Power-effective solutions for oil and gas industry
MORE THAN 250 COMPLETED PROJECTS

MORE THAN 12 YEARS OF SUCCESSFUL ACTIVITY

- Own manufacturing facilities in the Yaroslavl Region
- Own logistics system and warehouse
- Renting out power stations
- Leasing company providing soft-term financing
- GOST R ISO 9001-2001 quality management system
BPC Engineering is an exclusive distributor of Capstone Turbine Corporation (USA) in the territory of Russia, the CIS and the Baltic States.

<table>
<thead>
<tr>
<th>Power generating equipment</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capstone C15, C30, C65, C200, C1000 microturbines</td>
<td></td>
</tr>
<tr>
<td>▪ Single unit power output 15-1000 kW</td>
<td></td>
</tr>
<tr>
<td>WHG125 ORC turbines</td>
<td></td>
</tr>
<tr>
<td>▪ Single unit power output 125 kW</td>
<td></td>
</tr>
<tr>
<td>Solutions for hybrid vehicles based on Capstone C30, C65</td>
<td></td>
</tr>
<tr>
<td>▪ Single unit power output 30 and 65 kW</td>
<td></td>
</tr>
<tr>
<td>Distributed CHP (combined heat and power) systems</td>
<td></td>
</tr>
<tr>
<td>Distributed power generation systems</td>
<td></td>
</tr>
<tr>
<td>Green vehicles</td>
<td></td>
</tr>
<tr>
<td>▪ Urban passenger vehicles:</td>
<td></td>
</tr>
<tr>
<td>▪ buses, minibuses</td>
<td></td>
</tr>
<tr>
<td>▪ Trucks</td>
<td></td>
</tr>
<tr>
<td>▪ Special-purpose vehicles</td>
<td></td>
</tr>
<tr>
<td>▪ Motor cars</td>
<td></td>
</tr>
</tbody>
</table>
The industry challenges

- High power intensity of oil and gas production
- Low level of efficient use of associated gas
- High level of environmental pollution
- Necessity to increase rate of associated gas utilization up to 95% by 2012
- Necessity of long-term investments in programs of associated gas utilization
- Need for power efficient solutions of associated gas utilization
Special solutions: Associated gas utilization
Benefits of distributed power plants with associated gas utilization

- Increase of power efficiency in oil and gas industry
- Low prime cost of electric and thermal energy
- Increase of ecological sustainability of a production
- Short payback period
- Optimization of power costs
- Decrease of production costs
Technological base: Capstone microturbines
Modular microturbine engines
Capstone C15, C30, C65, C200, C1000

- 15, 30, 65, 200, 600, 800, 1000-kW electrical output
- Fuel: natural gas, associated gas, biogas, liquid fuels (kerosene, diesel), propane-butane mixes, liquefied gas
- Reliability, controllability
- High efficiency: up to 90% in CCHP
- Low operational costs
- Ecological features (CO / NOx < 9 ppm)
- Load flexibility (continuous operation at 0-100% power output)
- Modular design
- More than 1100 units in operation in Russia
- Certificates and permissions: UL, CE, GOST R ISO 9001 – 2008, Rostekhnadzor
Capstone microturbine engine
Capstone microturbine engine cycle

Diagram showing the flow of the engine cycle, including components like the Inlet Air Filter, Generator, Compressor, Turbine, Recuperator, Combustor, and various temperature sensors and values.
Electric diagram

AC to DC Inverter

DC Bus

DC to AC Inverter

Battery module and system controller

AC to DC Inverter

DC Bus

800 VDC

DC to AC Inverter

L1

L2

L3

N
Product range

**CAPSTONE C15/C30**
Power output
15/30 kW

**CAPSTONE C65**
Power output
65 kW

**CAPSTONE C200**
Power output
200 kW

---

**Capstone C1000 Series Microturbine Systems**

**Models:**

- **C600** — Power output 600 kW
- **C800** — Power output 800 kW
- **C1000** — Power output 1000 kW
Capstone C1000 Series Microturbine System
Key components of microturbine (Capstone C30 is shown)
Capstone C200 key components

