Plasma-chemical Technologies

(During Development)

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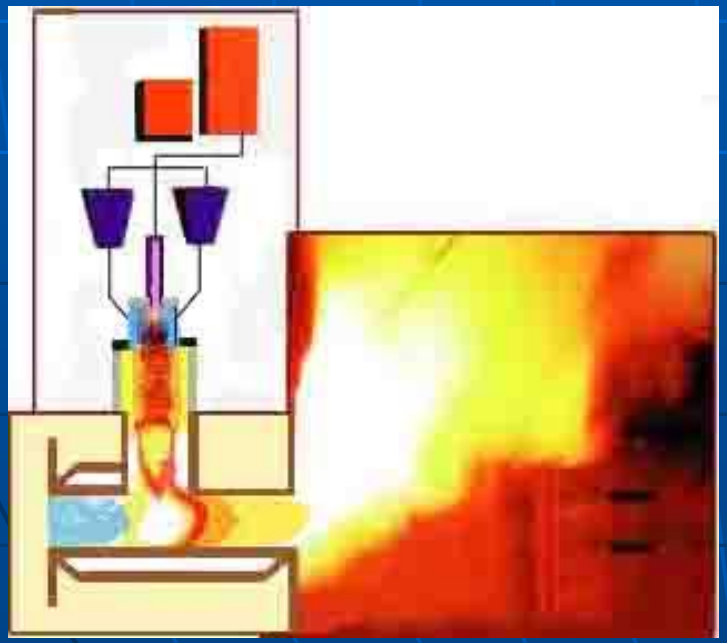
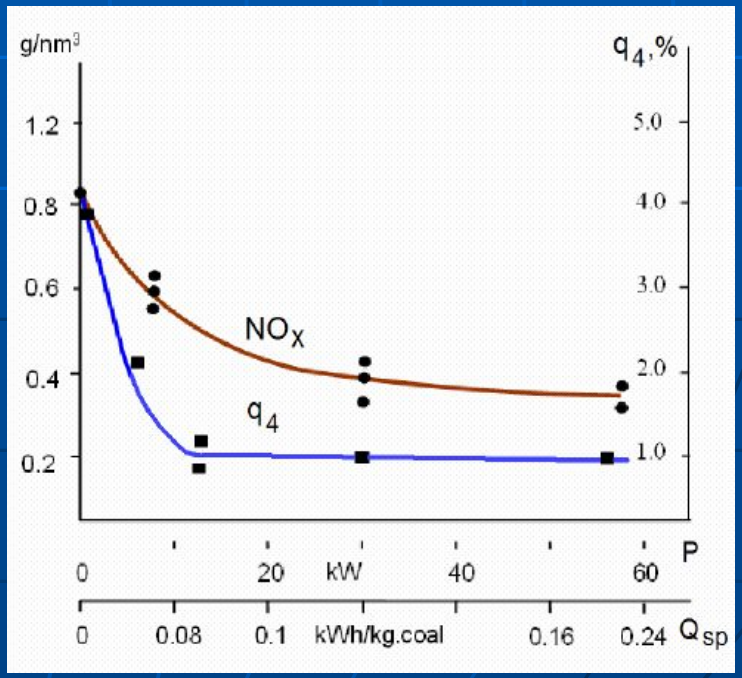
PLASMA – CATALYST OF COMBUSTION OF LOW-REACTIVE COALS

The plasma technology seems to hold the highest promise among the alternative technologies available for solving the problems of combustion of low0reactive coals. This technology provides a substantial increase in cost effectiveness and improvement in environmental indicators of power-generating plants working with solid fuel.

Plasmatron and its installation on a direct-flow coal torch



Decrease in formation NOx and mechanical undercombustion



plasma processing of low-reactive coals

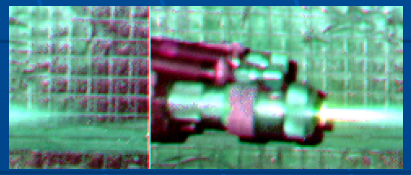
Main principle of plasma-power technology is **dramatic decrease in the required electric power**

Plasma-jet reactor

Multiplication of capacity

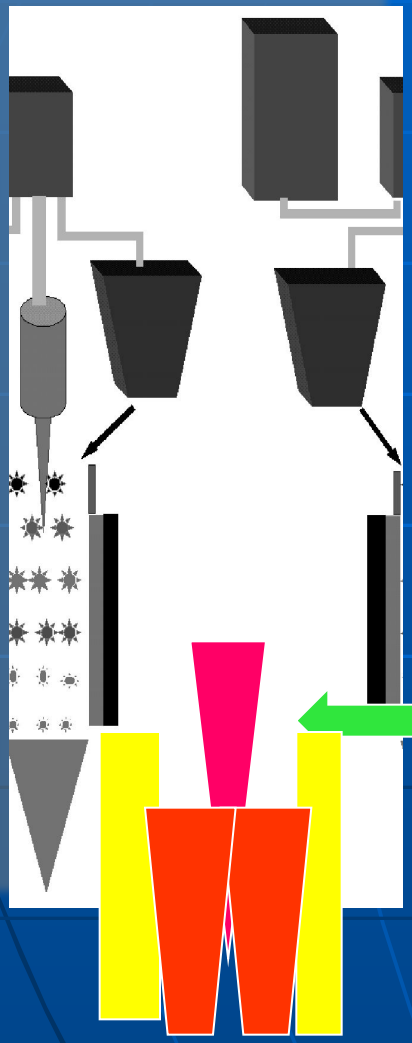
Coal torch

(200 kW)



