

# Microturbines and their use in Small Scale Cogeneration

Presentation

By

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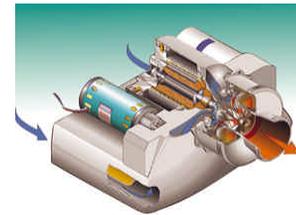
# Bowman Power Systems Ltd.

- Formed in 1994
- Dedicated to Distributed Generation (DG)
  - MTG systems – 30 kW to 400 kW
  - MTG components – 1 kW to 1500 kW
  - Power Conditioners for all DG systems
    - MTG's
    - Fuel Cells
    - Renewables (wind generators, solar)
- 100 people
- Offices
  - Headquartered in Southampton, UK
  - San Diego & Los Angeles, California
  - Tokyo, Japan

# BPS Focus – Small Scale Cogeneration > 400kW

Based on:

- Efficient, low emission gas turbines
- High speed generator technologies
- Power electronics and conditioning
- Integral heat recovery system
- Optimum use of waste heat
- Remote monitoring and diagnostics



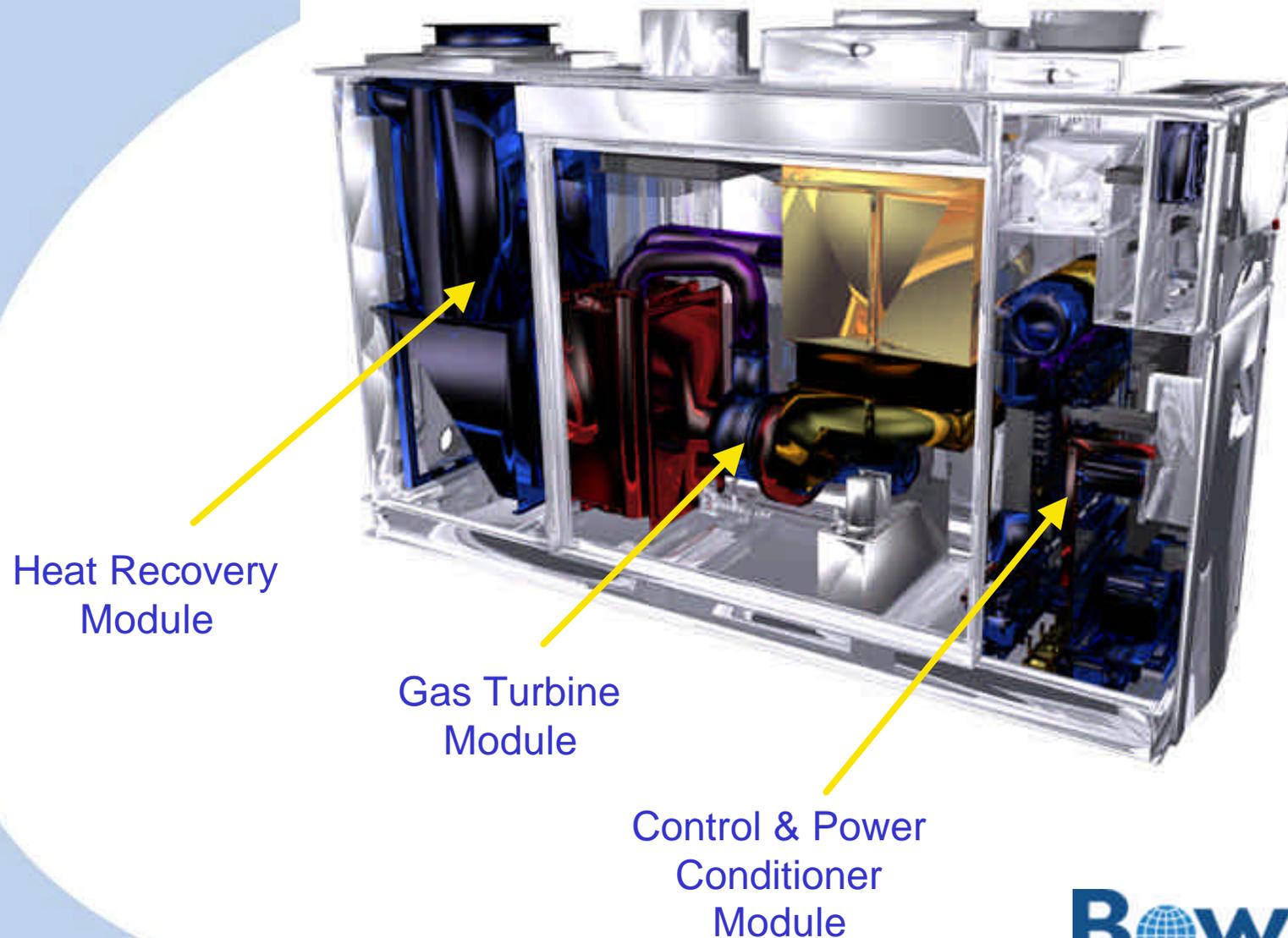
# MTG Cogen Systems

- 1. Range of Systems:** 50, 100, 250 kWe (typical)
- 2. Electrical Power Rating:** continuous
- 3. Electrical Efficiency:** 30% + (recuperated cycle)
- 4. Time between Gas Turbine overhauls:** 30,000 hours
- 5. Life Time of Gas Turbine:** 90,000 hours
- 6. Maintenance cost (100 kW unit) < 1.5 c/ kW-hour**
- 7. Start reliability:** Better than 99%

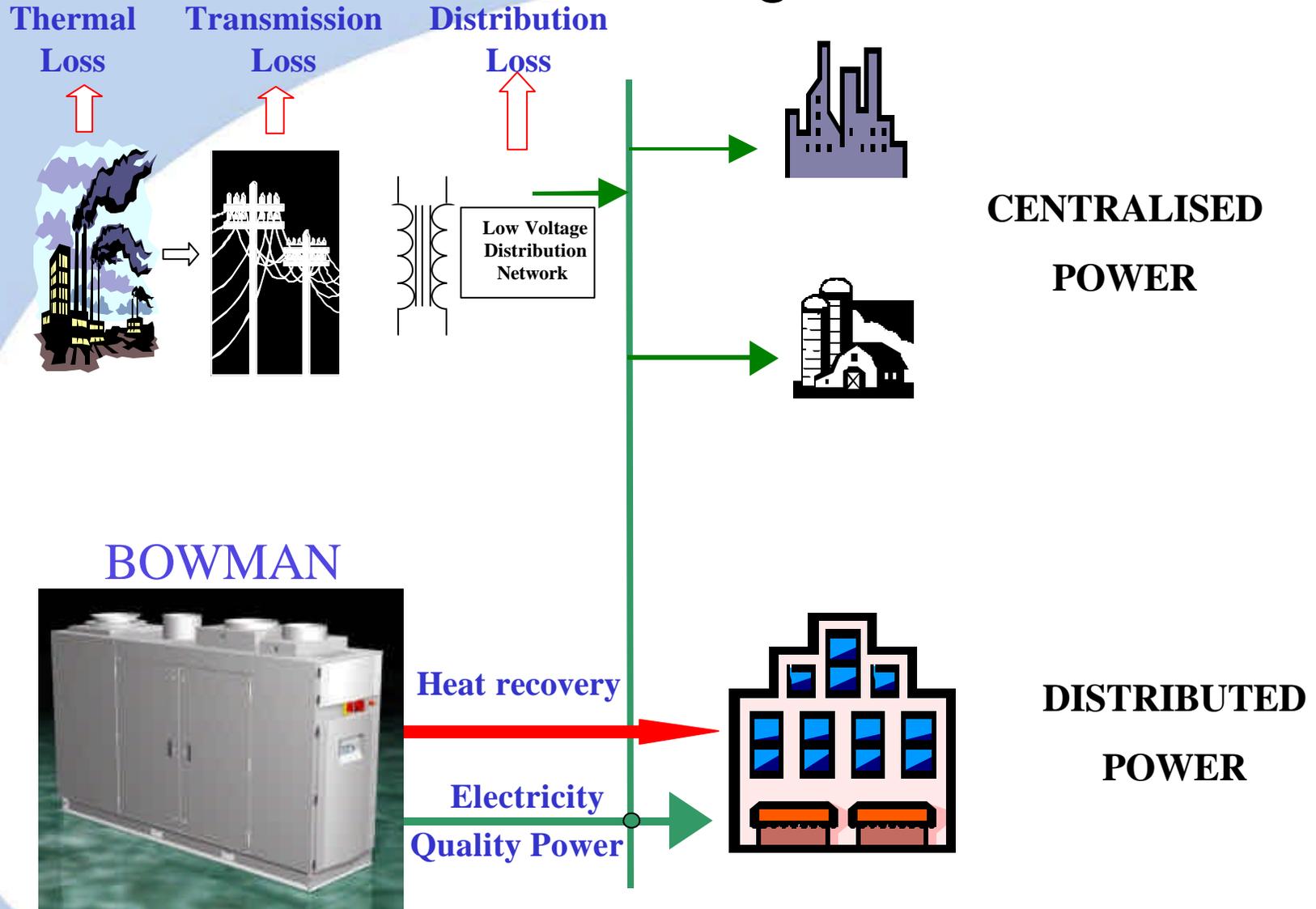
# What are the Advantages of the Turbogenerator CHP System

