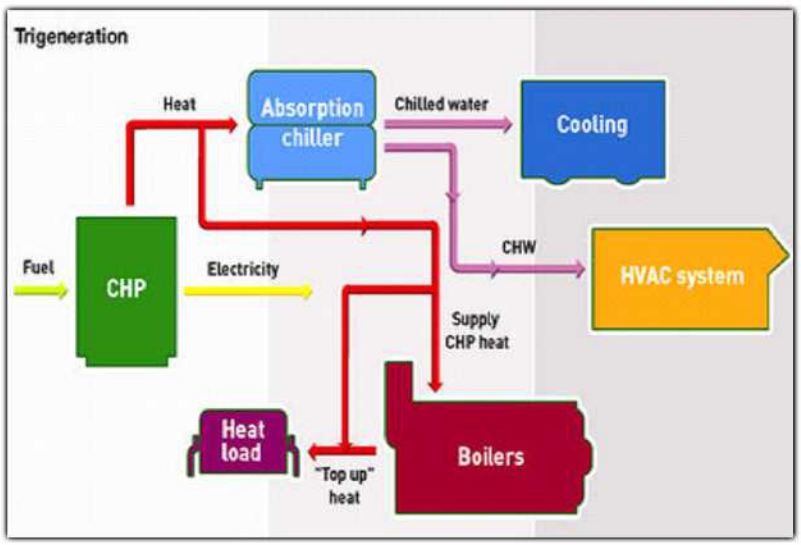


Note: Ansaldo Micro Turbines has been used in Cogen systems by HKD Design Group as main contractor.

DISTRIBUTED POWER SOLUTIONS (ONSITE GENERATION)

HKD is pleased to have Ansaldo Energia micro gas turbine AE-T100 (available in three different fuel versions: natural gas (AE-T100NG), biogas (AE-T100B) and external combustion (AE-T100E - EFGT technology)) distributionship in Turkey. HKD offers its customers a wide variety of local generation solutions ranging from renewable resources driven to gas-fired energy resource technologies for commercial (schools, shopping centers, hotels, swimming pools, airports, hospitals, etc.) and multi-family buildings as well as industrial applications. In the end of the day, end -users become partners sharing responsibility for more green energy supply in this way. Lastly, we do commercialization for distributed generation (DG)-related technologies developed by our staff, partners, and customers.

WHAT IS TRIGENERATION (CCHP)?



Combined cooling, heating and power (CCHP) is the generation of electricity and useful heat from the same item of plant. In some CCHP installations, the electricity supply network, and the heat recovered from the engine supplements or in some cases replaces heat from the sites boilers. CCHP systems can also provide cooling through the use of absorption chillers that utilize heat as their There are several types of technologies to be used in a CCHP system. The microturbine -based CCHP package differs from traditional CCHP because the engine is a gas turbine rather than a piston engine. The technology uses a gas combustion process to propel a turbine at very high speed.

This turbine then rotates a permanent magnet generator which produces electricity. The hot gases from the combustion process then pass through a water filled heat exchanger which produces hot water (to be used later for direct heating and/or cooling purposes).

WHY CCHP?

The benefits of CCHP when compared to importing electricity and using boilers to generate heat include (but not limited to):

- Savings on total energy costs for the end-user,
- Improved efficiency of fuel use (better fuel utilization factor),
- Reduced emissions,
- Independence and security of power supply, and
- Exemption from the Climate Change Levy for energy costs

WHICH CCHP?

The key to the success of a CCHP system is getting the sizing right. Many CCHP installations are oversized because the facilities energy demand profile has not been assessed properly.

To get the full benefits of CCHP, the unit needs to operate to its full potential, and all the power and heat produced has to be fully utilized. Hence, in assessing whether

CCHP is appropriate for a building or development, it is essential that the electricity and heat demand profiles are established. It is common for annual electricity and gas meter data to be used to calculate average power and heating/cooling demand. This type of calculation makes no allowance for seasonal variations in demand, particularly heat.

The output from a CCHP unit is typically approx. 30-40% electricity, 60-70% heat, so you need to establish whether the CCHP sizing is electricity or heat led. For example, if you had an electrical baseload of 100 kW, a unit of this size would provide about 200 kW of heat. Hence, if your heat demand baseload is 200 kW or above, the CCHP baseload is below 200 kW, it would heat led (i.e. you would choose unit based upon the thermal demand).