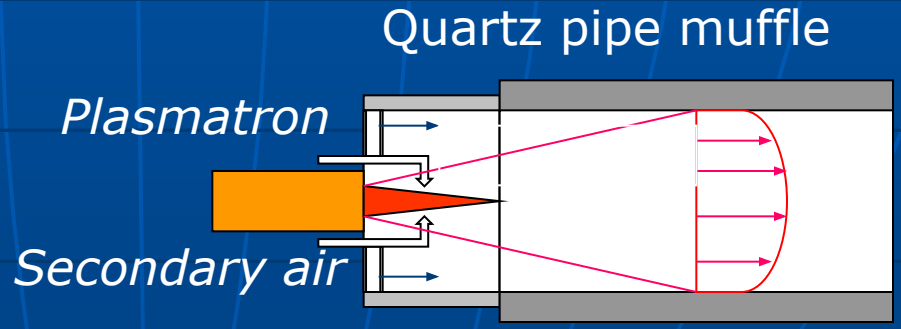
Plasma jet

(10kW)



Combined
Plasma-coal torch

Optimal utilization of the steam-plasma effects, leading to a substantial increase in rates of gasification and combustion (10 and more times) of coal particles



The scheme of a plasma-jet reactor

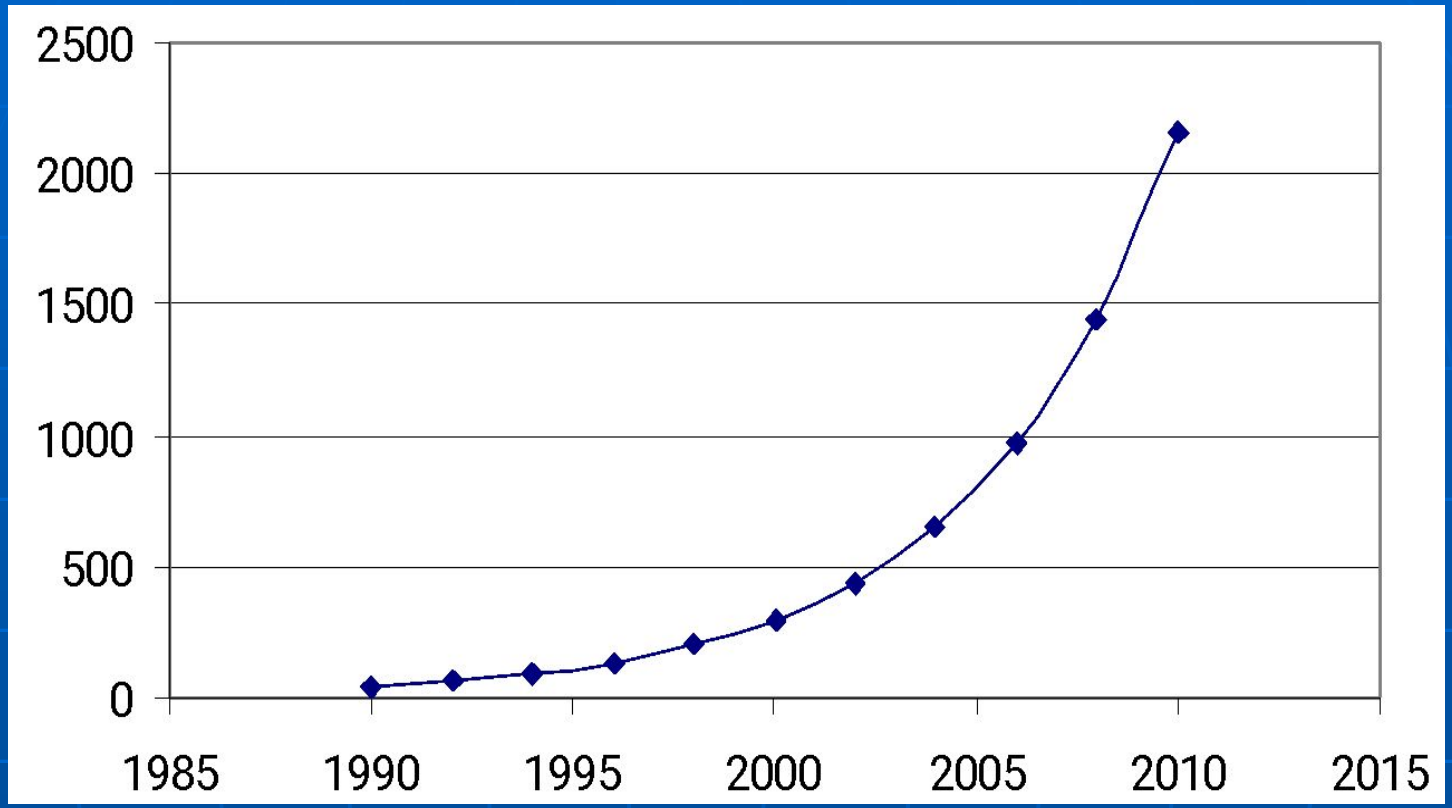
Dramatic decrease in the required electric power (by an order of magnitude) provides real technical and economical preconditions for efficient and wide-scale application of this technology in

