



Development of the coal chemical production cluster in Ukraine

PROJECT

2020

Project goal

Creation of the coal chemical high-tech production cluster on the basis of brown coal deposits in Ukraine.

The project provides deposit development with aggregate balance stock of black coal in the amount of 820 million tons.

Project implementation shall result in creation of the production complex with aggregate extraction and processing values not less than 3 million tons per year.

In Ukraine there will be over 10,000 working places and additional tax basis for the budget.

The proposed technologies are deemed as ecologically clean alternative to the existing ones.



Project supposition

Synthetic coal fuel was introduced for the first time in Germany: in 1911 the German chemist F. Bergius obtained petrol from the Ruhr brown coal.

In early 1970s the SASOL group of factories was founded in South Africa for coal processing into synthetic liquid fuel. Nowadays the company processes ca. 47 million tons of coal per year and produces ca. 7 million tons of liquid fuel.

After South Africa, the most widespread and up-to-date technologies of motor fuel synthesis appeared in the USA. Eight projects have been performed in China, at various stages; all of them are aimed at complete substitution of traditional fuels. In Nigeria, Qatar, Malaysia and the USA there are in general ca. 50 objects at the projecting and constructing stages and their aggregate production exceeds 300 million tons of fuel per year.



Total volume of the officially declared investments in this industry exceeded 15 billion USD and synthetic fuel and chemical production reached 35 million tons per year.

Project supposition

Ukraine has an exhaustive legislative basis concerning development of new technologies aimed at processing natural raw materials and power industry development. There are new privileges provided for business entities based on new technologies and power saving systems.

Power production

- **Tax release concerning enterprise incomes within capital expenses for power network construction and modernization.**
- **Tax release (till January 2025) concerning enterprise incomes, simultaneously with electrical and heat power production.**

Liquid fuel production

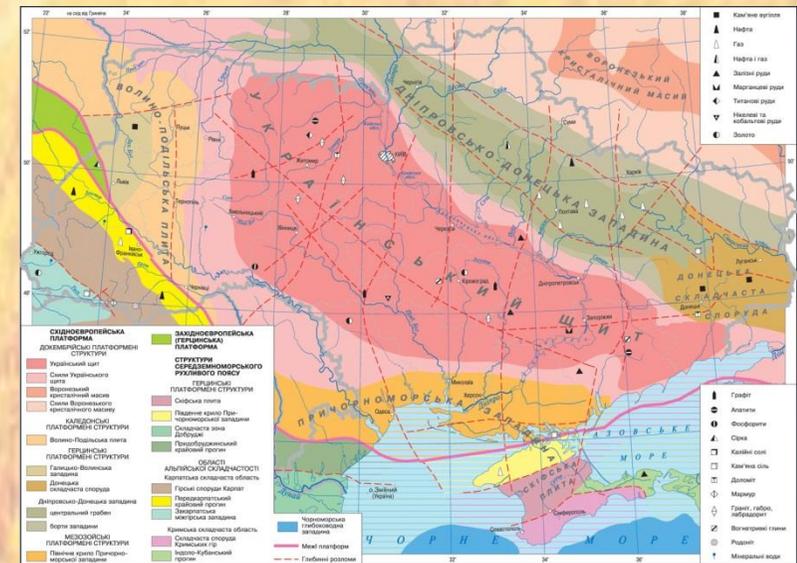
- **Tax release concerning operations on import of raw materials, equipment and components for alternative power production (including from brown coal) into the customs territory of Ukraine.**
- **VAT release concerning operations on import of raw materials, equipment and components for power saving equipment into the customs territory of Ukraine, as well as materials and products providing economic and reasonable use of fuel power sources.**

Deposits

Region	Deposit	Stock, million tons
Dnepropetrovsk	Verkhnedneprovski	146
Dnepropetrovsk	Karnaukhovski	203
Dnepropetrovsk	Novoalexandrovski	82
Kharkov	Novodmitrievski	390

Technical requirements to brown coal deposit

Parameter	Required value
Stock, million tons, not less than	60
Ash content, %, not more than	12-28
Aggregate sulfur weight fraction, %, not more than	4,5
Chlorine weight fraction, %, not more than	0,6
Arsenic weight fraction, %, not more than	0,02



