

## **Equipment for processing of industrial and domestic waste in various forms of energy.**

Proposed to use a complex of class «alternative fuel».

Complexes of this class is able to process any carbonaceous wastes (industrial and household waste, including rubber products, plastics and plastic, coal and oil slimes), perform reclamation (cleaning) of land, water, sewage, polluted with oil leakage and oil products with getting to the output of various kinds of synthetic fuel, heat, electricity, technical and distilled water.

The complex has a closed cycle, which eliminates any emissions in the atmosphere, derived synthetic motor fuel (SMF) has a number of competitive advantages, to enable him, in the future, almost completely replace traditional fuel - especially in the world's major cities.

Firstly, it radically solve the problem of exhaust gases, for example, diesel exhaust working on synthetic motor fuel (SMF), 6 times lower than EURO-4 emissions of carbon monoxide (CO), 4 times less emissions of hydrocarbons (HC), in 4 times less emissions of particulate (the notorious soot and a soot from diesel engines) and 20% less emissions of oxides of nitrogen (NOx). Get a surrogate technologically impossible, despite the fact that the processing are domestic waste and garbage, which is even not necessary to sort. There's no selection of dioxin and other harmful substances.

Secondly, given that Russia is in a very cold climate zone of application of the SMF completely solves the problem of the so-called cold start of diesel engines working on SMF diesel in normal mode and wind up at -50°C and more, because of the SMF has elevated low-temperature properties.

Thirdly, synthetic gasoline, produced by the complex of this class, offering the best quality compared with traditional due to the fact that octane in it is achieved due to a larger proportion of cyclic and branched hydrocarbons with correctly oriented hydrocarbon bonds rather than aromatic hydrocarbons, as in ordinary gasoline, sharply reducing the specific consumption of fuel and gives a much lower thermal load on the engine of internal combustion, significantly increasing its resource.

Fourthly, the sulfur content in a synthetic gasoline negligible - and this is important, because Russian gasoline produced from Russian oil brand «Urals», that has high sulphur content. Thus, exhaust engine running on a synthetic gasoline, at times безвреднее exhaust on the basis of traditional gasoline, and such fuel can act as a serious competitor products of Western oil refineries in the world markets.

Fifthly, the production of the SMF can be performed on the small modular plants that allows you to get great savings on transport costs for the delivery of motor fuel in remote regions.

Sixth, in contrast to the traditional fuel SMF has a long storage period - not less than 2 years.

The resulting disposal of waste ash (2,5-3 times lower in comparison with traditional technologies) can be used in road construction. A large amount of heat generated by the work of the complex is expedient to use for heating residential complexes, industrial facilities, greenhouses, and sports facilities.

Variants of manufacturing of the complex are envisaged as stationary and mobile types.

The base complex is executed on the walls of cassette-modular type, that allows to increase the productivity at times up to 5 times.

The price of the complex is issued on request of the customer on the basis provided by the technical task. Analogues in the world yet!

A pilot project allows you to create a closed loop recycling of garbage and sewage in thermal and electric energy within one residential block of flats or a cottage settlement. All the rubbish thrown out to the tenants of the apartment building, and sewage are available for processing into thermal or electric energy. And such recycling of garbage will be environmentally safe.

### **Technical features of the complex:**

- 1) the Utilization of different kinds of wastes without the release into the environment.
- 2) The use of the oven (reactor) of the new generation - the burning process replaced process dosed oxidation, which allowed to increase the return heat 2,5-3 times, while the input raw materials can be any composition and

content of mechanical impurities.

3) Obtaining of high-quality synthetic motor fuel - SMF (gasoline, diesel, kerosene) cost 0,04 roubles for 1 litre. Low cost SMF is caused by-products of the complex: the recycling of waste products, received warm, electricity, distilled water.

4) Full autonomy: energy is needed, only at launch complex and is 15 kW/h in 12 hours, next, the installation goes on offline and works 340 days until the first inspection. After 340 days of an annual paid service (not more than 7% of the installation cost, duration not exceeding 15 days, with a mandatory replacement of the block of catalysts and reactor installation).