power generation

Using such combined plasma-coal torch devices, it is possible to realize different sophisticated energy fuel-utilization technologies. They include:

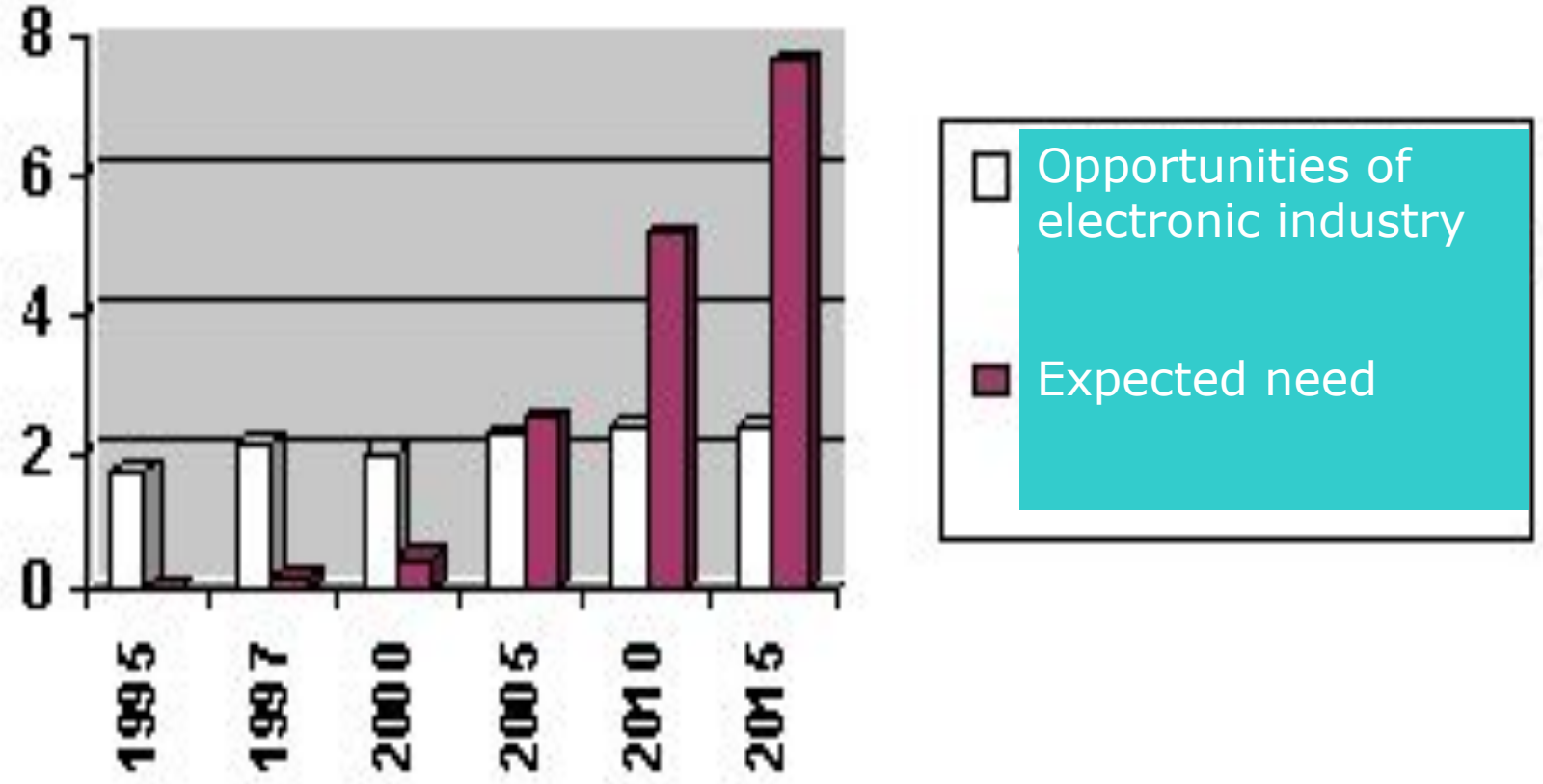
- plasma ignition of the coal-dust flame (fuel oil free kindling of boilers, lighting of the coal-dust flame, stabilization of the liquid slag yield in furnaces with liquid slag removal);
- electric-thermochemical preparation of fuel (ETCPF) for combustion;
- coal distillation;
- plasma-steam coal distillation, production of synthesis gas;
- integrated processing of low-grade solid fuels in plasma reactors;
- processing of coal production wastes – coal slime.

