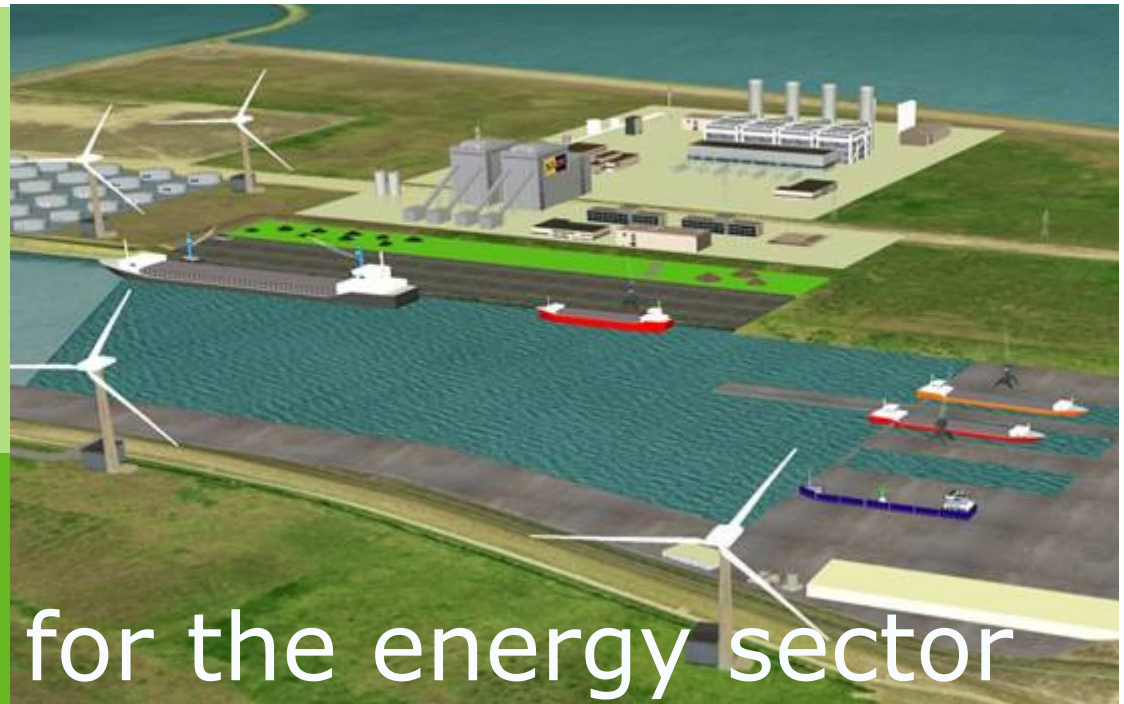


16 June 2006



Opportunities for the energy sector

Robert de Kler

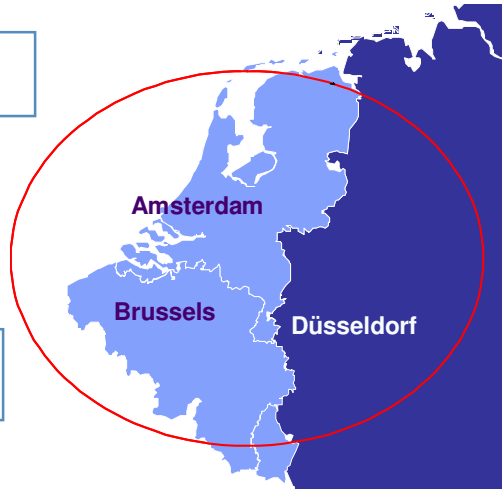
Content

- Introduction on Nuon
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- Bio-fuels long list