- Fuel Supply
- Valve
- Break Resistor
- Engine Control Module
- Microturbine Engine
- Battery Control Modules
- Batteries
Capstone C200 key components

Generator Control Module

Load Control Module

Break Resistor

GasPack Unit
Benefits of microturbine power plants

- **HIGH ECONOMIC EFFICIENCY**
  Investments payback period averages 2-4 years, project profitability is more than 30%, and cost of 1kW of electricity is two times lower than utility grid tariffs

- **HIGH POWER EFFICIENCY**
  High total efficiency through cogeneration and trigeneration, fuel efficiency is more than 90%

- **HIGH RELIABILITY**
  Through internal redundancy, modular design, and ability to connect to power grid

- **LOW OPERATIONAL COSTS**
  Absence of oils, coolants, and lubricants. Intervals between maintenance – 8000 hours. Lifecycle till overhaul – 60000 hours

- **SCALABLE, MODULAR, COMPACT, MOBILE**
  Wide range of power output – from 15kW to 20MW. Compact size, shipment of modules of needed power output, possibility to expand power capacity of a power plant in operation

- **SHORT TERMS OF POWER PLANT ERECTION AND START-UP**
  Average terms of power plant commissioning – 9-15 months

- **HIGH DEGREE OF AUTOMATION**
  Ability of operation in automatic mode, permanent presence of personnel is not needed, remote control and monitoring system is available
Electrical Efficiency. Capstone vs Other Gas Turbine Units

- Capstone C200
- Capstone C1000
- Capstone C65
- Capstone C30
- Elliott TA100R
- Ingersol Rand MT250
- Capstone C30
- OPRA Turbines OP16-3B (DLE)
- Solar Turbines Saturn 20
- Solar Turbines Centaur 50
- Solar Turbines Centaur 40
- OPRA Turbines OP16-3B (DLE)
- Rolls Royce 501-KB5S
- Roll Royce 501-KB7S
- Kawasaki GPB15D
- Kawasaki GPB30D
- Solar Turbines Mercury 50
- Siemens SGT-100
- General Electric GE5-1 (DLN)
- Dresser-Rand KG2-3E
- Dresser-Rand KG2-3C
- Kawasaki GPB60D

Power Output (MW) vs Electrical Efficiency (%) chart.
### Capstone microturbines vs Gas turbines (GT) vs Gas reciprocating engines (GRE)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Capstone microturbine</th>
<th>GT</th>
<th>GRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical efficiency</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>CHP efficiency</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reliability of power supply and redundancy</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Load flexibility, ability of continuous operation at 0-100% range of load</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lifecycle</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intervals between maintenance</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Production cost of 1kWh of electricity</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Operational and maintenance costs</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Experience in application in Russia</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ecological features</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Microturbines do not demand special gas treatment for most types of gaseous fuels. The heating value of gas must be within 2500 and 24000 kcal/m3.

- Low and high pressure natural gas complying with GOST R 5542-87;
- Biogas: landfill gas, wastewater treatment gas, digester gas;
- Associated gas, flare gas;
- Liquid fuels: kerosene, diesel, biodiesel;
- Low-calorific gases;
- Variable content gases;
- Liquefied gas: natural gas (methane), propane-butane;
- Colliery methane and coal bed methane;
- Coke oven gases;
- Syngas (synthetic gas)
Options of microturbines installation

- Outdoors in a weatherproof enclosure;
- In a detached building;
- In a main building, indoors;
- On a building’s rooftop;
- In a container for ambient temperature range -60°C ... +50°C
Mobile containerized Capstone microturbine-based power stations
Mobile containerized power stations

Reliable power supply for small and medium oil and gas fields

- Remote single wells
- Well clusters
- Wells with seasonal production
- Marginal wells and wells with low gas content
- Prospect wells
## Variants of standard solutions