- **Competitive Capital Investment** with other Technology.
- **High Grade Power Quality**
- **High System Efficiency** typically 70-80%
- **Environmentally Friendly** low emissions levels of NO<sub>x</sub>, CO, CO<sub>2</sub>.
- **Flexibility of Operation** with variable heat/chilling output on demand, resulting in optimized efficiency.
- **Low Maintenance**
- **Simple Installation** Lightweight / compact. Fully factory packaged, plug & play.

# TG80 System Arrangement



# Distributed Cogeneration



**BOWMAN**



# Electrical Efficiency Alone Not Adequate for Most Applications

MTG 27-30%



Heating  
or 45-55%  
Cooling



Economic  
payback

# CHP Applications

*Hot water*



*Steam*



*Direct Heating*



*Chilling for  
water and AC*



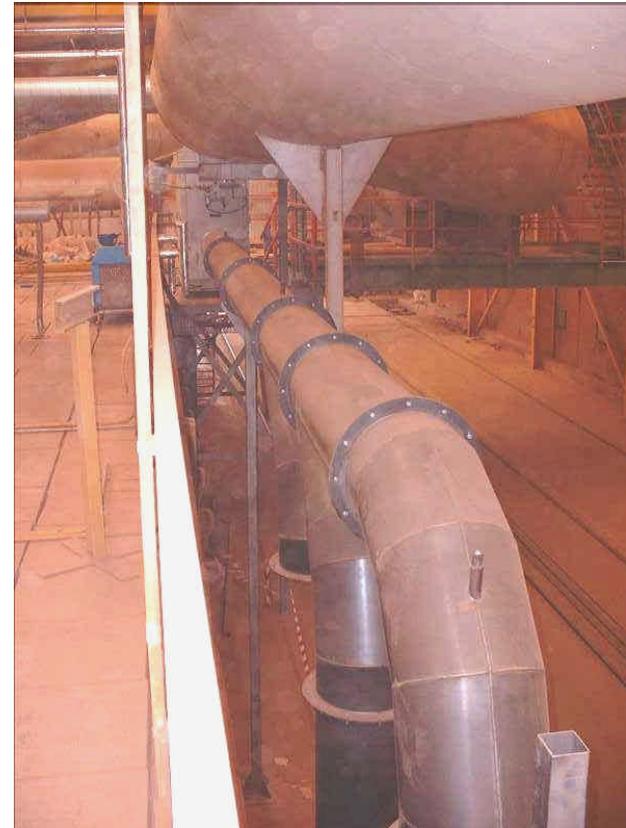
# Configuration Options

## Simple Cycle vs. Recuperated

Recuperators have great effectiveness on small, high specific output gas turbines