Nuon summary overview

Netherlands (9,000 FTE):
 • Generation, trading, distribution, sales

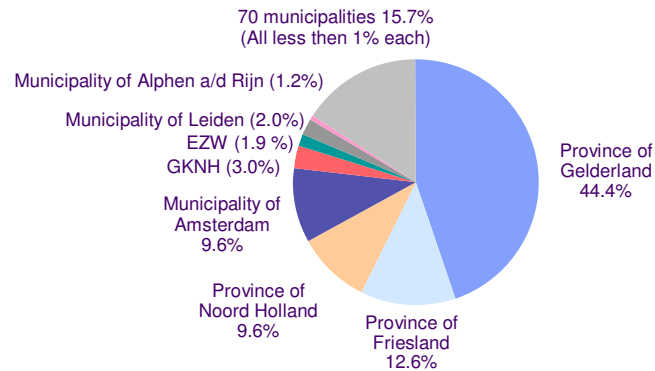
Belgium (120 FTE):
 • (Selective) production and sales



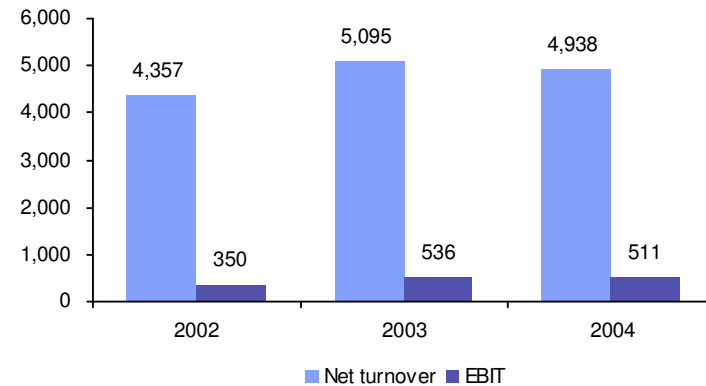
Germany (250 FTE):
 • Management of industry parks, and public lighting activities (eg. Berlin), (selective) production, sales