<table>
<thead>
<tr>
<th>External dimensions (LxWxH in mm)</th>
<th>Equipment configuration</th>
<th>Power output (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6000 x 2438 x 2896</td>
<td>1 turbine: Capstone C15 / C30 / C65 Exhaust recovery: yes/no</td>
<td>15 / 30 / 65</td>
</tr>
<tr>
<td>9000 x 2438 x 2896</td>
<td>2 turbines: Capstone C15 / C30 / C65 Exhaust recovery: yes/no</td>
<td>30 / 60 / 130</td>
</tr>
<tr>
<td>11144 x 4796 x 3420 (Transported in 3 modules)</td>
<td>Capstone C1000 systems (C600, C800, C1000) Exhaust recovery: yes/no</td>
<td>600 / 800 / 1000</td>
</tr>
</tbody>
</table>

## Operational conditions:
- Ambient temperature range – +40°C…-60°C
- Relative humidity – not more than 80% at +25°C
- Snow load – 200 kg/m²
- Seismic resistance – 8
TRANSPORTATION

WINTER: skid-mounted
SUMMER: step deck or flatbed trucks

Containerized power stations have standard transporting dimensions
<table>
<thead>
<tr>
<th>Standard configuration of a containerized power station</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Container is manufactured as a frame made of metal section covered with corrugated steel sheet with heat insulation. Containers are equipped with doors, louvers, holes for power cable outlet and connections for gas pipelines</td>
</tr>
<tr>
<td>- Capstone C15 / C30 / C65 microturbine units designed for associated gas combustion (including high hydrogen sulfide content – up to 4%)</td>
</tr>
<tr>
<td>- Capstone heat recovery unit (if required)</td>
</tr>
<tr>
<td>- Gas booster compressor (if required)</td>
</tr>
<tr>
<td>- Control system that provides efficient operation in different operational modes and conditions</td>
</tr>
<tr>
<td>- Auxiliary distribution board</td>
</tr>
<tr>
<td>- 0.4kW electrical distribution board with in-built power meter</td>
</tr>
<tr>
<td>- Heating and ventilation systems</td>
</tr>
<tr>
<td>- Main and standby lighting system</td>
</tr>
<tr>
<td>- Fire extinguishing systems (fire detection, audible alarm, automatic gas suppression system)</td>
</tr>
<tr>
<td>- Gas detection system (CO, CH4 detection, audible alarm)</td>
</tr>
<tr>
<td>- Anti-intrusion alarm system</td>
</tr>
<tr>
<td>- Uninterruptible power supply for protected loads (if required)</td>
</tr>
</tbody>
</table>
Example of containerized power station, 6000mm x 2438mm x 2896mm

1. Container
2. Capstone C15 / C30 / C65 microturbine
3. Air and ventilation intake
4. Exhaust pipe
5. Lamp
6. Gas suppression module
7. Gas equipment
8. Electrical distribution board
9. Auxiliaries board
10. Board with security alarm, gas detection and fire extinguishing systems
11. Electric heaters
12. Bleeder stack
13. Power and control cables inlet/outlet
14. Venting fan
Example of containerized power station, 9000mm x 2438mm x 2896mm

1. Container
2. Two Capstone C15 /C30 / C65 microturbines with compressor
3. Emergency venting
4. Air intake (winter)
5. Exhaust pipe
6. Lamp
7. Fire extinguisher
8. Gas equipment
9. Electric distribution board
10. Auxiliaries board
11. Electric heater
12. Bleeder stack
13. Air intake (summer)
14. Fire extinguishing and alarm board
Example of containerized power station, 11144mm x 4796mm x 3420mm

1. Air preparation module
2. Electric module
3. Capstone C1000 Series microturbines
4. Air duct
5. Summer air intake
6. Winter air intake
7. Relief valve (winter)
8. Fan
9. Electrical heat exchanger
10. Lamp
11. Electric convector
12. Auxiliaries board
13. Distribution board
14. Main power board
ENEX 2000 Gas Turbine Power Station

