KUALA LUMPUR 2012 WORLD GAS CONFERENCE

IGU

25th world gas conference

"Gas: Sustaining Future Global Growth"

"How to use in complementary ways, renewable and natural gas solutions in order to improve efficiency and sustainability of energy master plan of industrial plants"

WOC5 -SG5.1

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Date:

Venue:

Patron

IGU INTERNATIONAL GAS UNION UNION INTERNATIONALE DU GAZ

Host

MALAYSIAN Gas ASSOCIATION

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PETRONAS reimagining energy

AGENDA

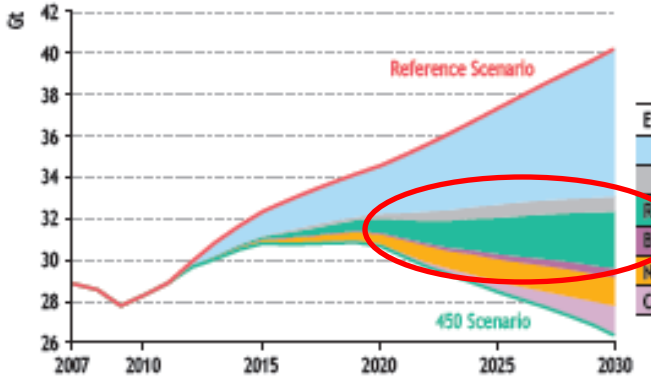
- Context – “From Energy efficiency to Low Carbon foot print industrial plants”
- Green energy production & NG
  - Bio-methane & NG for green gas production
  - On site production of synthetic methane with CO2 and Bio-hydrogen
  - Integrated Solar Combined Cycle (ISCC)
- Coupling renewable energy to NG appliances
  - Absorption Chiller & Solar Cooling
  - Coupling solar panel with immerged natural gas radiant Tube for production of hot water
- Conclusions

Context: "From Energy efficiency to Low Carbon foot print industrial plants"

Evolution of customers /market demands

- Energy and environmental context
  - ✓ Factor 4 – 450 ppm CO_2
  - ✓ European Energy - Climate change targets ex: EU 3 x 20% rules
- Regulation Context
  - ✓ Energy management standards - ISO 50001
  - ✓ New operating permitting for industrial plants
  - ✓ National quotas CO_2 allocations
- Profitability of industries or ind. Plate-forms **(Steel ind. Chemical ind**. ….)
  - ✓ Energy prices ➔ Reduction of energy consumption
  - ✓ « **Low carbon-foot print** » factories ou Eco-design:➔ Re-engineering of the energy master plans
- Strategic context – "Technology boosting"
  - ✓ Advanced technologies in energy (NTE)
  - ✓ Eco-technologies and fighting against Climate Changes

Figure 5.8 • World energy-related CO_2 emission savings by policy measure in the 450 Scenario