Europe:
 • Trading and renewable production

Shareholders

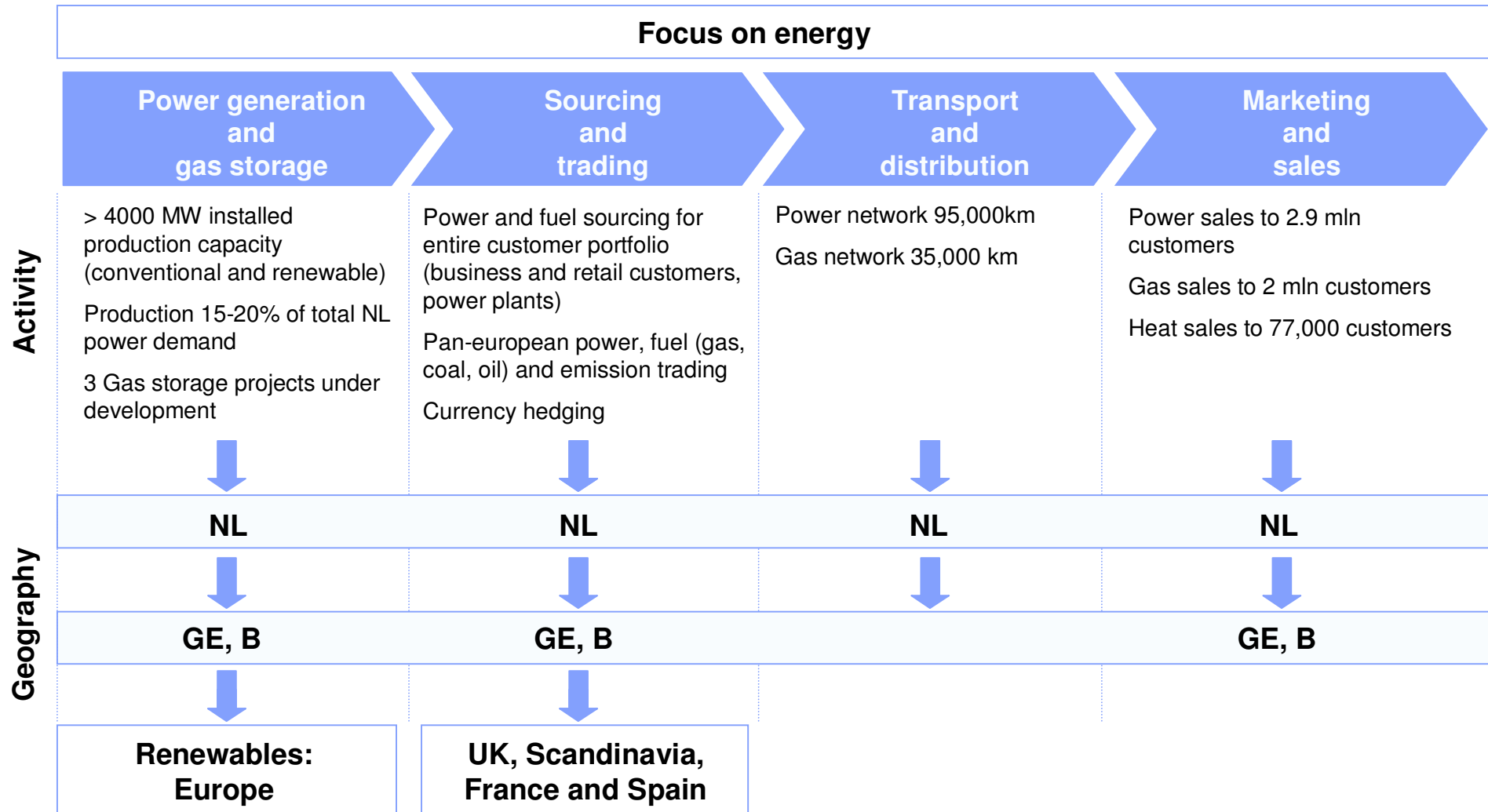


Summary financials



Nuon is an independent, international energy company based in the Netherlands, with focus on North West Europe, striving for balanced growth for all stakeholders

Nuon business chain



Nuon - generation portfolio overview



Cluster Amsterdam



Cluster Utrecht



Cluster Velsen

- Nuon third generator in Netherlands
- 16 'grey' generation assets on 9 premises in 4 clusters; Total installed capacity about 3500 MWe
- Efficient, dominantly gas fired generation
- Production of heat for district heating in Utrecht, Nieuwegein and Amsterdam-Zuidoost, and industrial steam
- Several renewable assets in 7 European countries, dominantly wind; installed capacity about 500 MWe
- Syngas development and operational experience: Buggenum (coal, 250 MWe), Velsen (BFG, 810 MWe), IJmond (BFG, 140 MWe)



Cluster Oost



Renewables



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Biomass projects

Lelystad (BMC)

Start operations: jan. 2000
Thermal power: 6,5 MWth
Heat production: 126.000 GJ/yr
Electrical output: 1,5 MWe CO2 neutral
Elektrical prod: 4500 MWh/yr
Fuel type: Wood
Fuel input: 20.000 ton/yr



Buggenum (Co-firing)

Start operations: jan. 2006
Electrical output: 42 MWe CO2 neutral
Fuel type: A-wood
B-wood
sewage sludge
paper pulp
Fuel input: 200.000 ton /yr



Developments

Nuon aims at increasing of volumes of secondary fuels.