**KG2-3G Gas Turbine**
- Industrial, single-shaft
- Radial, single-stage compressor
- Radial, single-stage turbine
- 4 DLE combustors

**Main reduction drive**
- Compound star

**Generator**
- Brushless synchronous generator
- Of client’s choice

**Package**
- Steel frame
- Direct-drive AC, pneumatic or electrohydraulic start system
- Natural gas fuel system
- Integrated lube oil system
- Control system
  - Microprocessor-based PLC
  - Generator control
  - Vibration and temperature monitoring
  - Auto-syncronizing
- Weatherproof acoustic enclosure
- Factory testing
- Full documentation
- Combustion and ventilation inlet air systems
- Exhaust system
- Turbine compressor cleaning system
<table>
<thead>
<tr>
<th><strong>ENEX 2000 Main Technical Data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical Efficiency</strong></td>
</tr>
<tr>
<td><strong>Shaft Output @ ISO (15°C / 59°F), kW</strong></td>
</tr>
<tr>
<td><strong>Output Shaft Speed (RPM)</strong></td>
</tr>
<tr>
<td><strong>Fuel Type</strong></td>
</tr>
<tr>
<td><strong>Fuel Rate (kJ/kWh)</strong></td>
</tr>
<tr>
<td><strong>Exhaust Gas Temperature (°C/°F)</strong></td>
</tr>
<tr>
<td><strong>Exhaust mass flow (kg/sec)</strong></td>
</tr>
<tr>
<td><strong>NOx Emissions (15% O2) (ppm)</strong></td>
</tr>
<tr>
<td><strong>Fuel Gas Inlet Pressure (bar g)</strong></td>
</tr>
<tr>
<td><strong>Generators</strong></td>
</tr>
<tr>
<td><strong>Weight, Turbine/Gear (kg)</strong></td>
</tr>
<tr>
<td><strong>Typical Package Weight (kg)</strong></td>
</tr>
<tr>
<td><strong>Approximate Package Dimensions (L x W x H) (m)</strong></td>
</tr>
</tbody>
</table>
Dresser-Rand KG2-3G Gas Turbine

- Class leading fuel efficiency
- Dry, low emissions (DLE) compliant with current and future standards
- H2S acceptance
- High reliability
- Easy maintenance
- Rugged, durable design
- Compact dimensions, low weight
- Dual fuel capability and wide fuel spec tolerance
- Low vibrations level
- Cantilevered rotor configurations (no bearings in hot zones)
- Bearings without life limitation
- Low oil consumption
- Mineral lube oil
- CE Certification
- Easy retrofit of current KG2
Gas booster stations for containerized power stations

- High reliability
- Stand-alone operational mode (start from microturbine)
- Mobile
- Low operational costs
- Convenient service schedule matching with microturbines service schedule
- High efficiency and sustainability of associated gas compression including gases with high heavy hydrocarbons and hydrogen sulfide contents

Flow rate: from 25 m³/hour to 4700 m³/hour
Output pressure: from 0.45 MPa to 24 MPa
Operational temperatures range: from -60 to +50°C

Options
- Skid-mounted
- Packaged booster station with all interconnections

Manufactured by: BPC Engineering, Russia
Standard configuration of containerized gas booster station

- Heat-insulated container
- Screw compressor (one or several) with oil and gas circuits
- Gas system
- Control system
- Heating system
- Venting system
- Lighting system
- Fire extinguishing system (upon customer’s request)
- Security alarm system
- Gas detection system

Supplier guarantees

- compliance of gas booster stations’ performance with applied standards
- reliable continuous operation of the stations upon observance of conditions and regulations of storage and operation
- failure repairs and parts replacement within warranty period is free of charge
## Specifications and benefits