The solar electric power

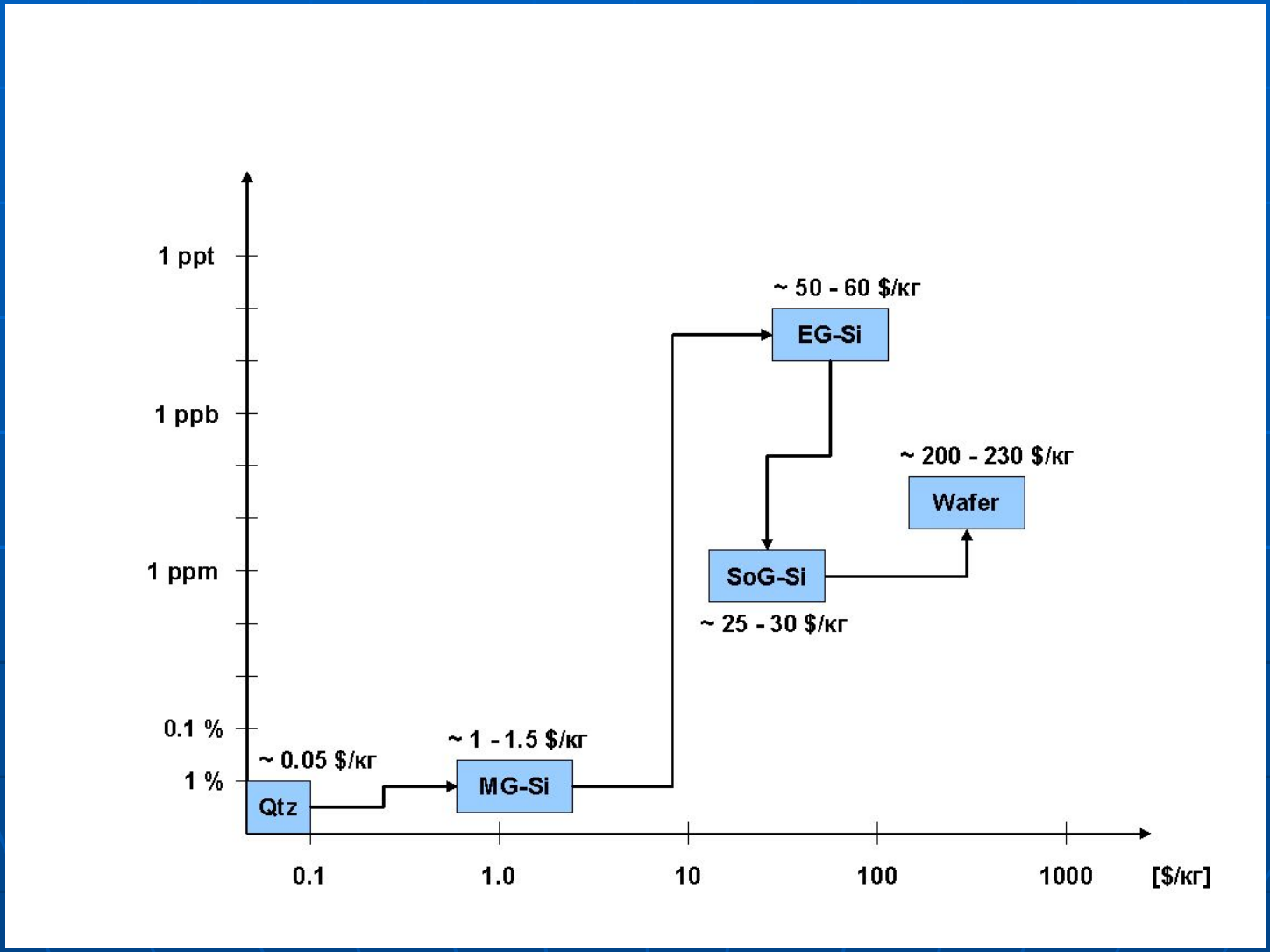


The average gain of manufacture of the solar electric power in the world with 1990 г on 2001 г has made 22 % a year. The nearest years higher rates of growth c corresponding escalating of manufacture highly purity solar silicon - from 65000 tons in 2001 г up to 350000 tons in 2010 are expected