Buggenum (Co-firing) challenges:

- Availability of bio-fuels
- Chemical acceptable fuels
- Physical acceptable fuels

Focus at: processing
pre-treatment, torrifaction,
blending, transport and storage



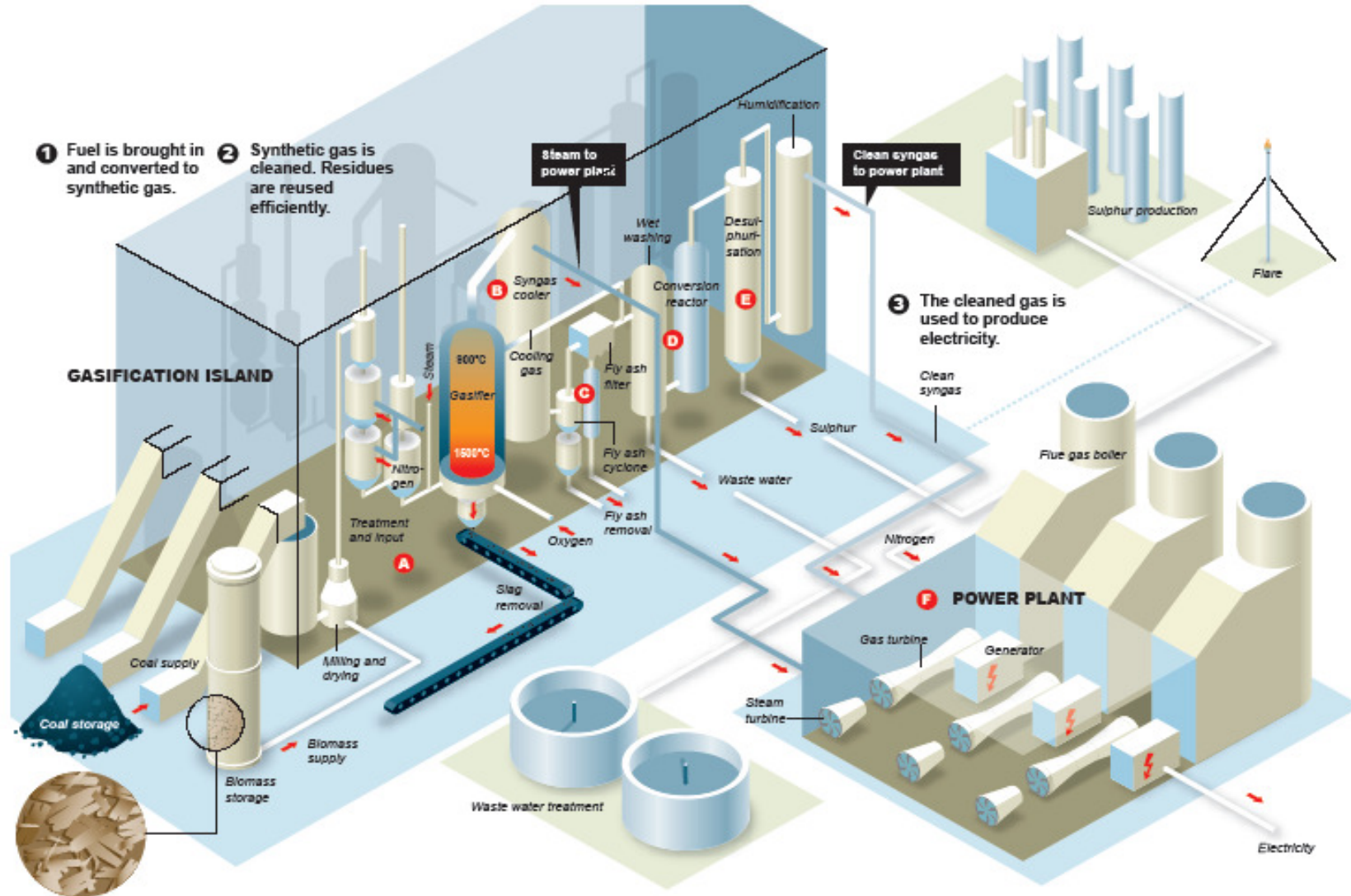
New built "Multi fuel Power Plant":

- Electrical output: 100 – 150 MWe CO2 neutral
- Fuel input: 500 – 700 kton/yr secondary fuels (Biomass)