5) The operational period of 10 years. This technology is used catalysts, which lasts for a year of work around the clock.

6) The efficiency of the recycling of the organic component of any types of waste not less 97-98%, i.e. a maximum of 2-3% of organic matter goes to "dump" + diode inorganic (with insignificant loss of weight), and the efficiency in terms of the output of a product due to losses in converting one substance (synthesis gas, steam) in the product (fuel, electricity, heat) not less 65-82% of carbon content (determined by morphological composition of raw materials).

### Potential consumers.

**Timber industry complex** - recycling of a waste of wood processing (sawdust, bark, branches, stumps, foliage, stumps of trees with preliminary crushing etc).

**Agricultural complex** - animal waste, crop production.

**Municipalities** - solution of the problems with household waste (housing and domestic organic waste - plastic bottles and packages, paper, food waste, sewage etc). Obtaining additional sources of energy for use by the population and community services.

**Oil industry** - disposal of contaminated land, oil spills.

**Coal industry** - processing of waste of the coal industry, as well as low-grade coal, obtaining additional sources of fuel, heat.

### The main characteristics of the apparatus-200:

The volume of waste utilization: 3 cubic metres (750-1400 kg, depending on the type of garbage)/1 hour - 24 tons/day of waste.

**Option 1:** the Final product (only heat): 3 gigacalories per hour.

**Option 2:** the Final product (only for electricity): 3488 kW/hour.

**Option 3:** the Final product (liquid fuel + electricity): 200 litres of synthetic motor fuel (kerosene, petrol with octane number «80» to «98», super-diesel fuel «Arctic» - have a passport) + 300 kW/hour.

Given the possibility of installing the term of payback of her for the consumer will be approximately 19 months depending on the processed material.

In a month will be produced: electricity - 216 thousand kW/h, and the SMF - 144 thousand litres

### Technical characteristics of the apparatus-200:

Dimensions of the unit (without block preparation):

Length (mm) 6000

Width (mm) 3000

Height (mm) 3000

Weight (t) 8

Raw material consumption (m<sup>3</sup>/hour) 3

The number of synthetic motor fuel (litre/hour) 200

Power requirement (kW/hour) 80 (max)

## Block preparation of raw material (RM):

Length (mm) 4080  
Width (mm) 2785  
Height (mm) 2400  
Input window of the tank (mm) 2200x1900  
Bunker volume (m<sup>3</sup>) 2,5  
Size of the cutting chamber (mm) 1570x1300  
Rotor length/diameter of rotor (mm) 1570/488  
Number of knives (Pcs) 72  
Electric motor power in the case of installation Schroeder (kW) 55  
Weight (kg) 7,5  
Capacity (kg/h) 3000

## The main characteristics of the apparatus-1000:

The volume of waste utilization: 15 m<sup>3</sup> (4 tons, depending on the type of garbage)/1 hour - 96 tons/day of waste.

**1 option:** The final product (only heat): 15 billion calorie per hour.

**2 option:** Final product (only for electricity): 17440 kW/hour. + heat capacity of the installation 1500 kW/hour.  
Own consumption: 500 kW/hour - 10% loss. Total 16,596 MW/hour.

**3 option:** The final product (liquid fuel + electricity): 1000 litres of synthetic motor fuel (kerosene, petrol with octane number «80» to «98», super-diesel «Arctic» - have a passport) + 1,5 MW/hour.

The data for the transport weight of 12 tons, length - 6 metres height - 3 metres width - 4 metres for the transportation of one complex requires one railway platform.

Given the possibility of installing its payback period for the consumer will be approximately **18-24 months** depending on the processed material.

## Sample questions.

1) **What is the composition of inlet gas turbine.**

**ANSWER:**

The process is in the high-temperature vacuum destruction:

The method is applicable to any carbon-containing raw materials.