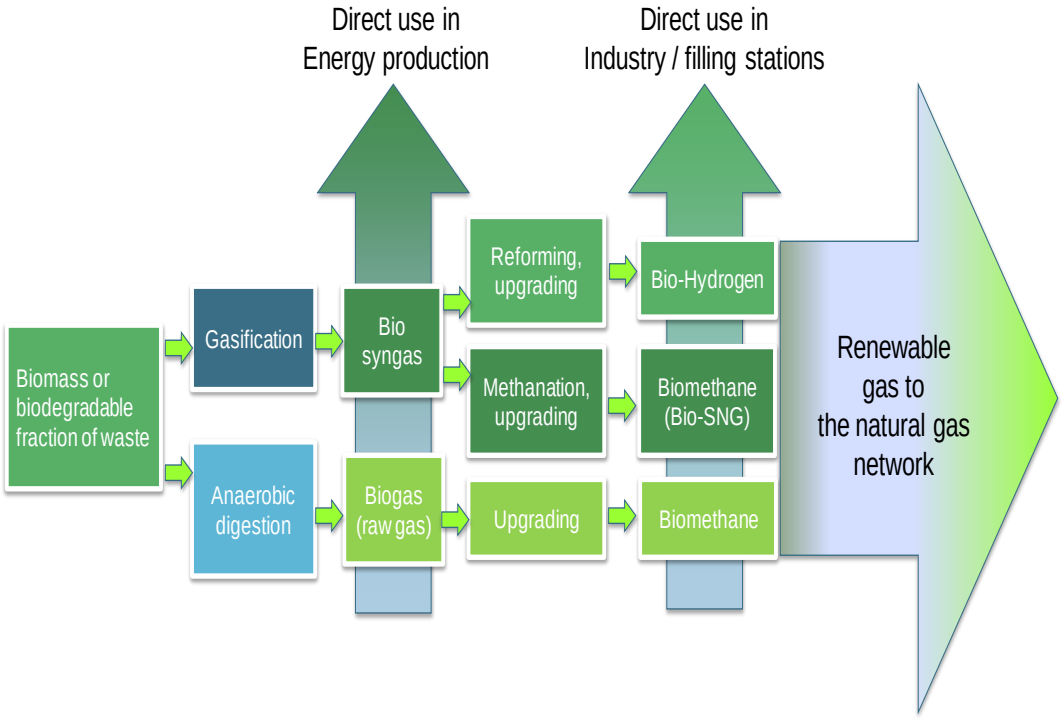


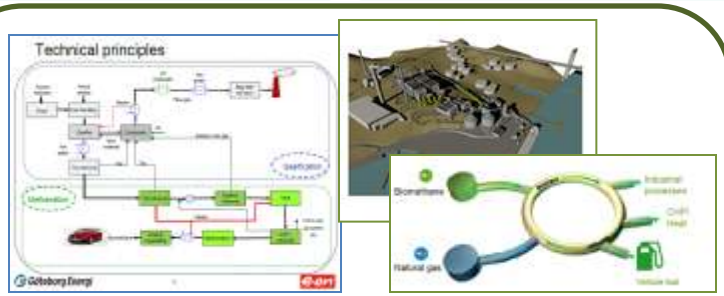
Abatement (Mt CO_2)	2020	2030
Efficiency	2 517	7 880
End-use	2 284	7 145
Power plants	233	735
Renewables	680	2 741
Biofuels	57	429
Nuclear	493	1 380
CCS	102	1 410

- **Implementation of renewable fuel into energy mix of industrial plants will be a priority to reach Climate Change targets**
- **Even if Natural gas is the lowest carbon contains fuel-gas , it's still a Fossil Fuel**
- **Our customers will ask us to provide "Green Fuel-gas molecules" and "Eco-design NG processes for their industrial Plants**
- **Coupling Natural gas & Renewables is a good opportunity to keep a place for NG in industrial Appliances**

Green energy production & NG: Bio-methane from biomass

- **Bio-methane production from Biomass - Several Processes are already undergoing :**





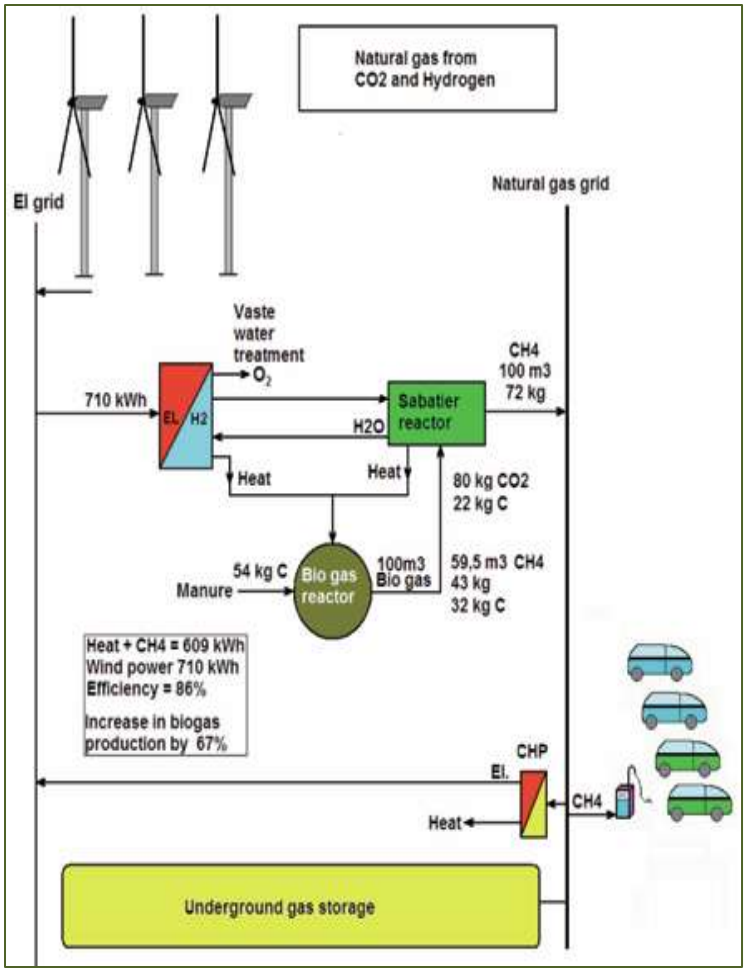
1- Mass production : GoBiGas - Göteborg Energi/Eon project with REPOTEC FICFB gasification process and Haldor Topsoe methanation process

