POLSKA GRUPA GÓRNICZA

Towards a low CO2 future: PGG strategic change of product mix - investment in coal gasification

Presentation for COP24
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Coal gasification – response to the new trends

PGG sees the new global trends as an opportunity to create new business value and support the global and national environmental agenda.

1. Investment in coal gasification responds to market signals and the increasing pressure to cut emissions related to the use of fossil fuels
2. With the heavy reliance of Poland on coal, investment in emission reduction in the energy sector is essential to fight climate change
3. This new investment lay the ground for the „coal region in transition” programme and has a positive spill over the local economy and the environment
4. Additionally, this initiative results in increased efficiency of material use, which contributes to transition towards a more circular economy

Moving up the mining value chain and transitioning to a combined mining and chemical specialization is the key strategic direction for PGG.

1 Investment in coal gasification responds to market signals and the increasing pressure to cut emissions related to the use of fossil fuels

- We observe growing CO_2 certificate prices
- We noticed a trend of increasing efficiency and lower capex cost of renewable energy sources – Polish November feed in tariff auction – 196,17 PLN/MWh
- We are subject of the pressure on the structure and quality of coal in house heating use – changes in law, thermomodernisation and heat sources improvement program, smog reduction local actions

Reducing pollutants and direction towards lower emission product mix is both environmental and economical must

CONCLUSION : We forecast an increase of demand for clean coal solutions

2 With the heavy reliance of Poland on coal, investment in emission reduction in the energy sector is essential to fight climate change

- Poland currently relies on its coal reserves for over 80% of its electricity generation
- We forecast some 25% increase of electricity demand in Poland till 2030
- Given the growing demand for electricity the coal based power generation will need to be stable despite a significant increase in renewables, gas and LNG consumption
- Poland is seeking advanced technology that allows the use of its indigenous resources in an environmentally responsible manner; plans to be 60% reliant on coal by 2050
- Gasification is an easy, proven and economical technology for catching CO_2 and SO_x which can be then commercially utilised

We need a compromise between Polish coal reliance, growing demand for electricity and the emissions level acceptable from environmental point of view

3 This new investment sets grounds for the „coal region in transition” programme and has positive spill over the local economy and the environment

- This verified, existing and proven technology is a tangible example of an action required to bridge the transition
- Improving air quality by eliminating the emission of fine dusts and other dangerous substances (sulfur, heavy metals, carbon dioxide), which are formed during the combustion of low-quality coal
- The possibility of management of carbon materials stored in dumps
- The implementation of advanced technologies in the region, development of coal treatment other than direct combustion
- **Possibility of solving communal waste issues**
- Local companies involvement in the Project will help compensate the local loss of GDP caused by the region restructuring
- Protection of existing workplaces and creating new jobs in an innovative "clean coal technologies" sector.

Changes in coal production profile will require a serious effort to compensate its local negative effect

4 Additionally, this initiative results in increased efficiency of material use,which contributes to transition towards a more circular economy

- The Project will broadly increase the know how and expertise
- As there are various alternatives for feedstock the Project may enhance different areas of economy :

- Waste – solid, water treatment waste, RDF
- Biomass – agriculture, biomass waste, forest industry
- Mining – the use of waste and low quality coal

- As there are various alternatives for the gasification end product the Project may play a role in :

- Chemical industry – methanol, hydrogen
- Clean transport – source of clean fuel
- Clean power generation – relatively easy CCS, CCU ; high efficiency of power generation comparable to supercritical coal plants

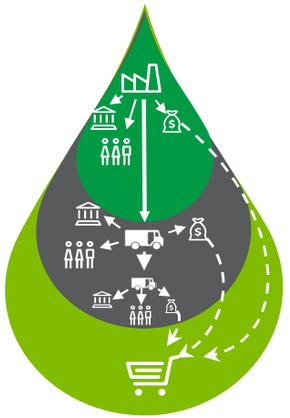
The Project will generate numerous business options for PGG and its Partners

Broader economic, social and environmental impact

Every investment has an impact on the surrounding. This one may bring several positive implication for the economy, society and the natural environment

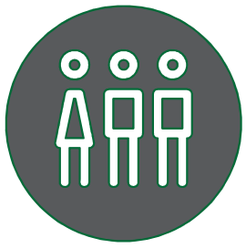
Economic

Three dimensions of the Economic impact: **direct impact** (resulting from the company's core business related to the new investment), **indirect effects** (generated among suppliers and operators of businesses and related industries) **induced effects** (generated by the spending of employees and employees of affiliated entities).