Content

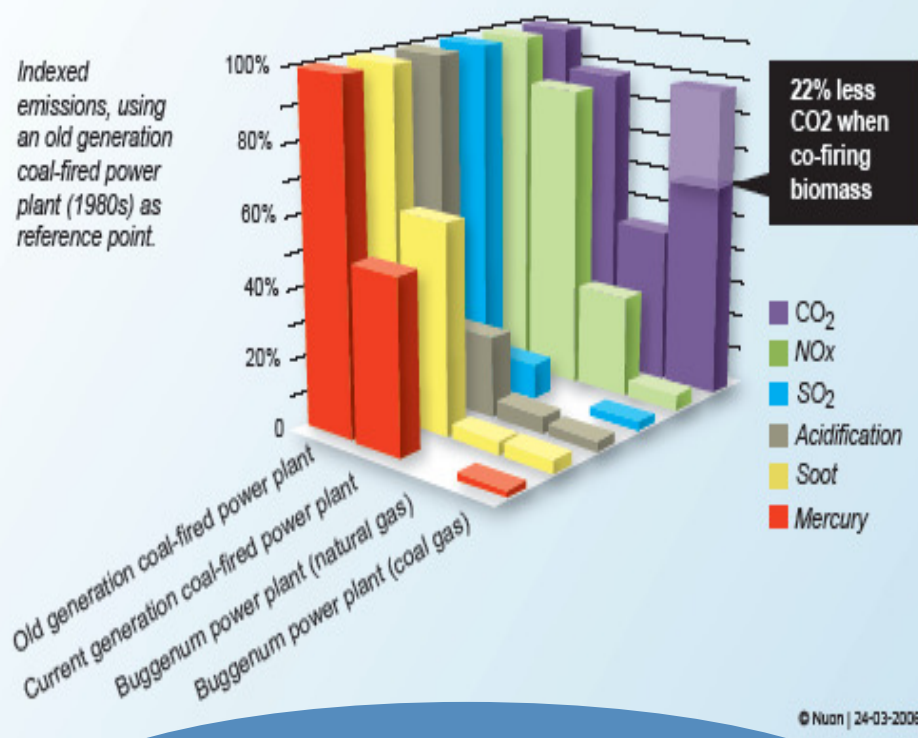
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New built "Multi fuel Centrale"



Emissions

By making gas out of coal and biomass and than cleaning it, a clean fuel is created for the production of electricity. Utility company Nuon is applying this principle at its power plant in Buggenum, in the Dutch province of Limburg.