The forecast of the industries highly purity silicon

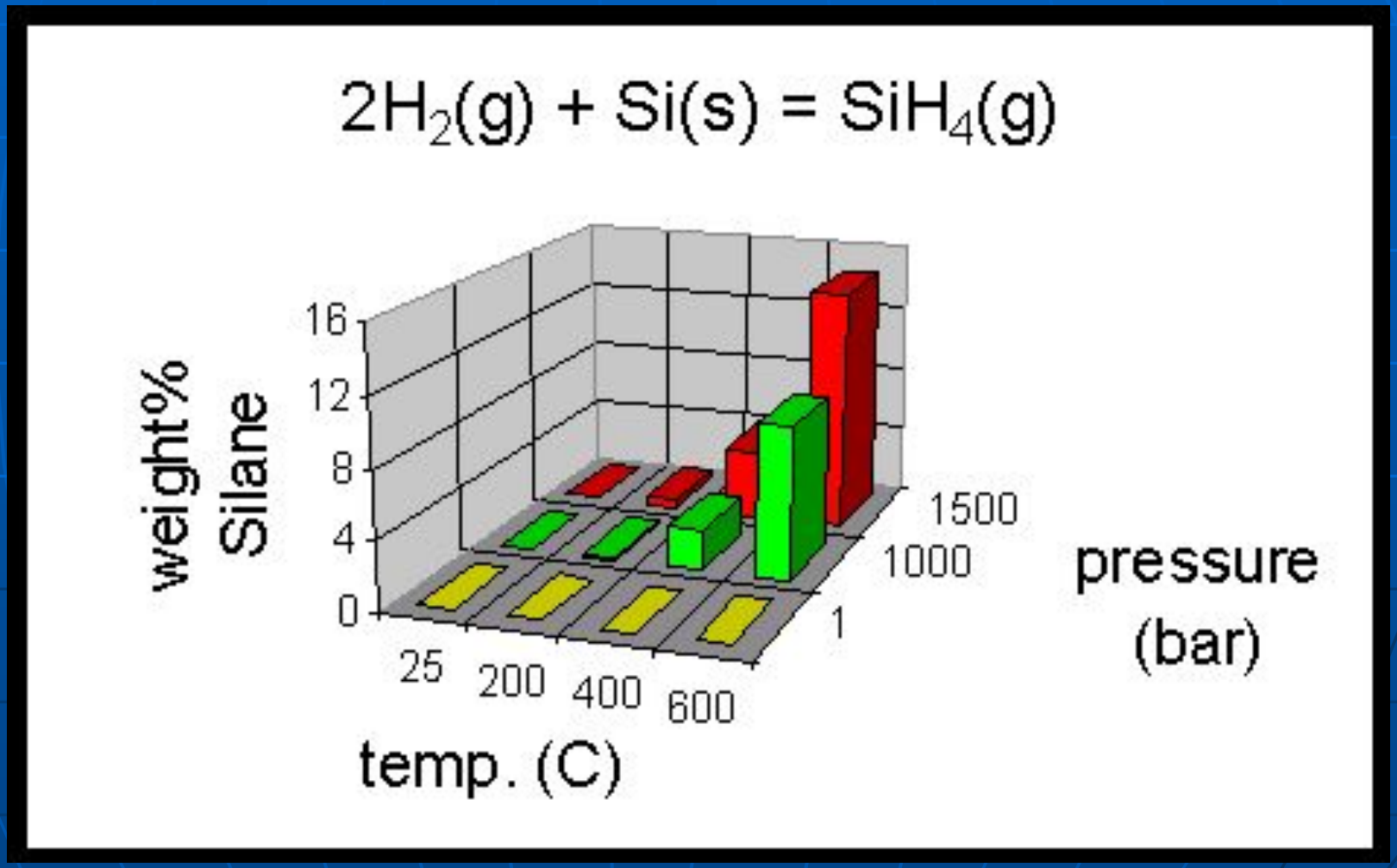


The price of silicon is defined by its cleanliness and today this dependence looks as follows



Manufacture of solar silicon

Equilibrium output of silicon (temperature, pressure)