2- Local production - GAYA project: Repotec FICFB gasification process – Güssing CHP unit and méthanation pilot plant with CTU process

3- Groen gas project -Netherlands : ENEXIS &KEMA anaerobic digestion of biomass & injection on 40 b NG grid

Green energy production & NG : On site production of synthetic methane with CO2 and Bio-hydrogen

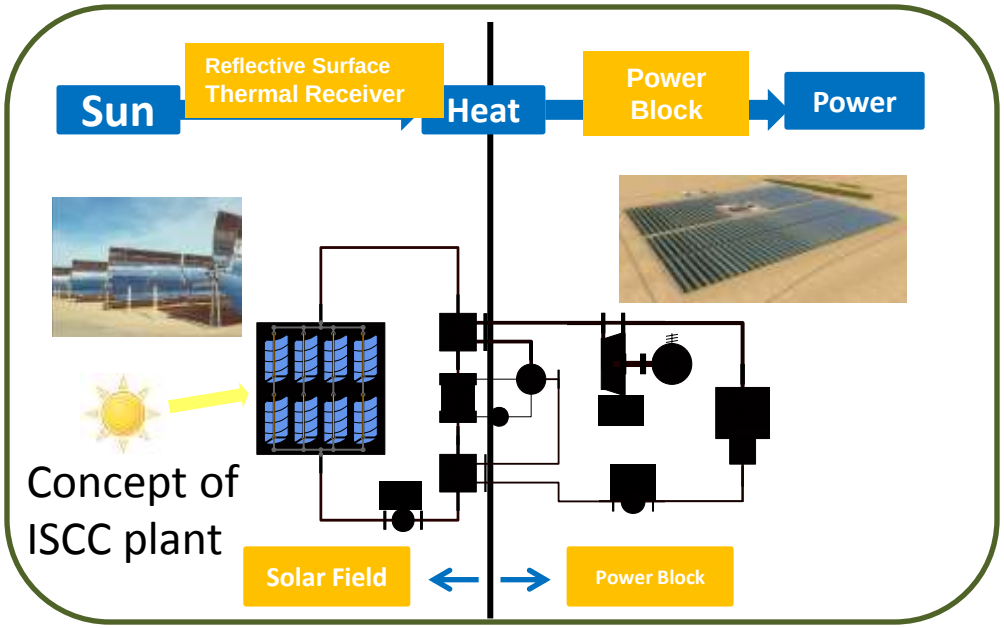
- For the “green methane” production several pathways are open
- SNG production Combined with the integration of renewable power from wind and sun seems is a new pathway.
  - This means a power based electrolyzing process combined with steam and CO2.
  - Biogas that contain 30 – 40% CO2 might be used in the last mentioned process – with the final result upgraded biogas.
  - 60 % to 80 % of energy efficiency conversion is expected