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overhaul period</strong></td>
<td>Up to 40000 hours</td>
</tr>
<tr>
<td><strong>Maintenance period</strong></td>
<td>Up to 8000 hours</td>
</tr>
<tr>
<td><strong>Repair and maintenance time</strong></td>
<td>Not more than 6 hours at a site</td>
</tr>
</tbody>
</table>
| **Components from leading European manufacturers:** | • Electric motor SIEMENS   
 |                               | • Screw pair TM (Termomeccanica S.p.A.)                                 |
| **Low level of noise and vibrations** | Does not require special foundation or basing                           |
| **Life cycle**                | 15 years                                                                |

### ATEX certification

### Capability to increase of warranty period

### Gas booster stations manufacturing according to individual customer’s needs
Use of gas holders at oil fields with irregular gas output

Function
- Accumulation and storage, gas pressure stabilization

Types of gas holders used
- Low pressure gas holders (up to 2 atm.)
- High pressure steel gas holders (up to 10 atm.)

Conceptual diagram
Special solutions:
Gas transmission infrastructure
Capstone microturbine-based containerized power stations

Power supply for gas transmission facilities:

- Linear parts of pipelines
- Booster compressor station
- Linear compressor stations
- Gas distribution stations

Applications:

- Prime power source
- Standby power
- Power source combined with UPS

Reliability • Independence • Redundancy
Solution for linear pipelines parts power supply

Standard containerized solution for linear pipelines parts power supply:

- 2 Capstone C15 / C30/ C65 microturbines (single unit power output 15/30/65 kW)
- Prime microturbine – natural gas
- Standby microturbine - diesel

Main loads:

- Valve blocks
- Cathodic protection
- Telemetry

Containerized microturbine-based power stations are a reliable and efficient solution for main pipelines auxiliaries power supply.
### Results of operation of Capstone microturbines at gas transmission facilities vs. alternative solutions

<table>
<thead>
<tr>
<th>Feature</th>
<th>Capstone</th>
<th>Utility grid</th>
<th>ORMAT-OEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of capital investments</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Reduction of heating and power costs</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Increase of power supply reliability</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Ease of operation and maintenance</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Case studies

Project: Power supply for Dzuarikau – Tshinval gas pipeline

- **Customer:** OOO Gasprom transgas Stavropol
- **Solution:** 12 blocks containing 2 Capstone C30 microturbines (main and stand-by power)
- **Power output:** 60 kW
- **Fuel:** natural gas
- **Commissioned:** IV quarter, 2009

**Project peculiarities:** the gas pipeline is laid through 5 mountain chains, the highest point is Kudarskiy pass - 3148 meters above sea level

Project: Gas-distributing station reconstruction

- **Customer:** OOO Gasprom transgas Stavropol
- **Solution:** 1 Capstone C30 microturbine
- **Power output:** 30 kW
- **Fuel:** natural gas
- **Commissioned:** II quarter, 2008

Project: Power supply of pipeline string Okha (Sakhalin) — Komsomolsk-on-Amur (the Khabarovsk Region)

- **Customer:** OAO Far Eastern Generating Company
- **Solution:** 11 blocks containing 2 Capstone C30 microturbines (main and stand-by power)
- **Power output:** 60 kW
- **Fuel:** natural gas / diesel
- **Commissioned:** I quarter, 2009
**Project**

**Power supply for a linear part of the Bovavenkovo-Uhta pipeline**

- **Customer:** OAO Gazprom transgas Uhta
- **Solution:** 50 containerized power stations based on 2 Capstone C30/C65 microturbines (prime and standby)
- **Power output:** 60 kW / 130 kW
- **Fuel:** natural gas

---

**Project**

**Power supply for a linear part of the North-European pipeline**

- **Customer:** OAO Gazprom transgas St. Petersburg
- **Solution:** 4 containerized power stations based on Capstone C65 microturbines (prime and standby); 1 containerized power station based on Capstone C30
- **Power output:** 130 kW / 30 kW
- **Fuel:** natural gas
Ecological features: emissions. Capstone vs GT vs GRE

- **Reciprocating engine at full load**
- **Industrial turbine at full load**
- **The “greenest” industrial turbine at full load**