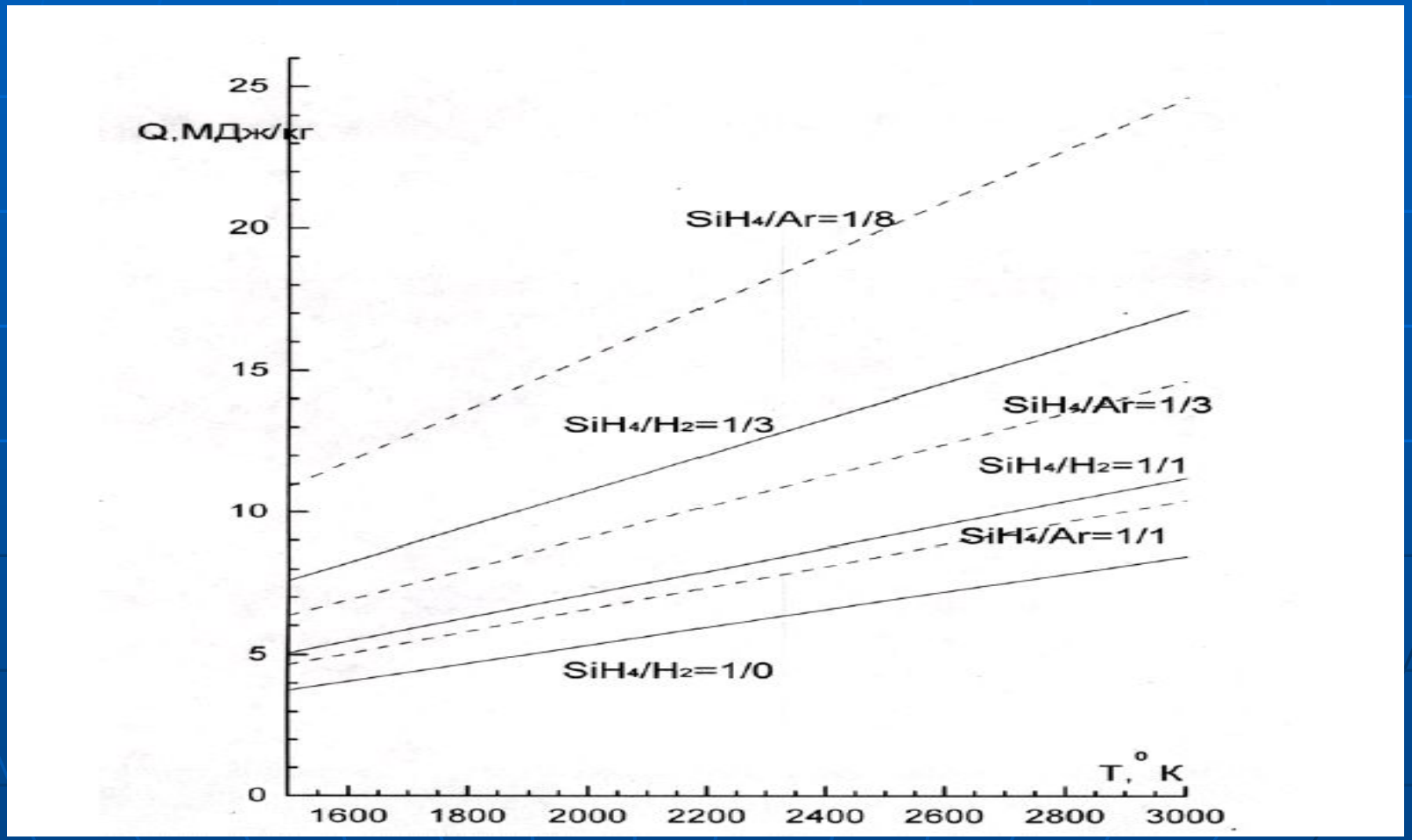
Manufacture of solar silicon

- According to thermodynamic calculations of 100 % decomposition of monosilane occurs already at 700 °C.
- Experimental data give higher value of temperature T « 1000 °C, but in any case disintegration SiH4 occurs
- At temperatures a lot of smaller temperatures of fusion of silicon
- Тпл. Si = 1690 °C.

Machines of electroarc decomposition of monosilane should meet following requirements:

- 1. To provide a high degree of transformation of silicon in the condensed phase;
- 2. To provide necessary granulemetric structure of a received product;
- 3. To exclude pollution of received silicon by products of erosion of electrodes;
- 4. To have there is enough high efficiency and small power inputs.

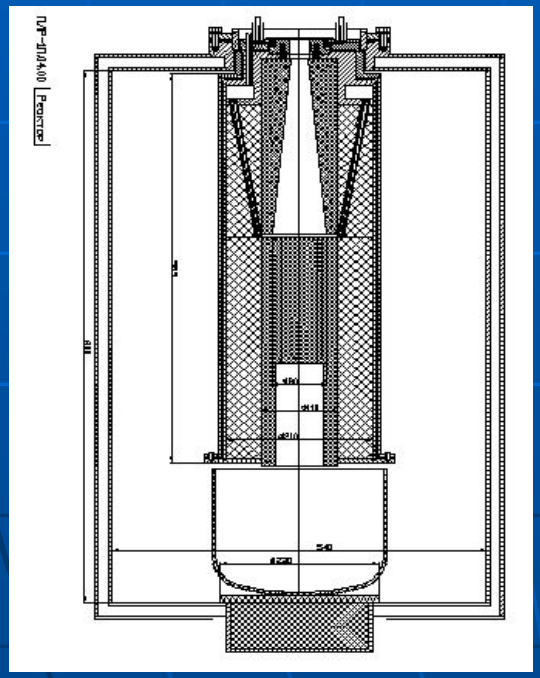
Dependence of power inputs on temperature