Deposits

Dnieper Brown Coal Deposit

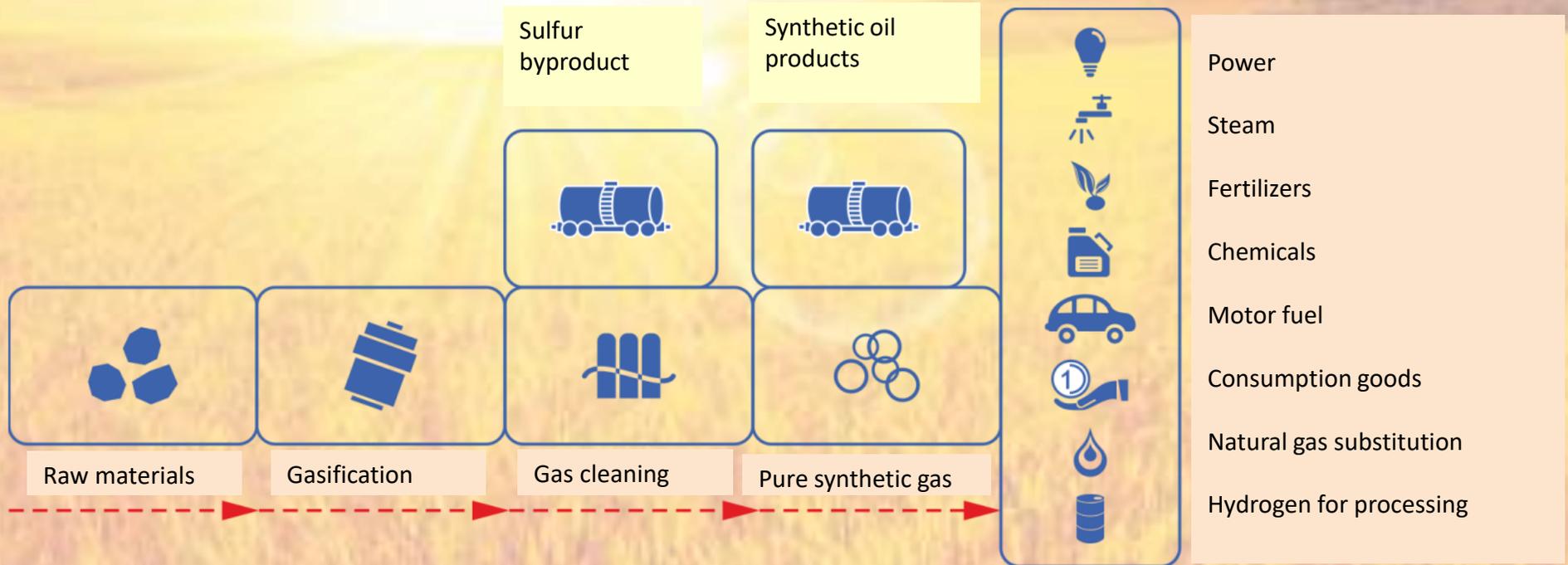
Located in Vinnitsa, Zhitomir, Kiev, Cherkassy, Kirovograd, Dnepropetrovsk and Zaporozhe Regions, from South West to South East along the Dnieper, 680 kilometers long, 70-175 meters wide. Total area is ca. 150 thousand square kilometers.

History. Coal sources have been known from the 11th century. Intensive development has been performed since 1946. 9 sources had 7 mines and 7 coal open cuts, with aggregate annual capacity of 10.1 million tons.

Deposit has over 150 separate sources of brown coal. Total geological stock makes up 5 billion tons, including 2.4 billion tons of researched stock (0.5 billion tons are suitable for open development). Coal layers make up 25 meters (3-4 meters in average). Coal stratification depth makes up from 5 to 160 meters. According to metamorphic degree, coal belongs to B1 group (soft brown coal). Humidity: 55-60%, ash content: 15-25%, sulfur content: 2.3-3%. The lowest calorific value: 5-9.2 MJ/kg.