- Simple cycle
  - Electrical efficiency 15%
  - Exhaust temperature 680°C / 1250°F
- Recuperated cycle
  - Electrical efficiency 30%
  - Exhaust temperature 280°C / 540°F

# Installation - Brickworks



# Project Description

- Simple cycle gas turbine
- 24 hour operation
- System installed in a brickworks with exhaust gases directly ducted to the brick drying kiln
- All waste heat can be used into drying kiln
- Gas introduced at match point to kiln temperature
- Generated electricity used to reduce site power importation
- System efficiency >90 %
- Kiln exhaust gases recycled as warm input air

# Project Economics

- Capital Investment \$45,000
- Fuel and Maintenance cost \$60,000 per year
- Avoided electricity \$43,500 per year
- Avoided gas \$39,000 per year
- Net saving \$22,500
- **Simple payback 2 years**

# Similar applications suitable for Simple Cycle Microturbines

- Food Processing industry
- Ceramic Industry
- Space heating (with heat exchanger)
- Animal Feed processing
- Waste product drying
- Metal fabrication process

# Installation – Leisure Centre



# Project Description

- London Borough Community Leisure Complex
- Swimming Pool
- Activity Halls
- Turbogen TG80CG providing
  - 150 kW th of Low temperature hot water
  - 80 kWe of embedded generation
- 4500 / 5000 operating hours per year

# Project Economics



# Installation – Residential Housing Complex

# Project Description

- Inner London Borough
- 1960's 12 storey building
- Heating and Electrical Load for 72 homes
- Turbogen TG50CG providing
- 50 kWe of embedded generation
- 108 – 275 kW<sub>th</sub> of low temperature hot water
- 6,000 operating hours / yr

# Project Economics

- Turbogen TG50CG £50,000
- Value of energy produced / yr £24,000
- Operating costs / yr £14,000
- Total annual savings £10,000
- Simple Payback 5 years

# Similar applications suitable for Microturbine Cogeneration

- Hotel Chain
- Office Block
- Residential Homes
- Clinic
- Small Hospitals
- Sports/Fitness Centres

# Trigeneration

- Turbogeneration can produce high temperature hot water 110/120 °C
- Easily integrated with an Absorption Chiller
- Hot water bypass provided to supply:
  - Heat in winter
  - Chilling/Air conditioning in summer
- TG80 can provide:
  - 80kWe of embedded generation
  - 150kWth of low temperature hot water
  - 30RF Tons of chilling
- Direct exhaust gas fired chillers currently under development

# Installation – Hospital Heating & Chilling



# Project Description

- Evaluation Scheme
- Major European City Trigeneration Project
- Turbogenerator TG80CG providing;
  - 80 kW<sub>e</sub> of embedded generation
  - 150 kW<sub>th</sub> of low temperature hot water
- Integrated with 30 ton, double effect, hot water fired absorption chiller
- Approx 8,000 operating hours / yr

# Benefits

- TG80 is easily retrofitted to existing chiller installations
- TG80 can produce high temperature hot water @ 110 / 120°C
- Utilization 365 days / year
- Hot water bypass provided to supply:
  - Heat in winter
  - Chilling / air conditioning in summer
- Higher efficiency will be obtained using direct exhaust gas fired chillers (currently under development)

# Similar applications

- Hospitals
- Supermarkets
- Frozen Food retailers
- Hotels
- Schools
- Residential Homes in warm areas requiring air conditioning

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