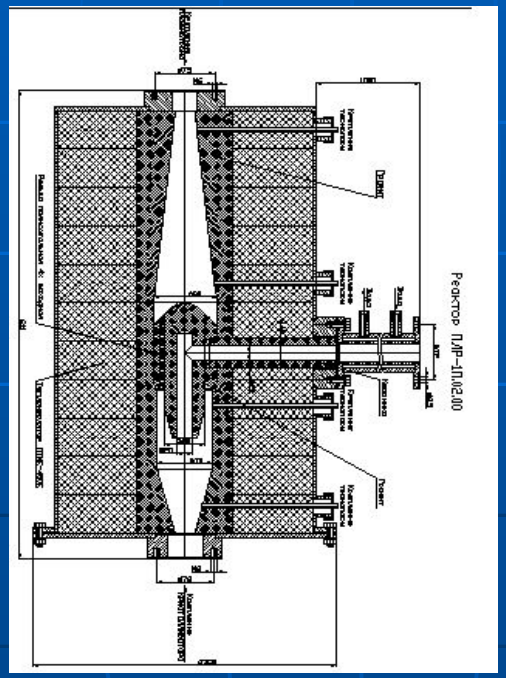


Manufacture of solar silicon

- At optimum a temperature mode and a degree dilution SiH4 (1:2) and as considering efficiency plasmatron (> 0,5) a level Power inputs it is possible to estimate as 15-25 МДж (4-6 kw hour) on kg Si.
- The level of development of plasma technics reached to the present time will allow to count on creation of installation by capacity 1-2 МВт and Productivity up to 300-400 kg/hours Si.