Social

Such investment may bring important changes to the local society – part of the program Coal region in transition. New innovative investment has many spill over effects that local societies can benefit from. New jobs opportunities, possibility for the former coal mining employers to requalify.



Environmental

Investing in zero-emissions technologies and climate-resilient infrastructure is vital for the future of the planet, and it can also drive economic growth. With proposed investment there is a space for PGG for further growth while keep zero – emission coal exploitation.

BENEFITS

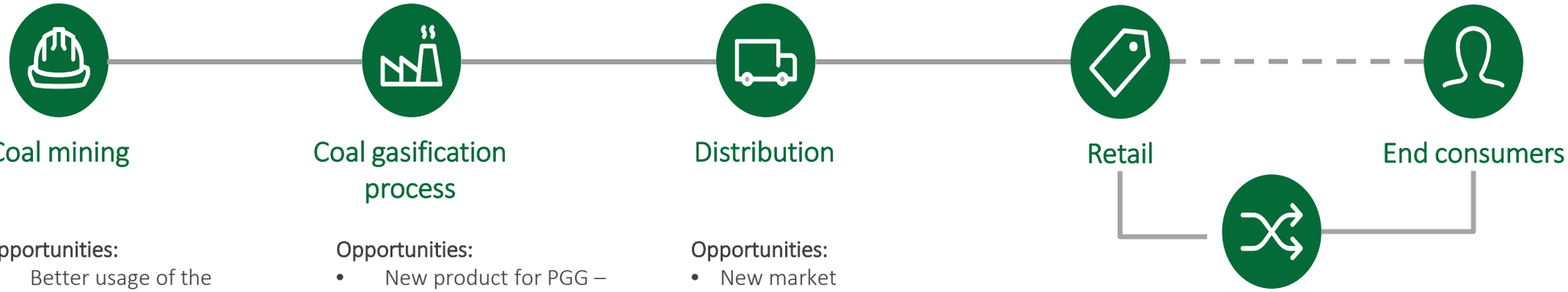
Impact analysis presents:

- the scale of the impact and the role of new investment in the economy and in the local community;
- quantification of the effects of measures;
- providing arguments for the legitimacy of the activities of companies in a given location, strengthening the dialogue with the public administration.

An impact report will help PGG understand its role for the Polish economy, society and the environment, as well as provide invaluable insights into strategic decision-making process.

Coal gasification value chain – challenges and opportunities

Although there are several challenges related to the investment in coal gasification, there is a number of important upsides for the company and other actors in its value chain



Coal mining

Opportunities:
- Better usage of the coal load
- Responding to the new trends of zero carbon emission

Challenges:
- Limited availability of fossil fuels
- Increasing extraction costs and environmental pressures

Coal gasification process

Opportunities:
- New product for PGG – new revenue stream
- First mover advantage in Poland
- Diversification and a shift towards the chemical sector
- Innovative technology for zero carbon emissions

Challenges:
- Technology not yet used in Poland – investment more risky

Distribution

Opportunities:
- New market opportunities abroad – export opportunities

Challenges:
- New market needs to be understood and well managed

Retail

End consumers

Products of coal gasification utilisation in industry

Opportunities:
- New clients

Challenges:
- Need to search for best applications
- Ensuring sustainable demand

Opportunities:
- New clients

Challenges:
- Ensuring sustainable demand

PGG has made the critical initial steps to validate this direction, including a pre-feasibility study, arranged study visit in China and locating the investment