The main composition of the resulting synthesis gas: CH<sub>4</sub> + H<sub>2</sub>O : CO + 3H<sub>2</sub> % composition: 15-18%, 38-40% N<sub>2</sub>, 9-11% CH<sub>4</sub>, 30-32% CO<sub>2</sub>

2) **What is the composition of gas at the outlet of the turbine.**

**ANSWER:**

Is a mixture of products of combustion of fuel remaining after the depletion of oxygen fractions air. If for full oxidation of 1 kg for example, kerosene required to about 3,4 kg of pure oxygen, given that the air contains only 23% oxygen by weight, for complete oxidation of the fuel needs 14,8 kg of air, and therefore the composition of the gas at the outlet of the turbine, at least 94% of its mass consists of the source of atmospheric air. In practice, the turbine, as a rule, takes place excess air flow (sometimes several times, compared with the minimum required for complete oxidation of fuel), for instance, in turbojet engines massive fuel consumption is 1%-2% of the air flow. This allows analysis of the turbine, in many cases, without much damage to the accuracy, consider the composition of the gas at the outlet of the turbine, one and the same substance - atmospheric air.

3) **Where is the gas outlet of the turbine.**

**ANSWER:**

Turbine deployed in the direction of the landfill. The rest is determined by the design of different manufacturers (although the question is not clear).

4) **Whether you need water for cooling turbines and how it should be.**

**ANSWER:**

Not required: the reaction mass is cooled by water condensation, boiling in the intra tube space, as well as regulation temperature through submission of cold gas between the layers of catalyst (or the built-in into the reactor heat exchangers).

5) **Opinion of ecologists, technical control service, Ministry of emergency situations, health standards, customer control, a license for equipment of mini-plant.**

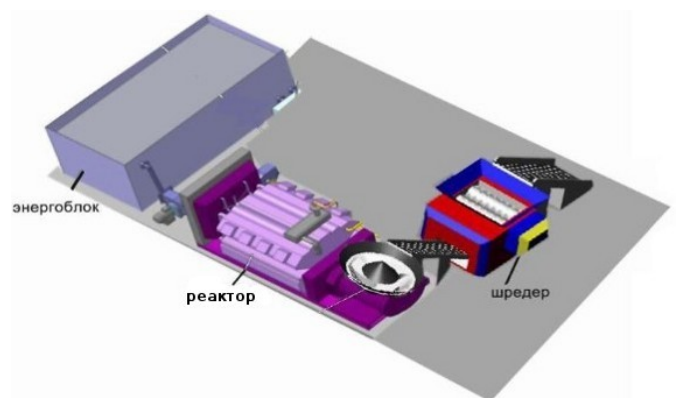
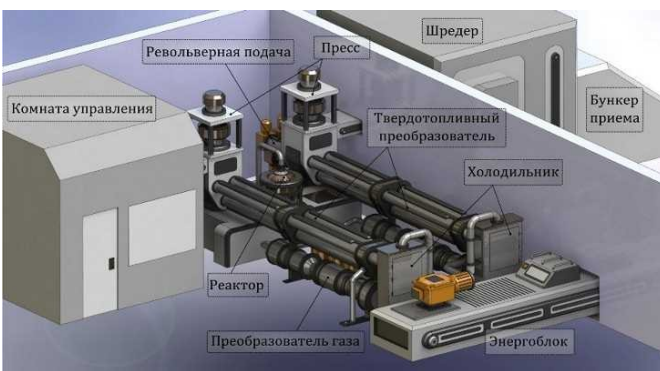
**ANSWER:**

Feature after manufacturing and launch of the ordered the industrial design.