Note that it may not be normal to run CCHP during the night time period. This is because, over this period, electricity is much cheaper than its price during the day , and maybe it is not economically attractive to produce your own power. Hence, CCHP is usually assessed and operated for 15-20 hours/day. All of these require a precise study and reliable case-depended analysis which can be done by HKD.

ECONOMIC VIABILITY OF CCHP

The economic viability of CCHP is, first and foremost, dependent upon the unit size being appropriate for the facility. It is essential that all of the electricity and all of the heat from the CCHP package is fully utilized for the vast majority of the time. The cost benefits achieved by CCHP unit are a function of:

- Electricity savings; power produced that would otherwise have been imported from the grid
- Heat savings; heat generated that would otherwise have been using onsite gas fired

Set against the benefits, the costs that need to be taken into account in assessing the economic viability of CCHP encompass:

- Installation costs
- Costs of fuel input required
- Maintenance costs

The costs of CCHP, in terms of $/kW installed, reduce as the size of the unit increases. The same applies to the cost of maintenance. In addition, the larger the unit, generally the better the efficiency but lower reliability.

Although clearly every potential CCHP scheme needs to be assessed individually, typical simple payback periods for an appropriately sized CCHP installation are typically 2 to 6 years.

With a power rating of up to 500 kWe, small-CCHP systems cover electricity, heating, cooling and hot water demand for many industrial and commercial as well as residential applications. They can replace conventional space-heating systems in addition to dependence of national electricity grid to have more reliable, affordable, and secure source of energy. To reach this purpose, HKD proposes a microturbine technology: AE-T100 CHP system.

AE-T100 MICROTURBINE DRIVEN SMALL SCALE CHP TECHNOLOGY

The Turbec Microturbine Company was originally a jointly owned subsidiary of Volvo and ABB and is now owned by an Italian technology manufacturer (Ansaldo Energia, AE).

The AE-T100 microturbine will generate 100 kWe as electrical power together with approximately 200 kWt of thermal power available to generate both heat and/or cooling power in the form of hot/cold water (using additional absorption chillers).

The AE-T100 CHP unit is available in three different fuel versions:

- Natural gas (AE-T100NG)
- Biogas (AE-T100B)
- External combustion (AE-T100E based on EFGT technology).

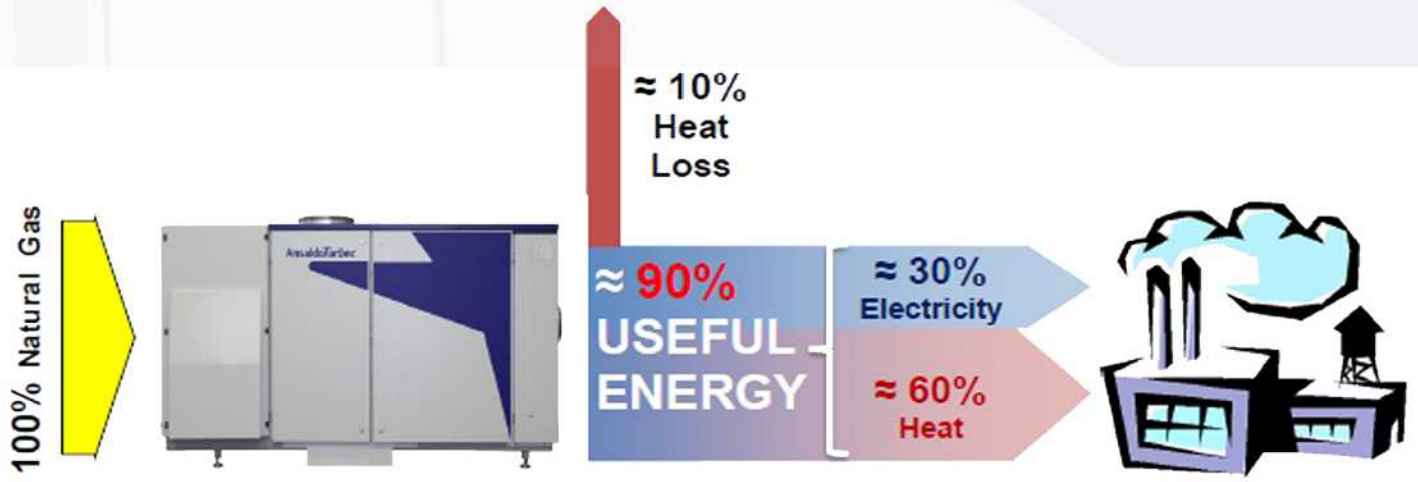
The AE-T100 microturbine produces electricity and heat fueled by natural gas and achieves an overall efficiency of 90%. Exhaust emissions from microturbine of important headline polluting gases such as CO and NOX are an order of magnitude lower than emissions from reciprocating engines. In fact, the exhaust gases are so clean that they can be used directly in greenhouses to increase CO2 levels which promotes plant growth.