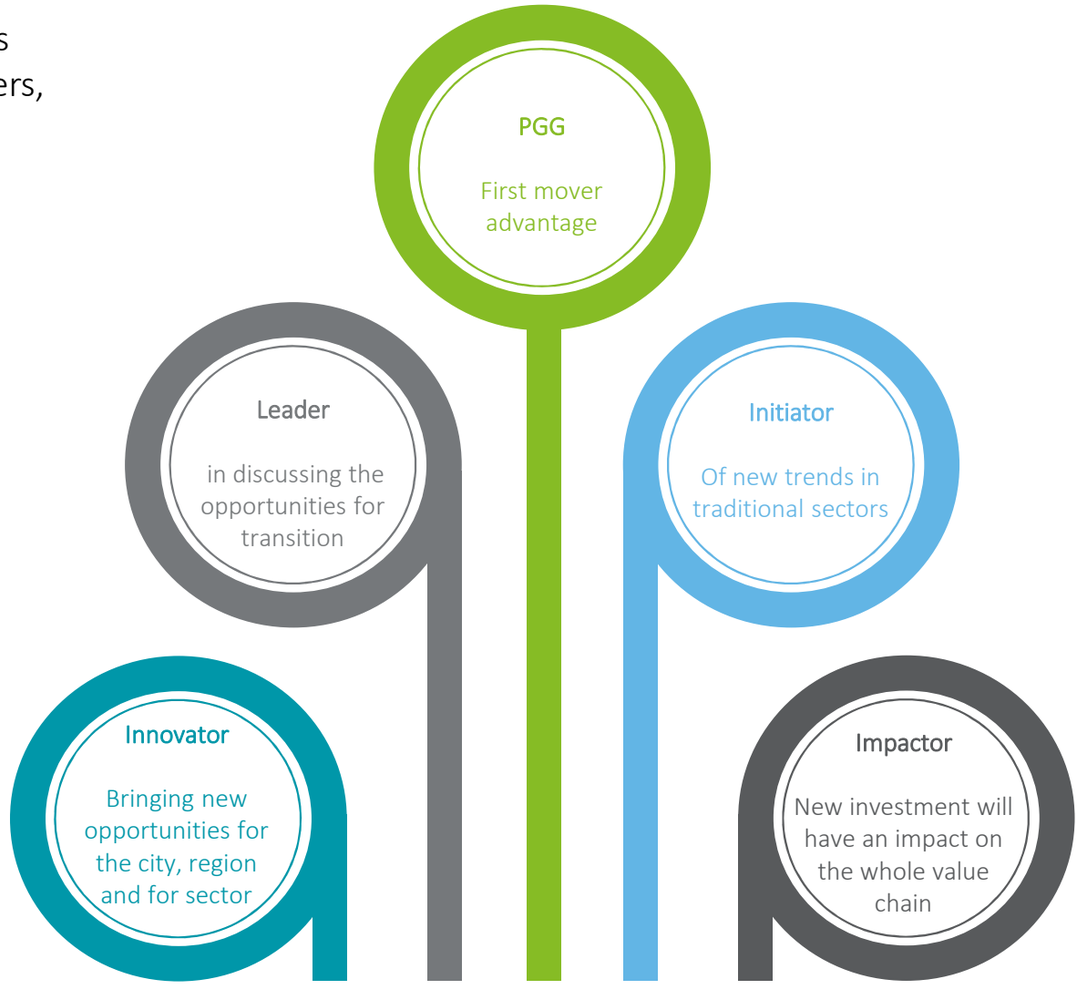
A pre-feasibility study showed the profitability of coal gasification combined with methanol production

Building a broader coalition

PGG can take an advantage from an early move from shifting towards zero emission coal investment

The new coal gasification investment requires dialog and cooperation with many stakeholders, including:

- Municipalities
- Region stakeholders
- The chemical sector
- Other end consumers.



Partnership with the chemical sector as a key enabler to the PGG's transition to offering mining and chemical products

5 The Project status – key figures

➢ Capex	EUR 500MM
➢ Construction	2-3 years
➢ Project development till NTP	2-3 years
➢ Methanol production	619 ktons
➢ Low quality coal consumption	1200 ktons
➢ CO2 avoided in the methanol process	150 ktons

PGG conciders errection of a relatively big plant with Best Available Technology and low emission footprint

5 The Project status – things done

- Letter of intent between PGG, GiG –mining and chemical Institute and SES Inc- technology owner to develop the Project
- „Comparative analysis of coal and waste gasification technologies”- SES technology indicated as the best available technology mainly due to flexibility of fuel intake
- We prepared intial economical analysis which indicated good coal gasification profitablility combined with methanol production
- Gasification to power profitability is linked to capture and commercial utilisation of CO2
- We selected 2 sites for first Project (feasibility study of the plots under way):

Piast – Ziemowit mine – low quality coal

ROW mine - flotoconcentare and coal waste

- Existance and viability of technology initially varified
- Methanol market analysis and its production benchmark with various fuels are promising
- Impact and value chain analysis to be conducted and shared with stakeholders