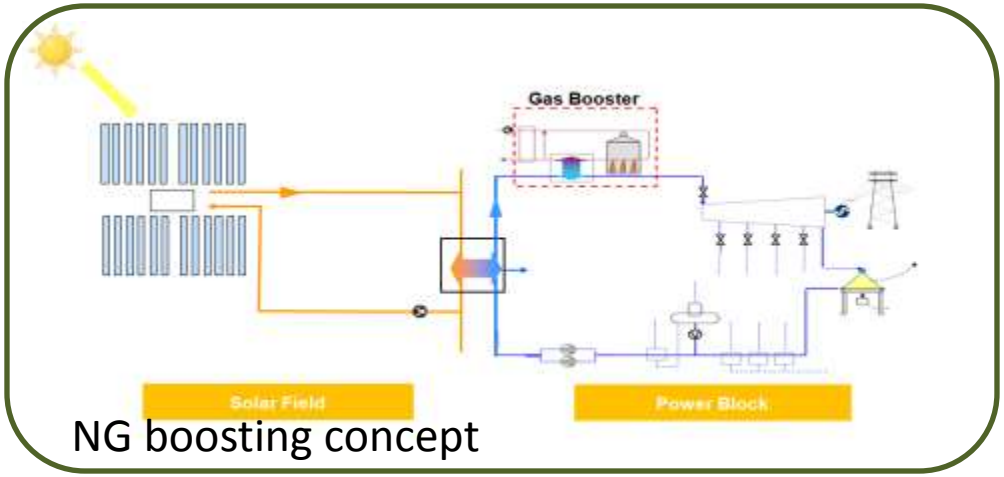
Dong Energy - Danmark

Green energy production & NG: Integrated Solar Combined Cycle (ISCC)

- For Power production hybridization technologies (ISCC) have been seen as attractive options to reduce the Cost of Electricity (COE).
- The main advantages of ISCC compared to separate CCGT and CSP plants are:
  - Increasing the fuel efficiency
  - Reducing the CO2 emissions per kWh
  - Investment and operating costs saving thanks to integration, thus leading to lower COE for ISCC versus having separate CCGT and CSP units.
- An other option is integration of a gas booster into the steam cycle of a CSP plant
  - Increasing temperature of steam & thermal efficiency of plants