**Diagram of the stationary apparatus.**

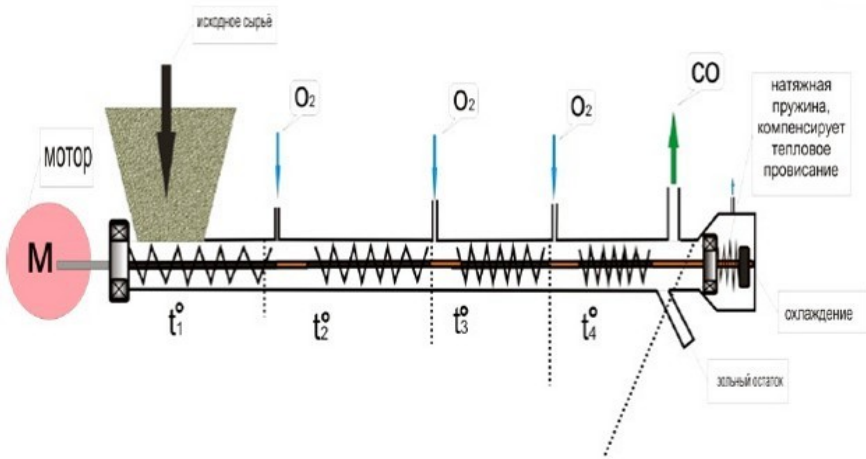


**Fixed apparatus-200.**



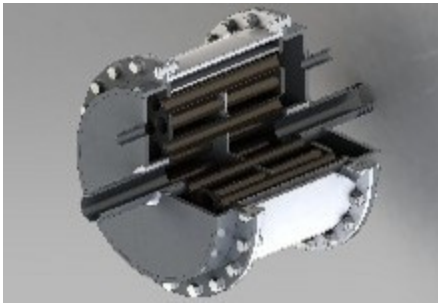
Schematic diagram of the apparatus for the production of synthesis-gas.

Принципиальная схема установки для производства синтез газа



Organic waste  
Motor  
Tension spring compensates for thermal sagging  
Cooling  
Ash residue

Reactors dryer and revolving-feed auger.



General view of the mobile version of the apparatus-200 and mobile version in the incision.

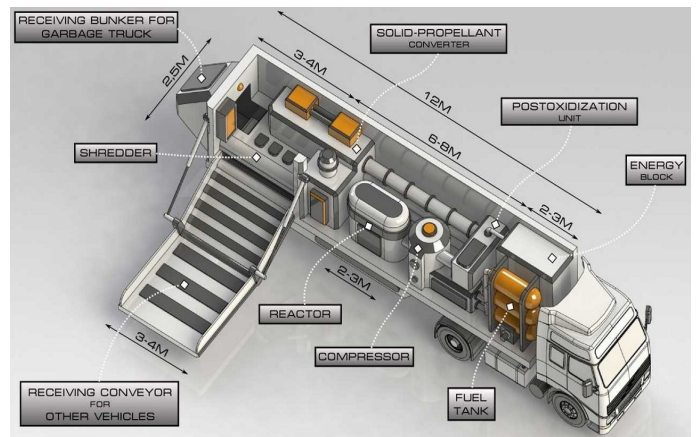


Diagram of the mini-plant.