Micro gas turbines offer many advantages over conventional reciprocating gas or diesel engines.

With only one moving part, they are inherently more reliable and maintenance costs are much lower than for reciprocating engines. Because the heat exchanger on the AE-T100 does not form part of the engine cooling system, unlike reciprocating engine CHP, the unit is extremely flexible with regards to higher water temperatures. They are also quieter, smaller and cleaner.

WHY AE-T100 MICRO TURBINES FOR DISTRIBUTED GENERATION?

- High total efficiency
- Short pay-back time
- Low ordinary maintenance
- Long useful life
- High reliability
- Low noise and emissions
- Ready to be remote controlled
- Compact design
- Different Fuels (NG, BIO, EFMGT)
- Flexible



AE-T100NG MICRO TURBINE – NATURAL GAS

AE-T100NG – Main Technical Data

General	
Installation	Indoor / Outdoor
Size (WxHxL)	900 x1810 x 277 0mm (P) 900 x 1810 x 3900 mm (CHP)
Weight	2250 / 2750 kg (P) – 2770 / 3100 kg (CHP)

Electrical data	
Frequency output	50 Hz (60 Hz on request)
Voltage output	400 V (AC), three phases

Fuel requirements	
Required pressure	20 mbar(g) ÷ 0.5 bar(g)|
Required temperature	(0 ÷ 60) °C
Lower Heating Value (LHV)	(38 ÷ 50) MJ/kg*

(*): depending on fuel LHV

Performances	
Electrical output	(100 ± 3) kWel
Electrical Efficiency	(30 ± 2) %
Fuel consumption	333 kWth ≈ 34 Nm3/h*
Exhaust gas flow	0.80 kg/s
Exhaust gas temperature	270 °C
Sound Power	85.4 dB(A)

Emissions *(@ Full load and 15% O2)*	
NOx	< 15 ppm(v)
CO	< 15 ppm(v)

AE-T100NG – Main Application Cases with Natural Gas

CHP *- Pools & Leisure centres*

CHP *- Hotel, hospitals, retirement houses, condominiums*

CCHP *– cooling through hot water or exhaust gas*

Steam *(industrial)*

Drying *processes (industrial)*

Diathermic oil (industrial)

Greenhouse

AE-T100NG MICRO TURBINE – BIOGAS

AE-T100B – Main Characteristics

-Matches AE-T100NG service intervals.

-No corrosion issues.

-Fuel system with proportional type valves specifically developed.

-Biogas Quality Ranges:

- - CH4 (methane): ≥ 40 $\%_{vol}$
- - H2S (hydrogen sulphide) ≤ 1500 ppm = 2280 mg/Nm^3
- - Siloxane* ≤ 100 mg/Nm^3.

CC @ 15.000 hours

Combustor and turbine volute intake section

Clean !

AE-T100B – Main Application Cases with Biogas






WWTP *– Waste Water Treatment Plants*



Landfills and farms

ANSALDO MICROTURBINE`S TURKEY DISTRIBUTOR

REFERENCES

Know-how, Standards and Softwares

HKD BUSINESS CASE

HKD , as distributer/agent of Ansaldo Energia for its micro turbines in Turkey supports clients in terms of procurement, installation, commissioning, operation, and maintenance of this technology. We are going to start with this specific small-scale CHP technology across the Turkey in high-rises, shopping centers, schools, hospitals, hotels, housing developments, cottage complexes, factories, greenhouses, cow farms, sewage treatment works, landfill sites, and island application.

In this regard, we make available a first class and tailored to the customers' individual requirements maintenance and after-sale service alongside this product, and fully we supply and/or install. We offer fully comprehensive Maintenance Contracts for any equipment which we install and/or supply. HKD also provides R&D ideas, contributes to research activities, and cooperates in proposal development within the research institutes which would be our clients for this well-established and famous CHP system.