The Project passed the initial screening phase

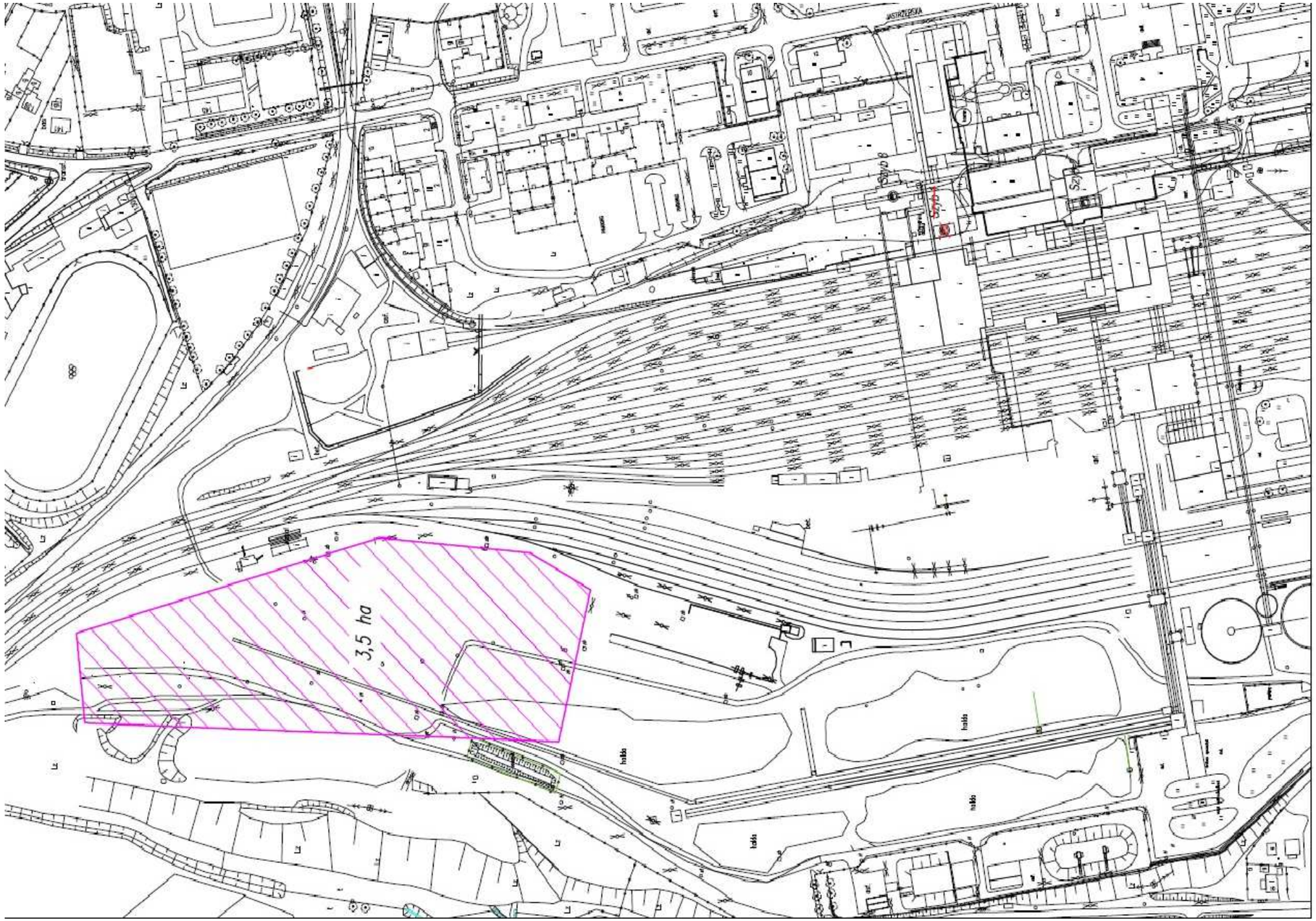
5 The Project status – things to do and improve

Project development:

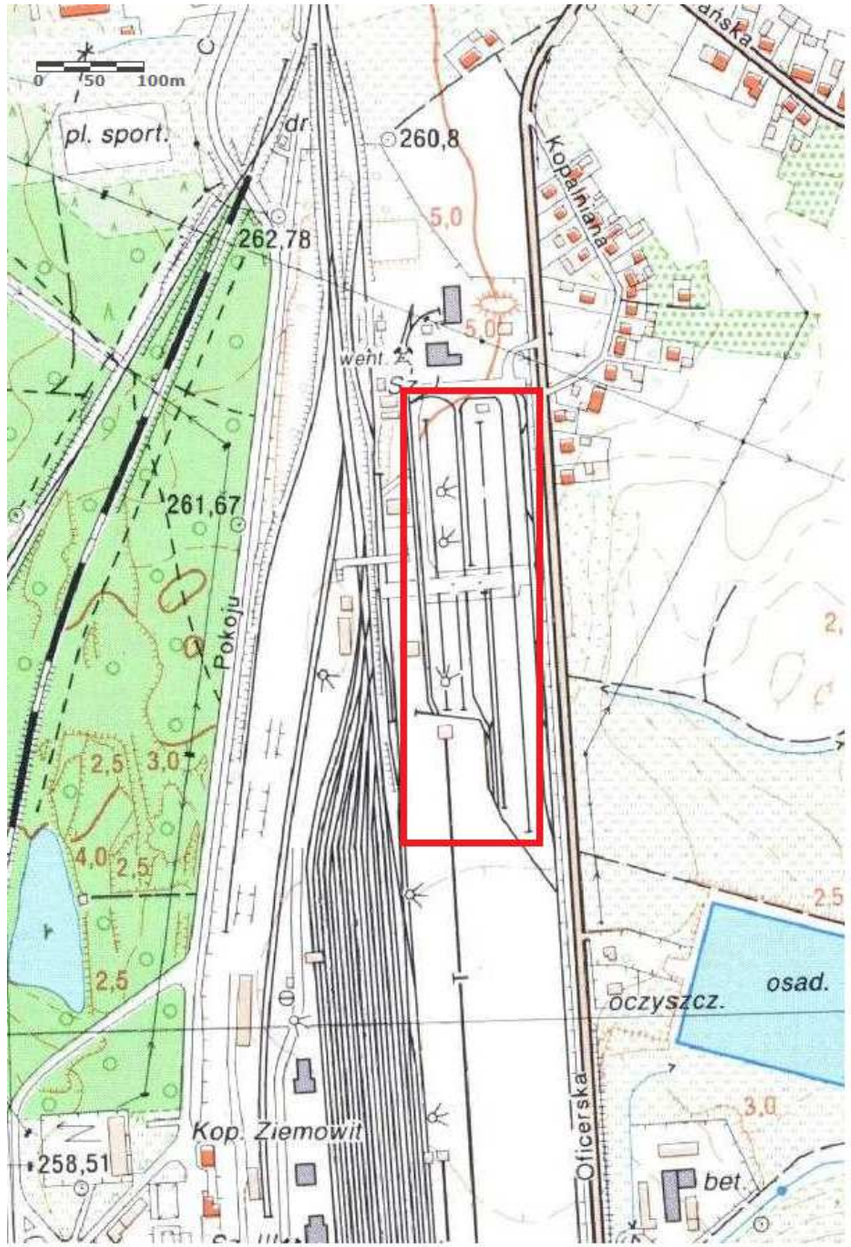
- Project documentation preparation
- Commercial Structure to be stabilised- contracts, possible sulphur sale, CO2 commercial utilisation, waste heat use, communal waste addition, combing the Project with hydrogen economy
- Financial structure – ownership agreement and external financing – grants and preferred financing if possible
- Organizational structure – SPV creation and its procedures – possibly various stakeholders involved
- Tender process – turn key to mitigate risk of new technology
- Financial closure
- Construction and mobilization of the Plant
- Operations & Maintenance agreement

The Project needs to complete the implementation phase

PROPOSED SITE IN ROW MINE (JANKOWICE)



PROPOSED SITE IN PIAST ZIEMOWIT MINE (ZIEMOWIT)

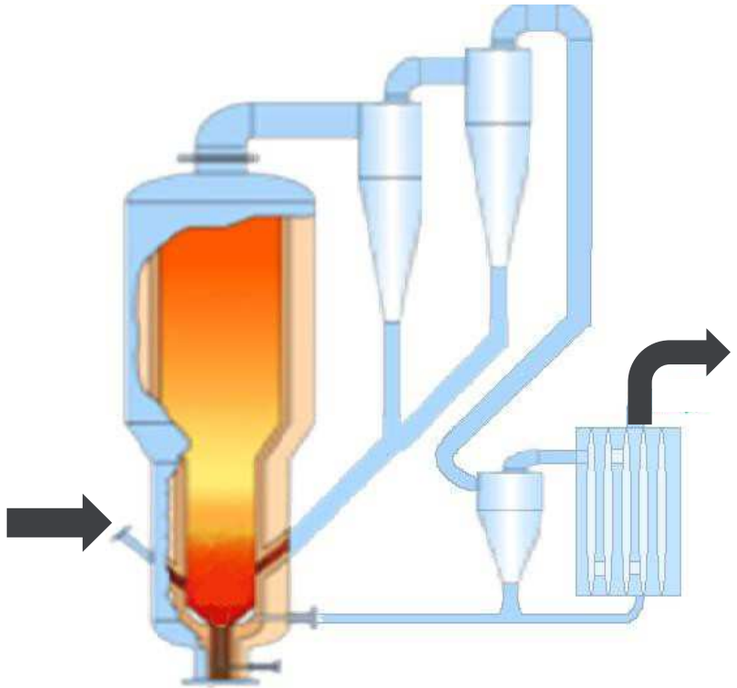


6 SES Inc method - flexible feedstock & numerous end products, proven technology

All grades of Coal & Coal Wastes

Biomass & Wood Wastes

MSW, RDF & Other Wastes



- Chemicals – Methanol
- Hydrogen
- Synthetic Natural Gas (SNG)
- Transportation Fuels
- Industrial Fuel Gas
- Fertilizers - Ammonia/Urea
- Electric Power
- Saleable Sulfur and Ash by-products