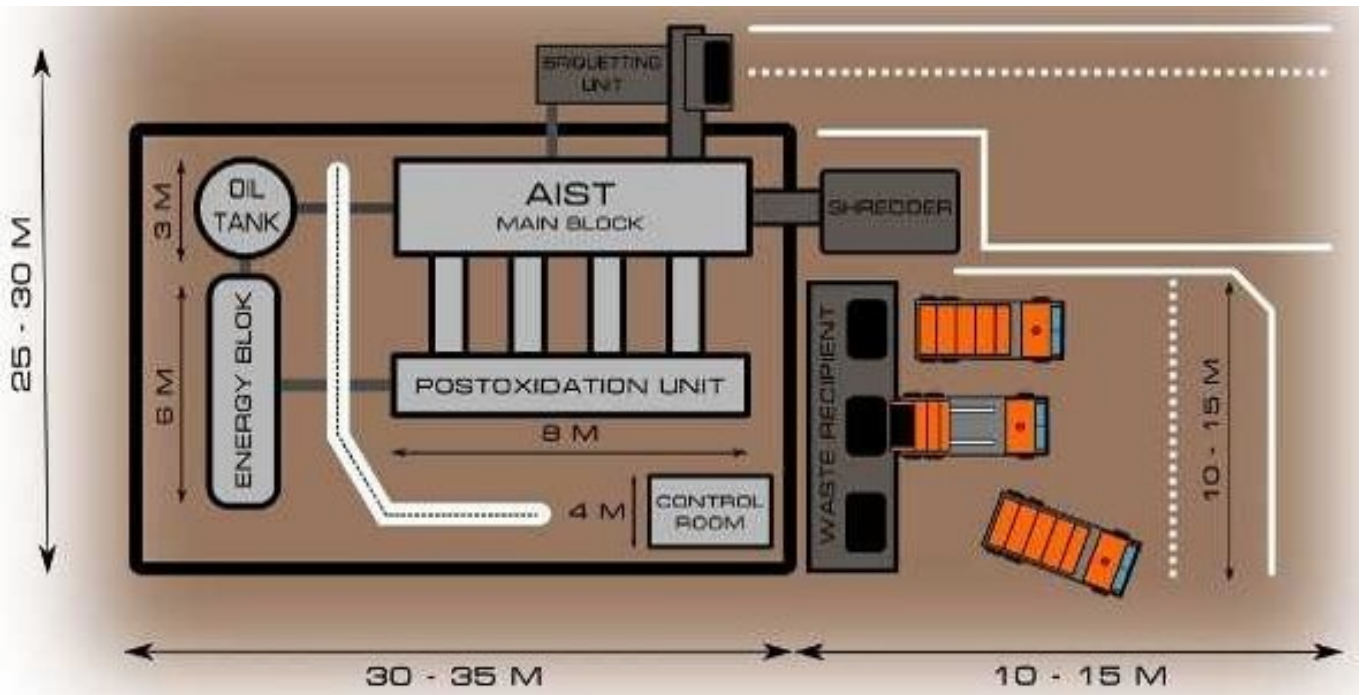
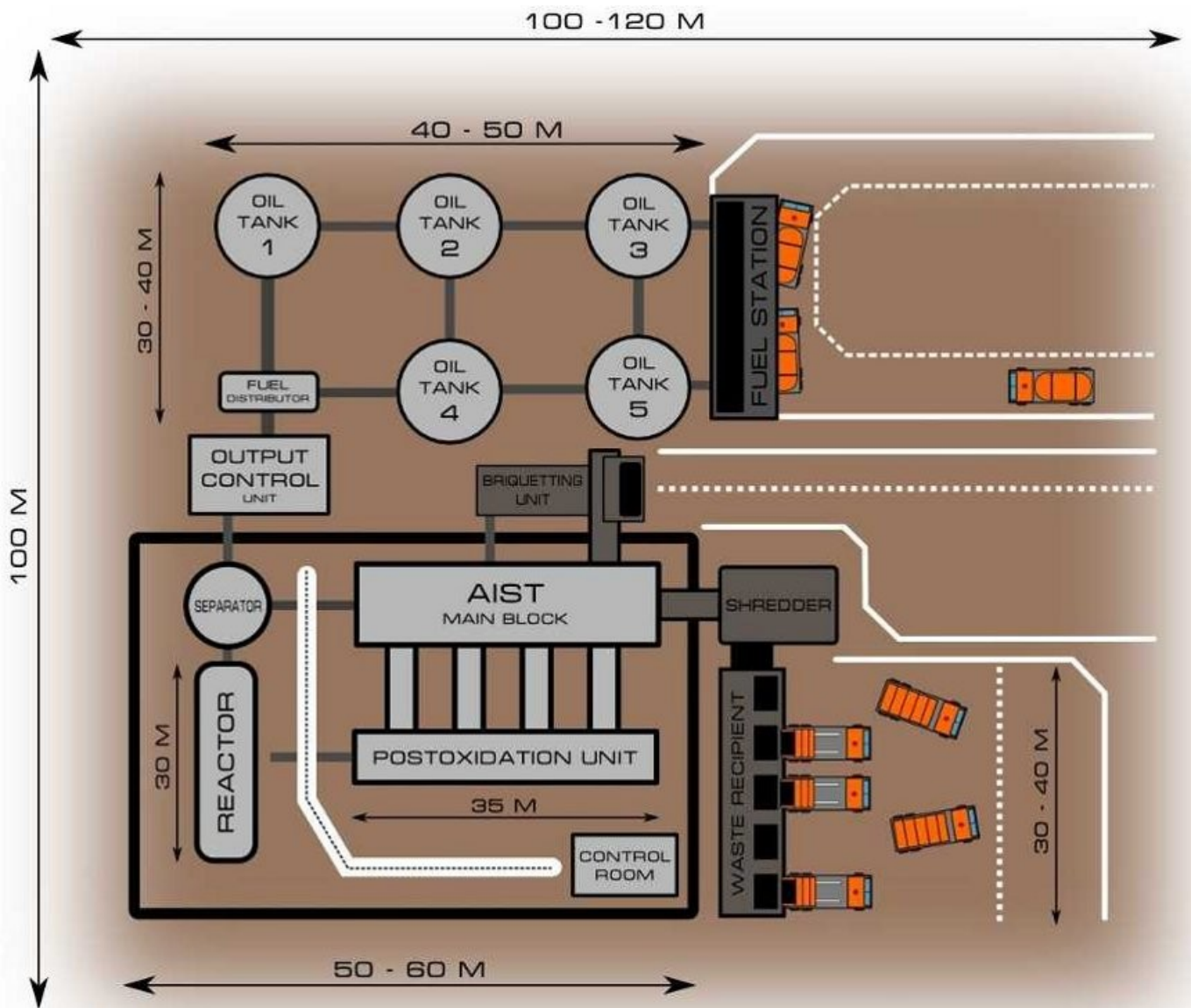