**Graph:**
- **ppmV NOx**
- **Harmful emissions**
  - **CAPSTONE** at 0-100% of load
  - **OPRA** at 0-100% of load
Economic parameters
Economic parameters

Cost of equipment
- 1200–1500 USD/kW

Cost of turn-key power plant
- 1500–2500 USD/kW

Cost of routine maintenance
- 0.005 – 0.008 USD/kW

Net cost of power production / with biogas consumption
- Electricity: 0.03 – 0.05 / 0.005–0.008 USD/kWh
- Heat: 2 kWh free
- Cooling: 1,3 kWh free

Terms of turnkey project execution
- 6 - 15 months

Payback period
- Power generation: 3–5 years
- Cogeneration / Trigeneration (power / heat / cooling): 3-4 years
- If connected to power grid: 2-3 years
Case studies
Clients

Oil and gas

- Gazprom
- ITERA
- Rosneft
- Tatneft
- Narьянмарнефтегаз
- ВолгаНефтеГаз

Shopping malls and office and warehouse complexes

- 36.6
- Sahatorg

Power engineering and housing and public utilities

- TTH
- THK-BP
- ТНК-ВР
- MP SK

Manufacturing industry

- VOMZ
- AMA
- Norilsk Nickel
- Liebherr

Telecommunications

Sports and recreational facilities

- Vake Swimming Pool and Fitness Club
- Красная Поляна
### Geography of realized Capstone microturbine-based projects

More than 1100 microturbines across Russia and CIS

<table>
<thead>
<tr>
<th>District</th>
<th>Number of units</th>
<th>Total power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Southern Federal District</td>
<td>69, 8 505 kW</td>
<td></td>
</tr>
<tr>
<td>2. Central Federal District</td>
<td>153, 15 010 kW</td>
<td></td>
</tr>
<tr>
<td>3. Northwestern Federal District</td>
<td>258, 20 515 kW</td>
<td></td>
</tr>
<tr>
<td>4. Privolzhsky Federal District</td>
<td>189, 27 700 kW</td>
<td></td>
</tr>
<tr>
<td>5. Ural Federal District</td>
<td>74, 4 670 kW</td>
<td></td>
</tr>
<tr>
<td>6. Siberian Federal District</td>
<td>26, 1 620 kW</td>
<td></td>
</tr>
<tr>
<td>7. Far Eastern Federal District</td>
<td>176, 15 160 kW</td>
<td></td>
</tr>
<tr>
<td>8. North Caucasian Federal District</td>
<td>33, 1 155 kW</td>
<td></td>
</tr>
<tr>
<td>9. Georgia</td>
<td>4, 14 640 kW</td>
<td></td>
</tr>
<tr>
<td>10. Ukraine</td>
<td>13, 845 kW</td>
<td></td>
</tr>
<tr>
<td>11. Republic of Belarus</td>
<td>84, 9 520 kW</td>
<td></td>
</tr>
<tr>
<td>12. Kazakhstan</td>
<td>33, 4 790 kW</td>
<td></td>
</tr>
<tr>
<td>13. Lithuania</td>
<td>1, 200 kW</td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Power Output</td>
<td>Equipment</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>Tedinskoye oilfield</td>
<td>4 MW</td>
<td>OPRA</td>
</tr>
<tr>
<td>Rodnikovskoye oilfield</td>
<td>8 MW</td>
<td>OPRA</td>
</tr>
<tr>
<td>Vakhitovskoye oilfield</td>
<td>12 MW</td>
<td>OPRA</td>
</tr>
<tr>
<td>Western Malobalykskoye oilfield</td>
<td>16 MW</td>
<td>OPRA</td>
</tr>
<tr>
<td>Eastern-Sotchemyu-Talyu oilfield</td>
<td>2 MW</td>
<td>Capstone</td>
</tr>
<tr>
<td>Shemeti, Preliminary water</td>
<td>130 kW</td>
<td>Capstone</td>
</tr>
<tr>
<td>discharge unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pogromnenskoye oilfield</td>
<td>195 kW</td>
<td>Capstone</td>
</tr>
<tr>
<td>Onbiyskoye oilfield</td>
<td>30 kW</td>
<td>Capstone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
On-site power plant at Pogromenskoye oilfield