Concept of ISCC plant



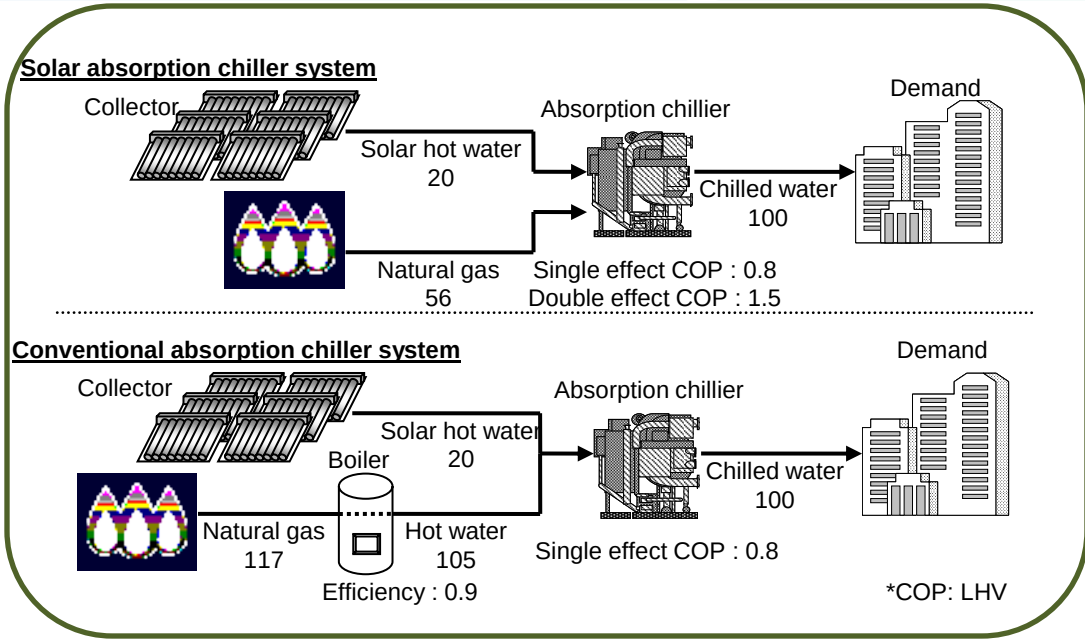
NG boosting concept

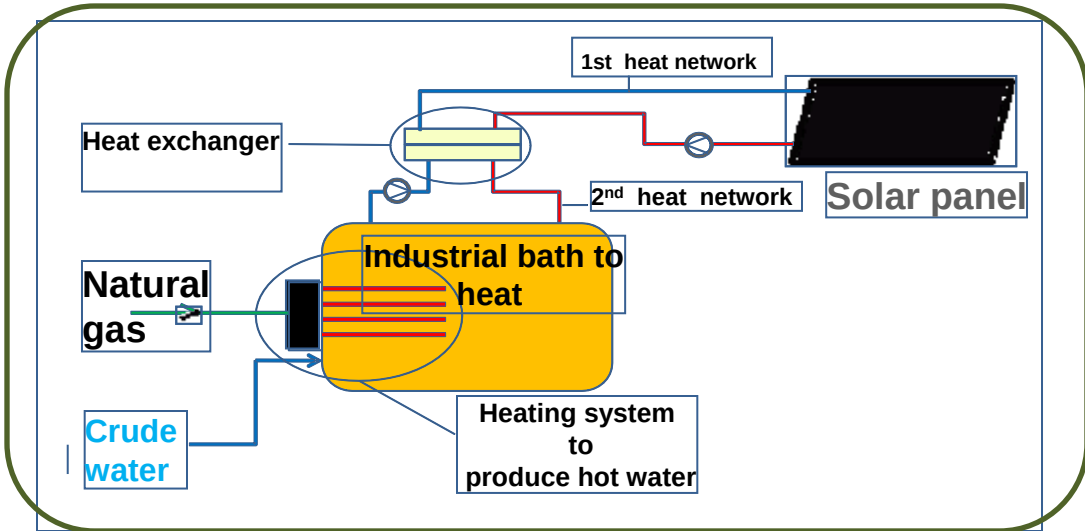
From TOTAL energy

Coupling renewable energy to NG appliances: "Eco-Design NG appliances "

- Coupling Renewable to NG processes is an opportunity to develop innovative "Eco-design" NG appliances
- Production of hot water and cooling systems are good and natural NG appliances for those new concepts:
  - **Cooling systems**: An advanced absorption chiller for solar cooling (solar absorption chiller) was developed to maximize absorption chillers' efficiency with solar power COP 1.6 to 1.9 **– OSAKA Gas & TOKYO Gas**
  - **On site production of hot water** : Coupling of Solar panel with NG boilers or NG Immerged tubes : **THERMIGAS Sarl** - Increase EE > 30 %

Typical possible markets are Paper Mill and Food industries





Associated business models for natural gas companies

- Biomass trading or energy tolling ✓
- Engineering Services to support implementation of plants ✓
- Global Services for Mass production of green Fuel gas ✓
- Global Services for local production of green Fuel gas ✓
- O & M services ✓
- Engineering servic and plant erection
- Design of technolo es

- **EX: Opportunities of Business: *For 10% of Renewable methane in Europe 2030***
  - **~ 50 billion m3/year (500 TWh/year) to produce and transport**
  - **~55 billion€/year for sales**
  - **~60 billion€ for investments**

Conclusions

- Provide ”Green fuel-gas” and ”Eco-design NG processes” will be a major target for NG compagnies to answere to this new market demands.
- To reach these objectives several ways are available now:
  - Mass or local “Green Fuel-Gas” production distributed through NG Grid
  - Hybrids Power plants coupling Solar energy and CCGT
  - Develop Eco-design NG industrial processes coupling renewable & NG appliances
- **Coupling NG & Renewable is a good answer to “Low carbon foot-Print” industrial plants and could prepare transition for a future Green fuel-gas (Synthetic methane; Hydrogen or Bio-Hydrogen) period !.**