Diagram of the mini-plant with storage of fuel.



## Advantages.



## ПРЕИМУЩЕСТВА

- ▶ использование в качестве сырья любых углеродосодержащих отходов
  - ▶ широкий спектр области применения
  - ▶ экологическая безопасность
  - ▶ возможность создания передвижных и мобильных комплексов, не привязанных к стационарным площадкам.
  - ▶ малый срок развёртывания и ввода в эксплуатацию.
  - ▶ модульно – кассетный тип исполнения
  - ▶ безопасность эксплуатации
- Use as raw materials of any carbon waste.
  - A wide range of application areas.
  - Environmental security.
  - Ecological security.
  - The ability to create mobile and mobile complexes, which are not linked to stationary sites.
  - Small deployment time and input in operation.
  - The module-cassette version.
  - Safety of operation.

## Consumed raw materials.

### Потребляемое сырьё

#### ▶ Бытовой мусор



The trash.

Rubber and plastic waste.

#### ▶ Резиновые и пластиковые отходы



Waste of forest industry.  
Oil-slimes.



#### ▶ Отходы лесной промышленности



#### ▶ Нефтешламы

Sewage sludge.



#### ▶ Осадки сточных вод



#### ▶ Отходы сельского хозяйства (погибшие животные, куриный помет, навоз и т.п.)

Waste from agriculture (dead animals, chicken dung, manure etc)

### Development and manufacture of apparatus \*.

| № | Phase name  | Description of the stage  | Duration of the stage  | The stage cost EURO |
|---|---|---|--|---------------------|
| 0 | Preparatory   | Coordination of vehicle design with the customer.   | 1 week<br>Payment from the 1st week<br>Payment from the 1st week | 165172              |
| 1 | Design  | Equipment of working documentation on the basis of model taking into account the customer's request.  |  | 1145688             |
| 2 | Purchase of spare parts   | Procurement of standard components, materials according to the working documentation.   | from 3 to 12 week<br>Payment of 3rd week                         | 1145688             |
| 3 | Fabrication and installation apparatus  | Manufacture of units and aggregates of installation.  | from 5 to 12 week<br>Payment of the 4th week                     | 794428              |
| 4 | Purchase of spare parts, assembling of the systems of automatic control and the control | Purchase of spare parts and assembling, installation of systems of automatic control and management.  | from 3 to 12 week<br>Payment of 3rd week                         | 318313              |
| 5 | Installation works trials   | Assembly of the installation, launch preparation.   | from 7 to 17 week<br>Payment of the 7th week                     | 134897              |
| 6 | Sample test: commissioning, regime-up and adjustment works                              | Commissioning and testing of individual components and units. A full run of the installation.   | from 14 to 19 week<br>Payment 14 weeks                           | 155162              |
| 7 | Testing of the Sample at full power. Time of technological cards                        | Testing of all parameters and reliability of work of a product prototype. Processing of technological regimes, taking into account the amendments to the basic model, according to the tor. | from 19 to 31 weeks<br>Payment of the 19th week                  | 108113              |
| 8 | Personnel training  | Staff training.   | from 13 to 31 weeks<br>Payment of the 13th week                  | 26027               |