Incidental minerals are oil shale in the coal layers and kaolinic weathering mantle. Oil shale stock makes up 57 million tons. Ash content: 14-60%, humidity: 2.45%, sulfur content: 0.9%, average calorific capacity (for dry oil shale) makes up 3.5 thousand kilocalories per kilogram. Carbon: 52-73%, hydrogen: 7.5-10% (mean 9.8%), nitrogen and oxygen: 18-24% (mean 22%). Semi-coking results in: 13.7-24.2% (mean 20.4%) of resin, 65% of char, 7.5% of gas (mainly nitrogen-carbon-hydrogen-sulfide). Oil shale ash has an increased content of titanium dioxide (1.31%). Kaolinic weathering mantle (directly under the brown coal layer) consists of kaolinite and allite with Al₂O₃ content up to 30-50%. Mantle top has small pieces of bauxites. Predicted stock of allite with alumina content over 30% makes up 814 million tons and with alumina content over 35% makes up 253 million tons. Thus, kaolinic weathering mantle may be used as raw material for alumina and refractory products. Toxic element content in the coal does not exceed admissible values.

Technologies

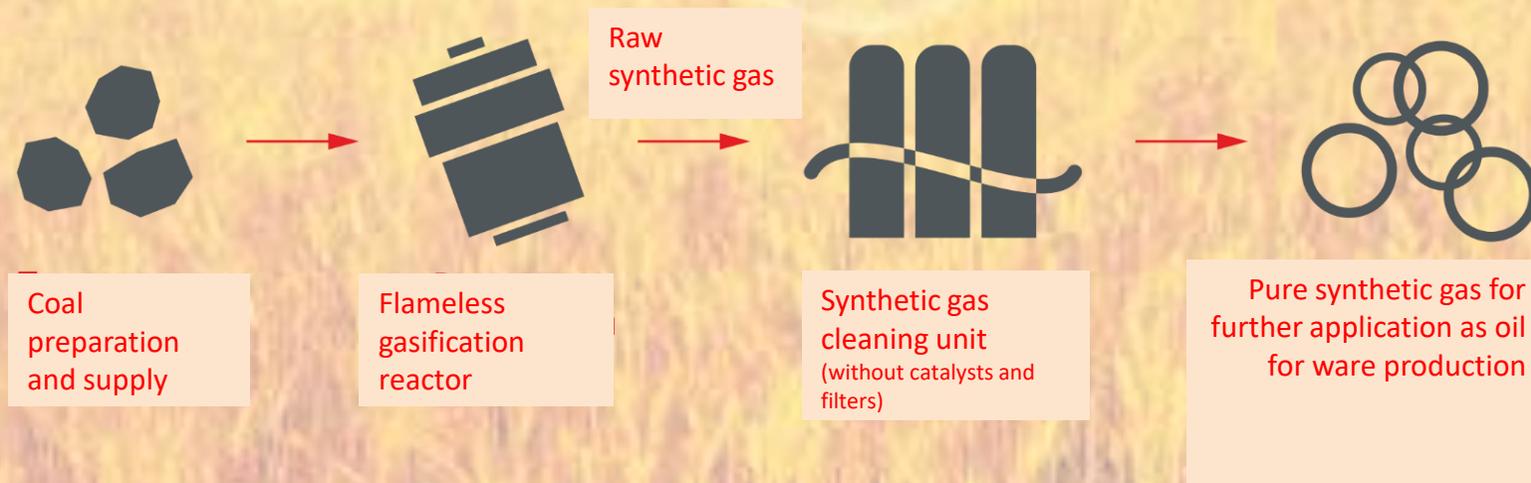


Technologies

Proposed technologies Extracted coal enrichment

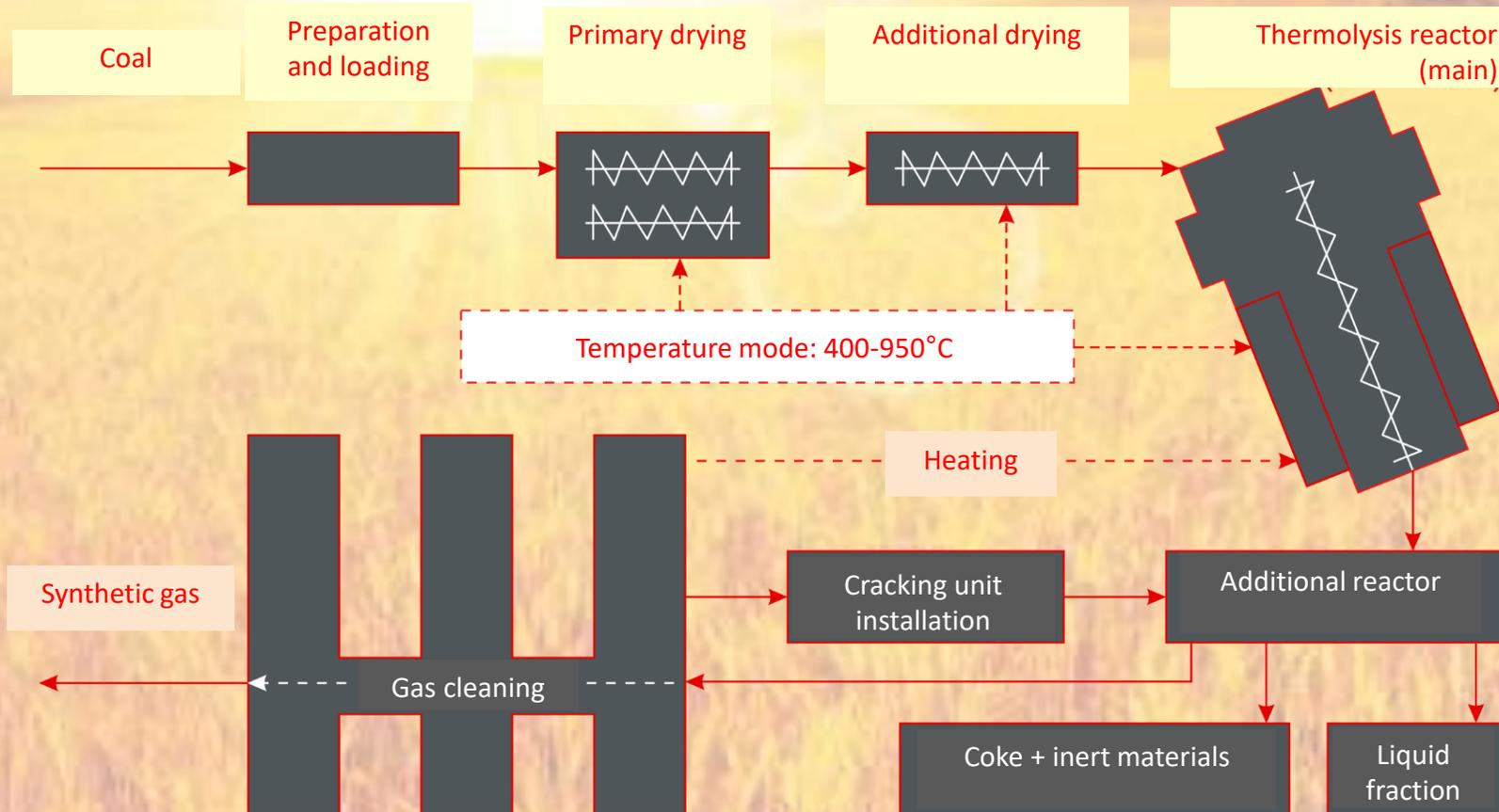
- Flameless gasification of prepared raw materials
- Synthesis of semi-finished and finished products

Flameless coal gasification is ecologically safe and provides product processing without damage to the environment.