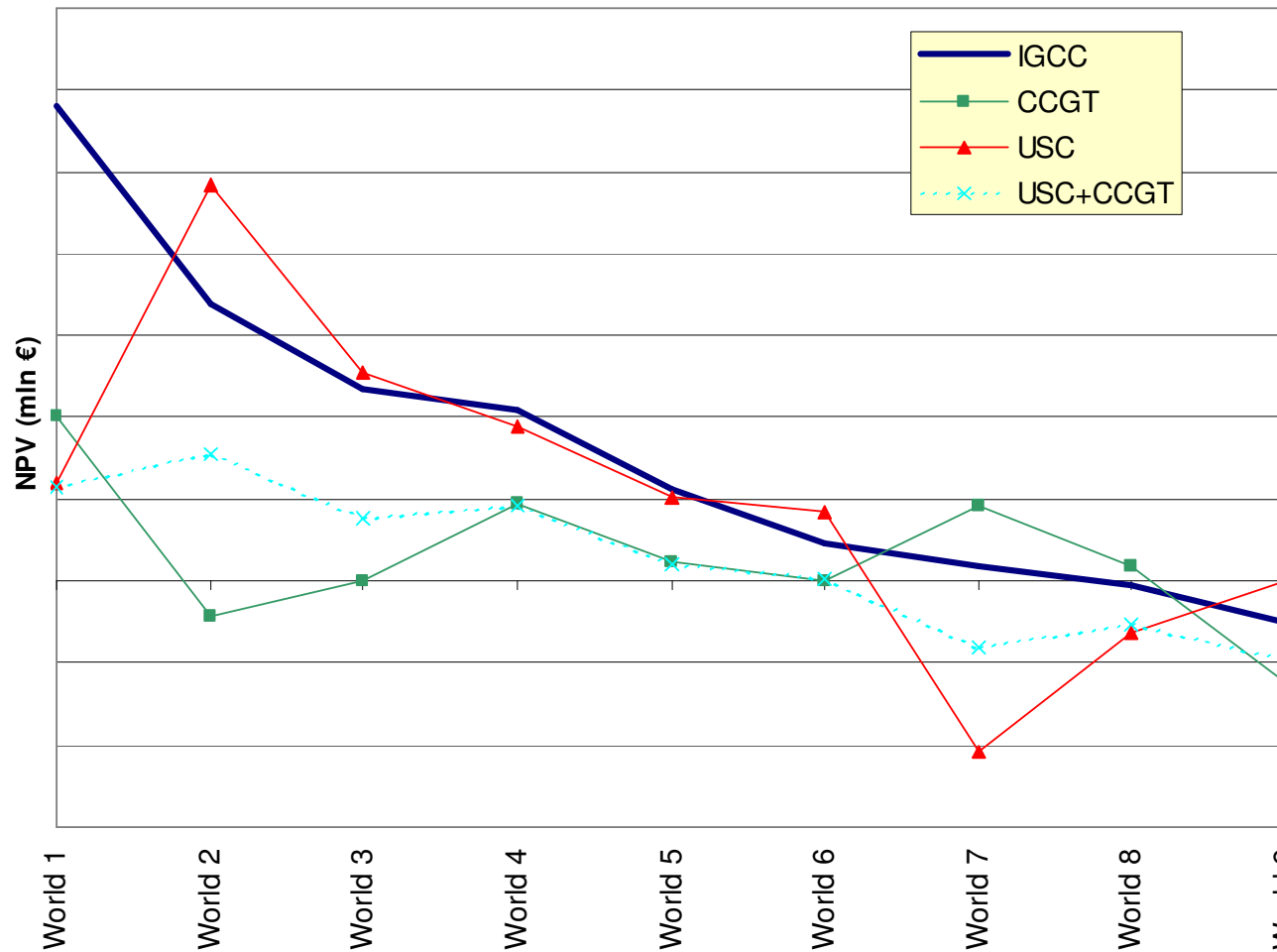


Entrained flow Gasification
The cleanest technology for large scale biomass conversion to power



Profitability of a Concept based on IGCC in a number of scenario's ("worlds")

Solid business case IGCC vs. alternatives



Profitability of IGCC in different worlds (worlds can be e.g. CO2 free, monopolistic, limited gas availability, micro-generation, etc) **is guaranteed by the versatility of IGCC:**

- Efficient CO2 capture
- Biomass and secondary fuel co-firing ability and %
- Fisher Tropps: Coal to liquids
- Hydrogen production
- Emission levels
- Modular build-up enabling efficiency upgrades

Versatility of IGCC enables mitigation of future uncertainty and key risks

	Regulatory	Market	Technology
KNOWN	<ul style="list-style-type: none"> ■ CO2 reduction ■ Renewable generation and subsidization ■ Emission reduction ■ BAT / BREF compliance 	<ul style="list-style-type: none"> ■ Gas to coal spread ■ Imbalance cost ↔ size ■ New entry ↔ size market ■ Fuel volatility (LNG) ■ Secondary fuels ■ Gas reserves 	<ul style="list-style-type: none"> ■ GT development ■ Promising technologies as fuel cell ■ Lessons learned Buggenum ■ Economies of scale
UNKNOWN	<ul style="list-style-type: none"> ¿ Security of supply, fuel mix obligation ¿ CHP obligation ¿ CO2 neutrality ¿ Interconnection capacity ¿ Known elements ¿ 	<ul style="list-style-type: none"> ¿ Micro CHP development and penetration ¿ Hydrogen production ¿ Synthetic fuels ¿ Large industries ¿ Demand developments ¿ 	<ul style="list-style-type: none"> ¿ Micro CHP development and penetration ¿ Solar, wind, tidal ¿ Improvement of modules ¿