Project total (01.01.2013 y.) - 2 847 799 euros (Two million, eight hundred forty-seven thousand, seven hundred ninety-nine euros) (EXW – INCOTERMS).

\*If necessary, the generation of electricity to external customers cost of the gas turbine apparatus (or the GTA) of its design capacity, upon completion of the tests, is accounted for separately, depending on the manufacturer.



Photos of the apparatus-200





## Calculations of the project for waste recycling.

Sale price of electricity owner of the device of processing waste in Cyprus: 0.147 euro per 1 kW/hour.

The price of electricity for the population of Cyprus: 0.214 euro per 1 kW/hour.

The volume of garbage in 1 hour: 3 m<sup>3</sup> (weight ≈ 2 tons of garbage with 70% of the carbon in a garbage)

The number of garbage processing for 1 day: 2 tons x 24 hours = 48 tons

The number of garbage processing for 1 month: 48 tons x 30 days = 1,440 tons

The amount of expenses:

1) For the beginning of work of the device of a waste to spend 15 kW within 12 hours

One-time price of the beginning of work of the device: 15 kW x 12 hour x 0.241 euro = 43.38 euro

2) Salaries of personnel of the plant:

- Wages of 1 worker - 1,500 euro for 1 month

The number of work - 9 persons

The total cost of wages for 1 month - 9 x 1,500 euro = 13,500 euro

- Wages of 1 manager for 1 month - 2,000 euro

- Wages of 1 engineer for 1 month - 2,000 euro

The total cost of the salary of the personnel of the plant (9 working + 1 manager + 1 engineer) for 1 month - 13,500 + 2,000 + 2,000 = 17,500 euro

3) the price of planned maintenance apparatus (1 year 343 euro) - 28.59 euro for 1 month

Unforeseen costs related to exploitation of the complex - 707.69 euro for 1 month

The amount of other expenses for 1 month - 9,968.46 euro

Term of work of the device is 10 years

4) the price of the device on the INCOTERMS conditions - EXW (warehouse in Russian city) - 2,947,800 euro (01.06.2013 y.)

The cost of the device in 1 month (2,947,800 euro : 10 years) : 12 month = 24,565 euro

**Total:** Total expenses for 1 month

**17,500 + 28.59 + 707.69 + 9,968.46 + 24,565 = 52,769.74 euro** + 43.38 euro (lump sum that can be make the amount of the cost of 1 month)

Electricity production in the 1 month - (3,488 kW/hour x 24 hours x 30 days) = 2,511,360 kW/hour

Cost of 1 kW/hour - 52,769.74 euro : 2,511,360 kW/hour = 0.021 euro

Income for the production of electricity:

**Income for 1 month - 2,511,360 kW/hour x 0.147 euro = 369,169.92 euro**

Income with the deduction of the expenses for 1 month:

369,169.92 — 52,769.74 = **316,400.18 euro**

Income with the deduction of the expenses for 1 year: 316,400.18 euro x 12 months = **3,796,802.16 euro**

**P.S.:**

1) The total amount does not include travel expenses, customs and other expenses for transportation of the apparatus of the city of Russia on Cyprus and payment of taxes.

2) The total amount of income does not include income for the acceptance of waste processing. In Russia, firms pay for sending garbage to the warehouse for the storage or processing.