EXAMPLE PROJECT IN CHINA YIMA 300KTON OF METHANOL

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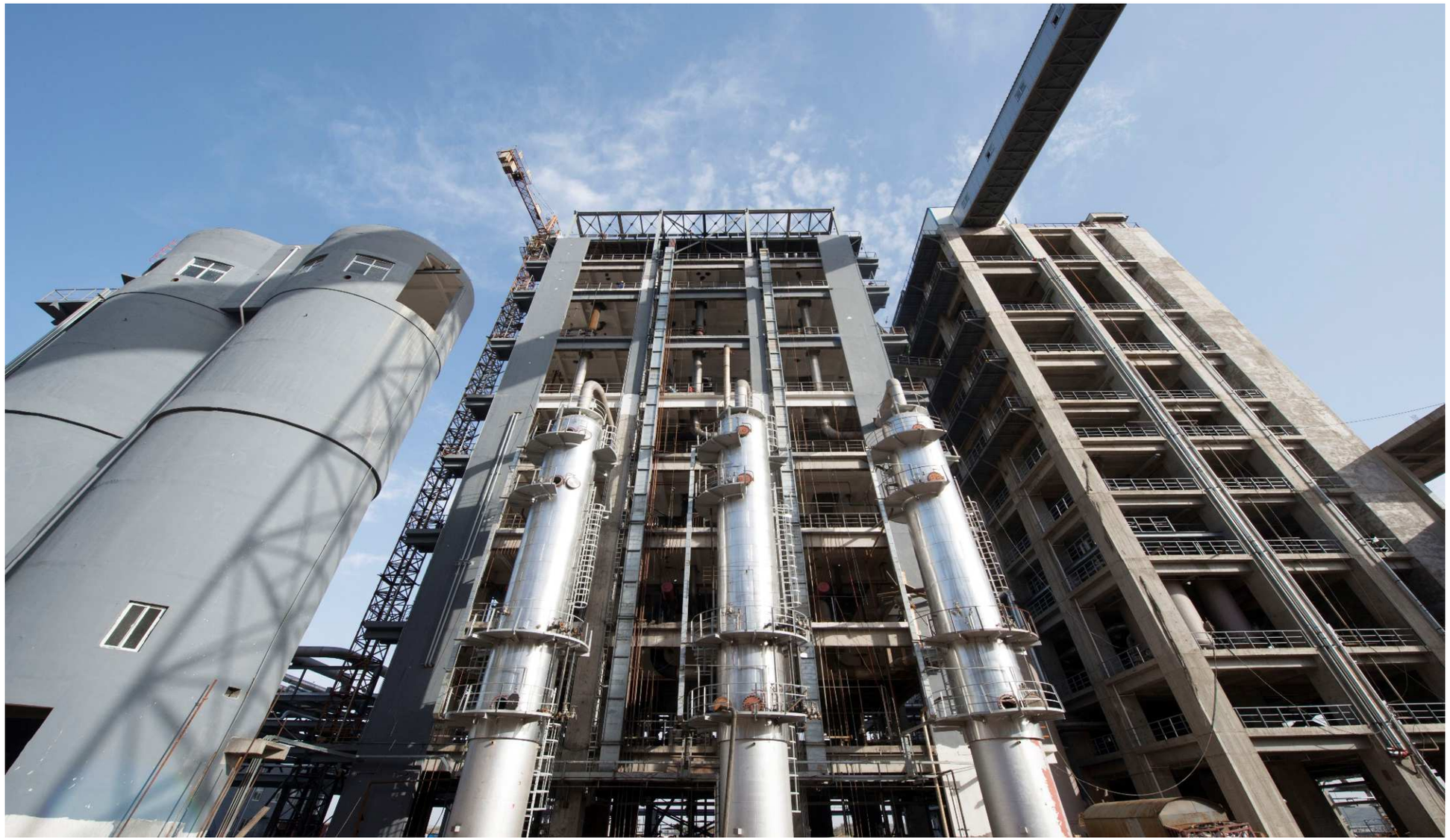