Plasma-chemical reactor for pyrolysis of silane



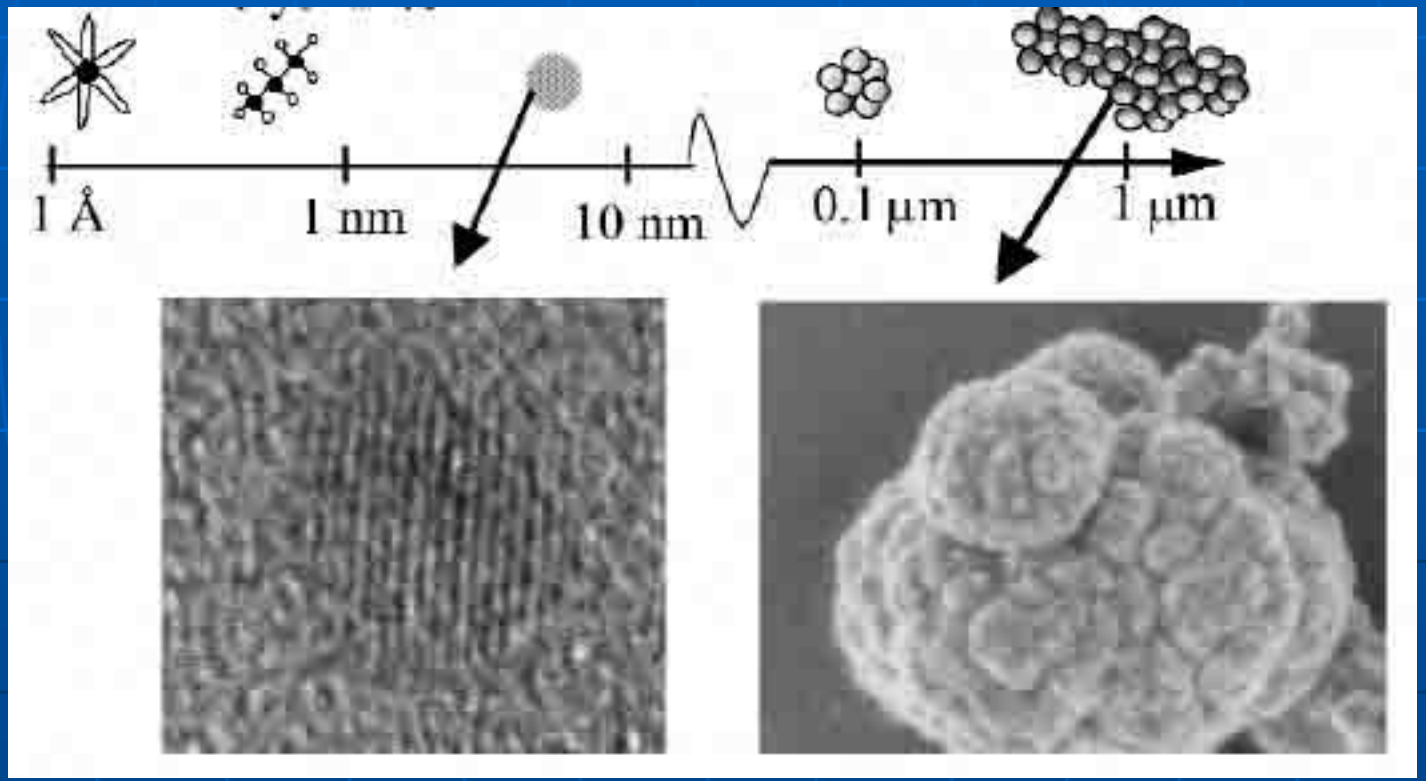


Hydrogen plasmatron 200 kw for pyrolysis of silane

Demonstration machine of plasma pyrolysis of silane

Plasmatron in operate for pyrolysis of silane

Origin of particles of silicon from steam in plasma

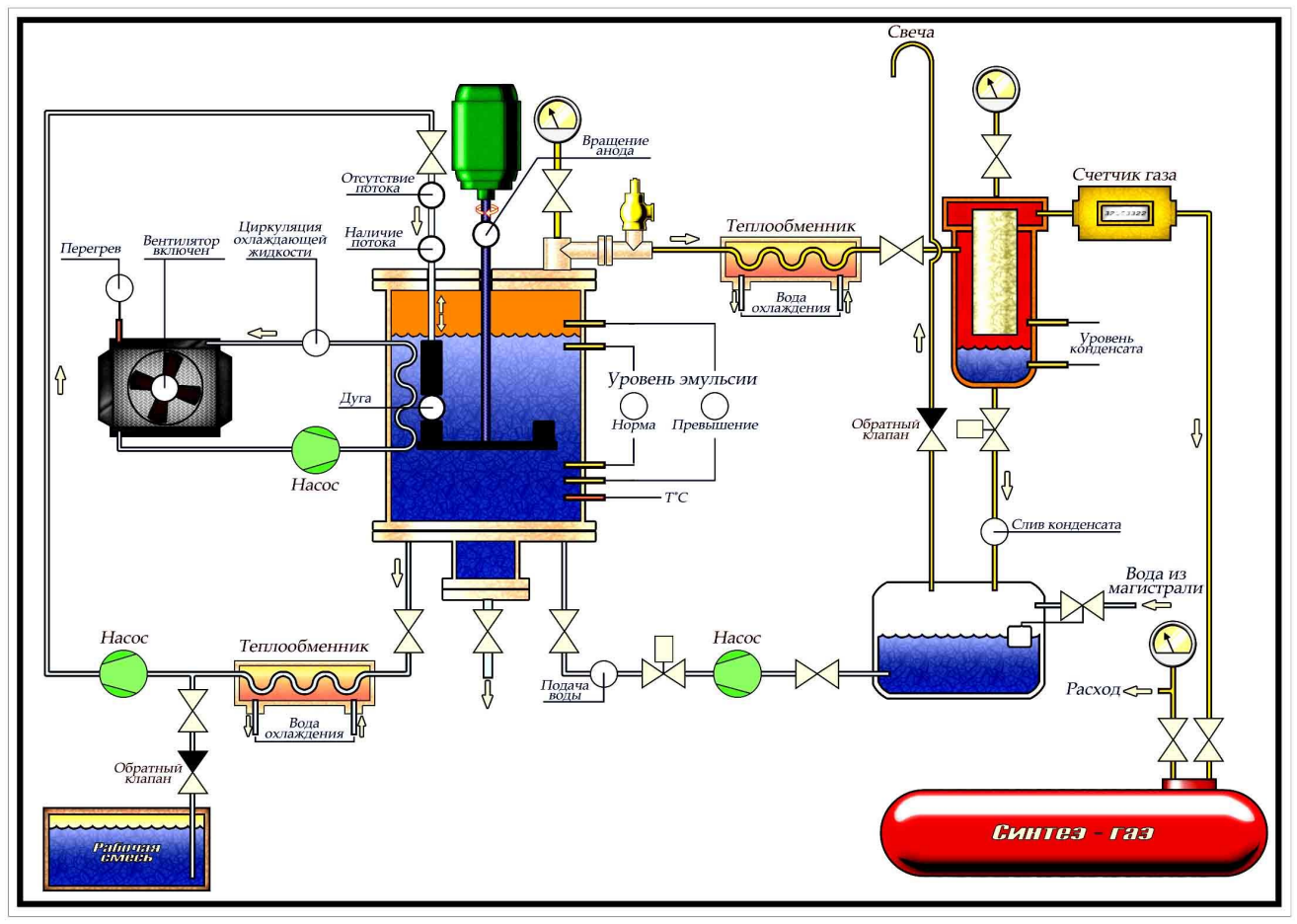


Manufacture of solar silicon

- Productivity of the plasma unit with plasmatron capacity of 200 kw makes 50 kg/hours of silicon. It provides at three-shift work and 220 working days in a year 200 Ton/year

PLASMA-ARC TECHNOLOGY OF PRODUCTION OF NEW ECOLOGICALLY PURE GASEOUS FUEL

Such gas is formed in conditions of very intensive magnetic fields in the electric arc shipped in processed liquid raw material



PLASMA-ARC MACHINE OF PRODUCTION OF NEW ECOLOGICALLY PURE GASEOUS FUEL FOR MOTOR TRANSPORT

DEVELOPMENT OF ELECTROARC GENERATORS OF STEAM-WATER PLASMA

Steam Plasmatron
40 KW

Laboratory Steam Plasma
Machine by capacity of 40 KW

DEVELOPMENT OF ELECTROARC GENERATORS STEAM-WATER PLASMA WITH RECUPERATIVE STEAM HEAT UP