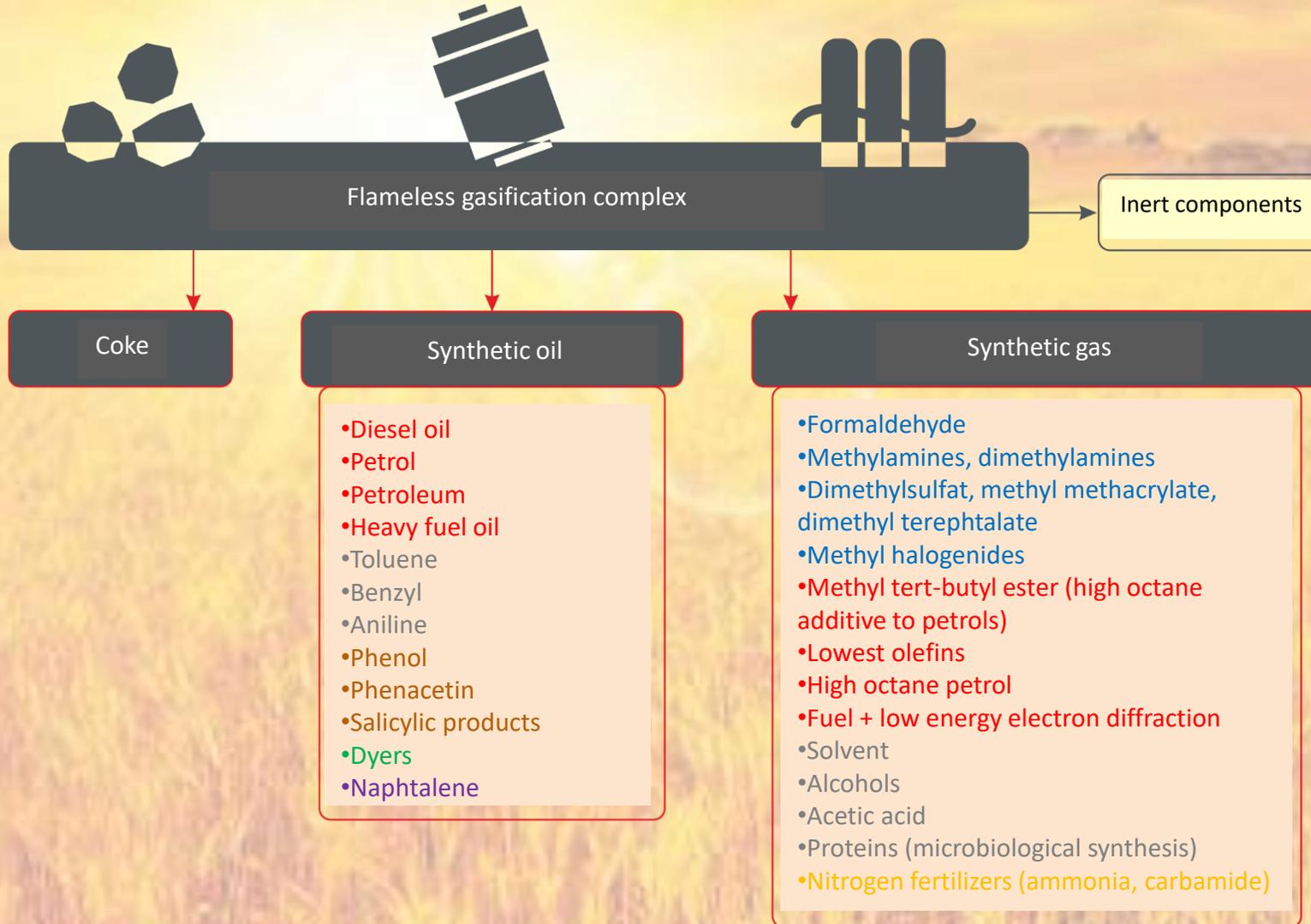


Technologies

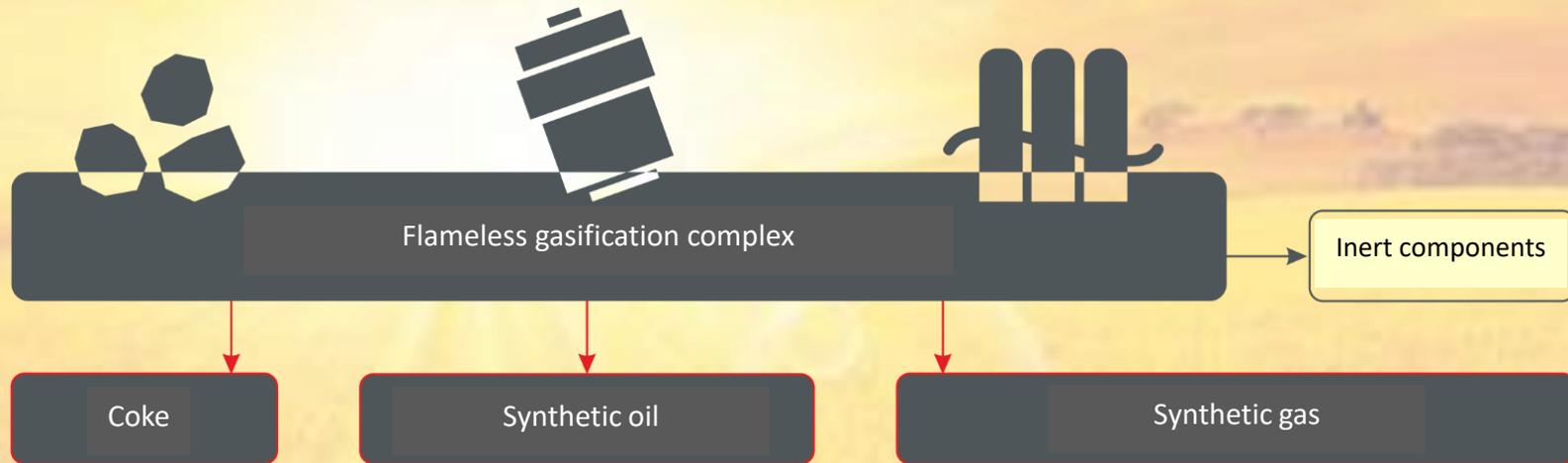
Thermolysis is a high adiabatic decaying process attributed to any organic raw materials under the temperature not exceeding 950°C without oxygen access.



Technologies



Product output balance (*)



Synthetic gas (for sale)

from 25,00 % to 55,00 %

Synthetic gas (for technology)

15,00 %

Liquid fraction

from 5,00 % to 10,00 %

Water

from 5,00 % to 20,00 %

Coke

from 10,00 % to 40,00 %

() – depends on a certain type of raw material*

Similar foreign companies



Great Plains Synfuels Plant! (the USA)

Annual production of ca. 160 million cubic meters of synthetic gas. Daily processing of 18,000 tons of lignite.

Technology. Overground coal gasification (CTL).

Products. Liquid fuel, phenol, fertilizers, cresyl formaldehyde acid, liquid nitrogen, methanol, petroleum, krypton, xenon.



Alaska Coal Gasification Plant! (the USA)

Daily processing of 11,700 tons of lignite.

Technology. Overground coal gasification (CTL).

Products. 14,600 barrels of liquid fuel per day (5.3 million barrels per year). Byproduct: power of 45.5 MW, sulfur or 18 tons per day.



API Energia (Italy)

IGCC process, 2 productions: synthetic gas production (SMPP), factory with combined cycle of power generation.

Technology. Overground coal gasification (IGCC).

Products. Power production of 280 MW.

Similar existing companies



ENEL Viesgo Puertollano (Spain)

Founded by Siemens. Burning 2600 tons of mixed fuel per day (coal + petrol coke).

Technology. Overground coal gasification (IGCC).

Products. Power production of 330 MW.



Sasol's Secunda Plant! (South Africa)

Burning 30 million tons of coal per year.

Technology. Overground coal processing into synthetic gas and power under CTL>L technologies.

Products. Power production of 900 MW. GTL fuel production of 160,000 barrels per day.