EXAMPLE PROJECT IN CHINA SHANDON 2 GASIFIERS

EXAMPLE PROJECT IN CHINA SHANX 1 GASIFIER

EXAMPLE PROJECT IN CHINA HENAN 4 GASIFIERS

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Thank You

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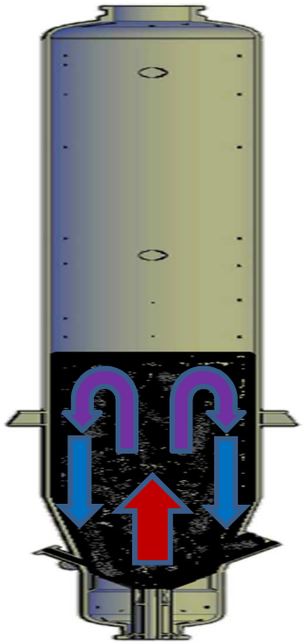
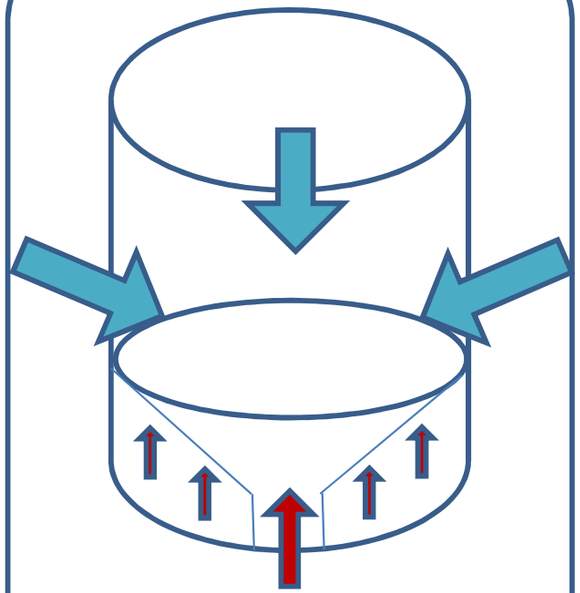
SGT Technology Differentiation

SGT's advanced fluidized bed balances feed flexibility, performance and ease of operation



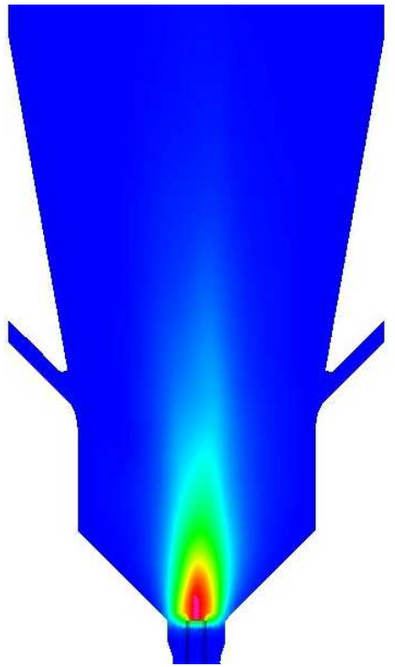
Fluidized Bed

- Maximize the residence time of reactants
- Enables feed flexibility and process stability