As HKD only offers a refreshingly honest approach when assessing a projects technical and economic viability, if this technology/product that we supply isn't right for you, we will tell you; we'll even point you in the right direction if we think that there is something else available that is a better solution for your application, be sure!

If your objective is to install CCHP, of whatever form and fuel type, which will stand the test of time and meet payback expectations, then we have a solution that is right for you.

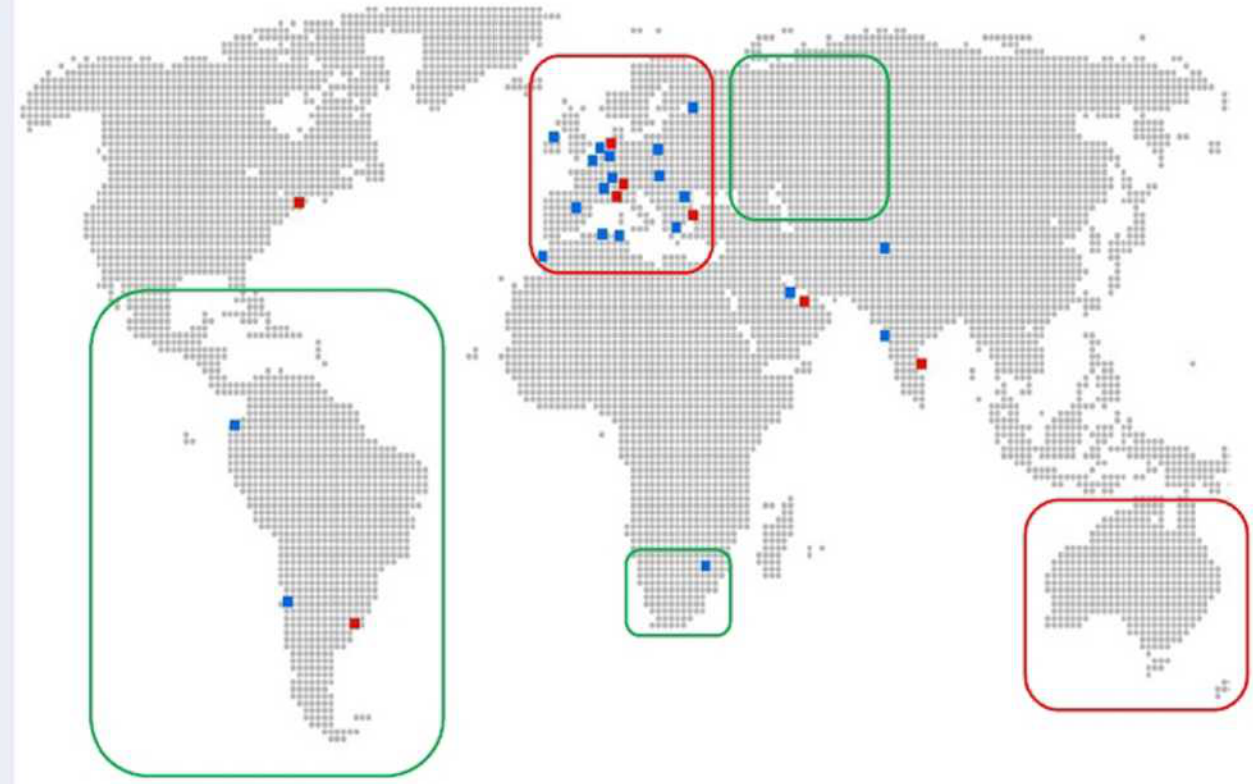
HKD International Engineering & Consulting

ANSALDO ENERGIA

Distibuted Generation
Turbec® Ansaldo Energia™

Distributed Generation – Where ?

*...more than **460** units worldwide*



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CUMMINS Gas Engines of power generation systems:

Developed in-house, CUMMINS Gas Engines power generation based power generation systems have set new standards in overall performance, connectivity, power quality and value. It provides solutions for blackouts and brownouts with continuous and reliable power not only for cities and infrastructure building, but also for micro-grid and the most remote corners of the world. Cummins power plants are enabling thousands of families and businesses to thrive in an otherwise desolate situation.

Note: Cummins Gas Engines has been used in Cogen systems by GSD General Systems Design Group as main contractor. (HKD is sub-contractor)