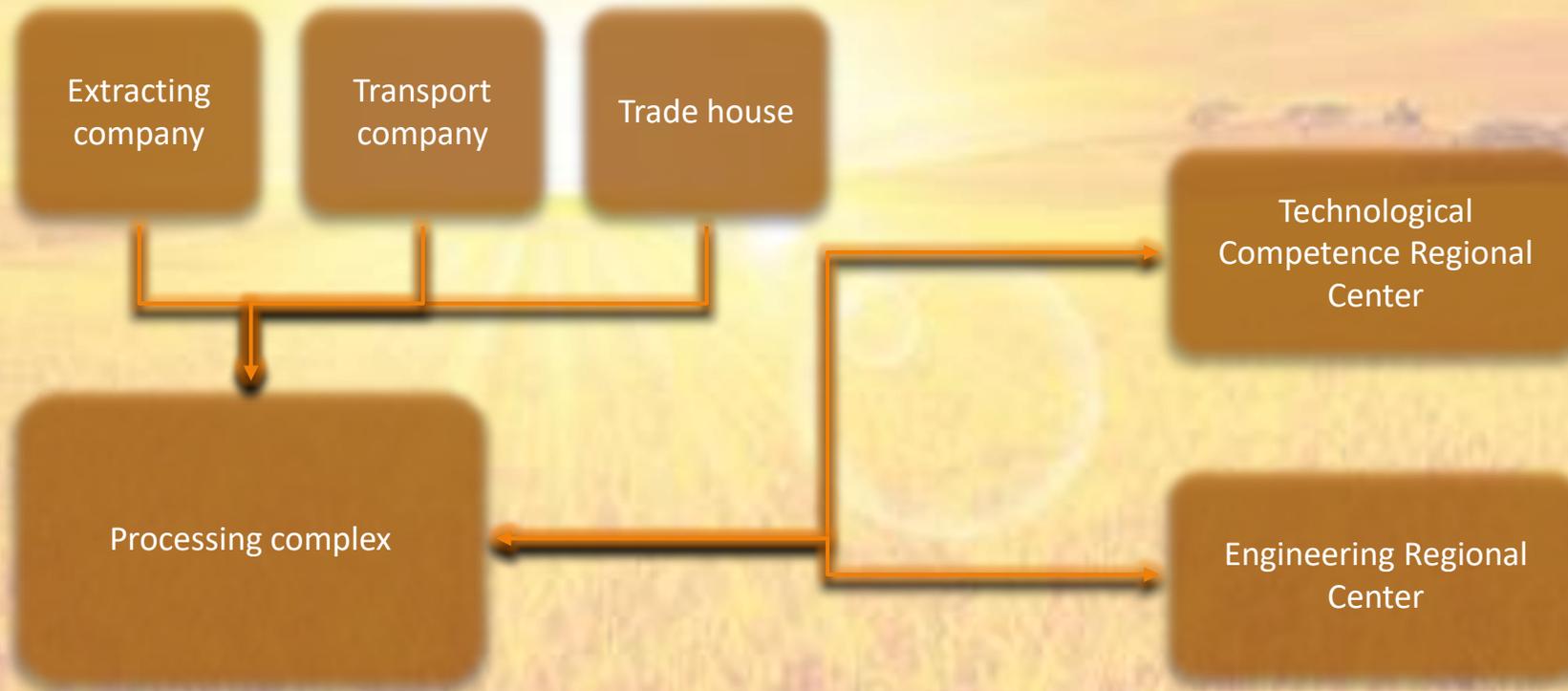
Vresova IGCC Power Plant! (Czech Republic)

Founded by "Sokolov Coal Corporation". Consumes 2000 tons of brown coal per day.

Technology. Overground coal gasification.

Products. Power production of 400 MW.

Investment structure and scope



Aggregate investment scope: ca. 1 billion Euros for 3 years

Aggregate coal extraction: not less than 3 million tons per year

Project payback period: 5 years

Project implementation will result in creation of innovative industrial Regional Centers of technological competence and engineering in Ukraine.

Project implementation plan

Project stage	Period	Result
Preparation	2020	Technical and economic assessment, research, company incorporation, equipment acquisition
Investment	2021 2024	Deposit research, launch of extracting and processing operations
Launch	2024	Extracting and processing, achievement of designed output
Operation, not less than 20 years	2024- 2044	Extracting and processing, project sale and investment payback

Project initiators

Project initiator

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Innovative projects and technologies of mining and processing equipment, mineral processing.