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Gasification technologies

Fluidized bed gasification

- Not implemented on a large scale
- Research is being done and some test plants exist.
- Good mixing of feed and oxidant. This is good for mass and heat transfer.
- Gasifier temperature below the ash softening to prevent sintering/slagging. The disadvantage of the lower temperatures is that it increases the tar content in the syngas.

Moving bed gasification

- Mature technology, large scale synthesis gas production.
- Across moving-bed there is a large temperature gradient between 400 °C and 550 °C.
- Conversion is not complete which results in tars, phenols, ammonia and other hydrocarbons species that pollute the syngas.

Entrained flow gasification

- Large scale experience
- Fuel to be milled to a size of 100 µm or smaller.
- The temperature has to be above the coal melting point to ensure that the ash accumulates as slag (molten ash) in the reactor.
- Due to a high reactor temperature there will be no tar in the syngas.

	Fuel flexibility	Quality of syngas	Large scale applicable	Quality of ash / slag	complexity of technology	Ease of water purification	Gasification efficiency
Fluidised bed	++	-	-	-	o	o	+
Moving bed	o	--	o	+	-	--	++
Entrained flow	+	o	+	++	+	o	o

Selection factors for Entrained Flow Gasification

Syngas quality, Quality of slag and flyash, fuel flexibility, maturity of technology compare to fluidized bed, integration system efficiency.

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Bio-fuels list

- Woody Biomass
 - e.g. pellets, demolition wood, saw dust

- Agricultural biomass
 - e.g. coconut shells, palm kernel shells, sugar cane bagasse briquettes

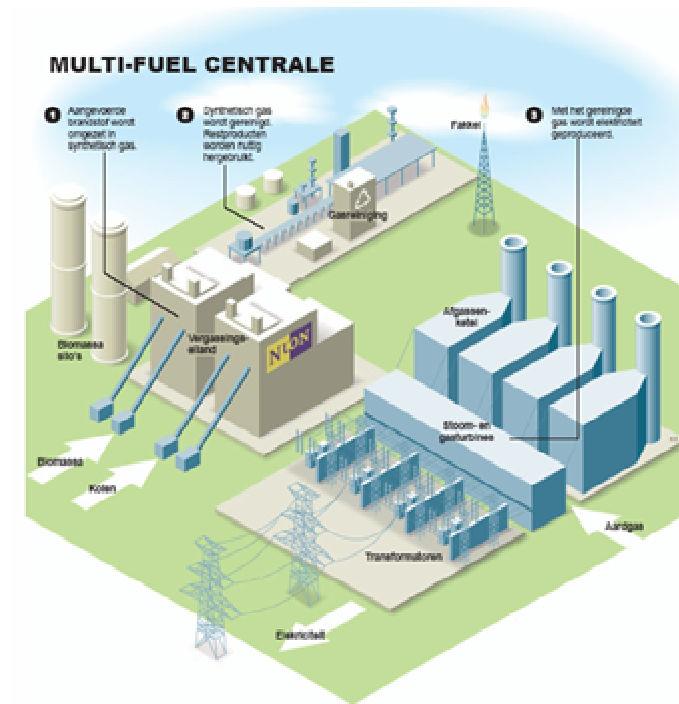
- Non-biomass sources
 - e.g. waste tires, sewage sludge, RDF



Risks:
Market (commodity, price, amount)
Small suppliers / contracts
Technology

Key questions:

- Is there a an agricultural tailor made energy product ?
- What are the product specifications ?



Thanks !