**Customer:** ITERA  
**Operation mode:** stand alone / CHP  
**Power output:** 195 kW (electricity)  
**Loads:** pumps, portacabins

**Main equipment:**
- 3 Capstone C65 microturbines (65-kW single unit power output)  
- 3 gas booster compressors  
- Gas-gas heat exchangers

**Fuel:** associated gas

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Methane contents, %</th>
<th>Hydrogen sulfide contents, %</th>
<th>Gas heating value, kcal/m³</th>
<th>Special gas treatment equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>29,57</td>
<td>no</td>
<td>12 000</td>
<td>no</td>
</tr>
</tbody>
</table>

**Start of commercial operation:**
- 1 stage – 4 quarter, 2008  
- 2 stage – 3 quarter, 2010  
- 3 stage – January, 2011

**Benefits:**
Reliable power supply for loads at isolated oil wells allows avoiding the construction of associated gas transportation system and power lines.
On-site power plant at Onbiyskoye oil field

**Customer:** TATEX

**Operation mode:** Grid connected / power generation

**Power output:** 830 kW (electricity)

**Main equipment:**
1 Capstone C30 microturbine (30-kW single unit power output)
1 Capstone C800 microturbine (800-kW)

**Fuel:** associated gas

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Hydrogen sulfide contents, %</th>
<th>Gas heating value, kcal/m³</th>
<th>Special gas treatment equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>1,56</td>
<td>12 800</td>
<td>no</td>
</tr>
</tbody>
</table>

**Start of commercial operation:** January, 2007

**Benefits:** Reliable power supply for loads at small isolated oil wells
**On-site power plant at Shemeti oil field**

**Customer:** Lukoil-Perm  
**Operation mode:** Parallel with the customer’s grid / CHP  
**Power output:** 130 kW (electricity)  
**Loads:** Pumps of preliminary water discharge unit  
**Volume of consumed associated gas:** 400,000 m³ annually

**Start of commercial operation:** October, 2009

**Main equipment:**
- 3 Capstone C65 microturbines (65-kW single unit power output)  
- 3 gas booster compressors

**Fuel:** associated gas

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Methane contents, %</th>
<th>Hydrogen sulfide contents, %</th>
<th>Gas heating value, kcal/m³</th>
<th>Special gas treatment equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>22.14</td>
<td>0.66</td>
<td>10,500</td>
<td>no</td>
</tr>
</tbody>
</table>

**Economic effect:** Annual savings considering penalties for emissions amount to more than 2 mln. rubles
On-site power plant at Eastern-Sotchemyu-Talyu oilfield

**Customer:** Pechoraneftegas  
**Operation mode:** Stand alone / power generation  
**Power output:** 2000 kW (electricity)  
**Loads:** oil separation units, oil-transfer pumps

**Main equipment:**
- 2 Capstone C1000 microturbine systems  
  (100-kW single system power output)  
- 2 gas booster compressors

**Fuel:** associated gas

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Methane contents, %</th>
<th>Hydrogen sulfide contents, %</th>
<th>Gas heating value, kcal/m³</th>
<th>Special gas treatment equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>27,01</td>
<td>1,15</td>
<td>9192</td>
<td>no</td>
</tr>
</tbody>
</table>

**Start of commercial operation:**  
April, 2011

**Benefits:**
Reliable power supply for loads at isolated oil wells allows avoiding the construction of associated gas transportation system and power lines
BPC Engineering

50A/8 Bld. 2, Zemlyanoy Val St., Moscow, Russia, 109028

Tel.: +7 (495) 780-31-65
Fax: +7 (495) 780-31-67

E-mail: energy@bpc.ru
http://www.bpcenergy.ru