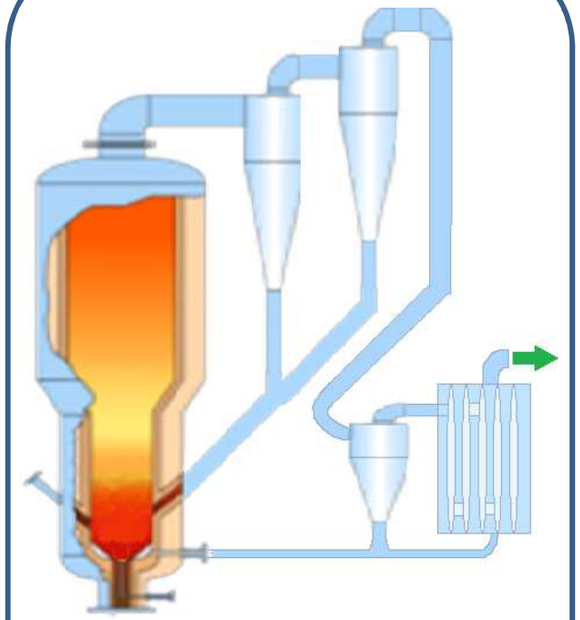
Multi-point Feed Injection

- Allows for online maintenance
- Co-feed coal, biomass and waste materials

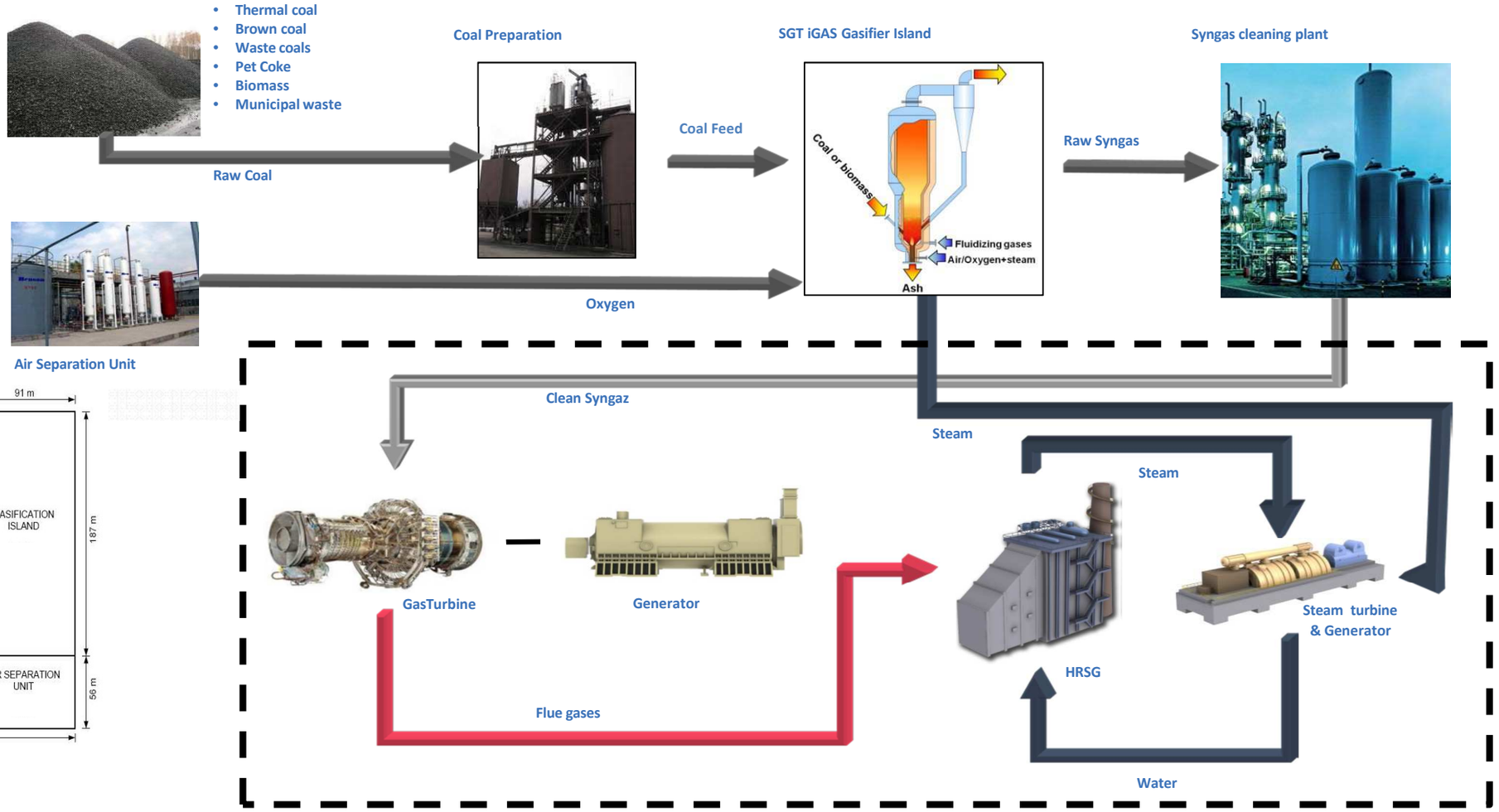
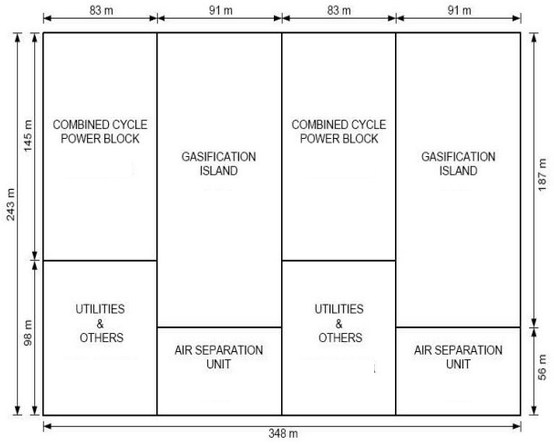


Center Jet Design

- Independent gas and temperature control
- Optimize bed mixing for efficient reactions



Four Stage Fines Recycle

- Capture >99.9% of particulate matter
- Return fines to bed for high conversion

Configuration in Combined Cycle