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IGU

New sources of gas – impact on markets

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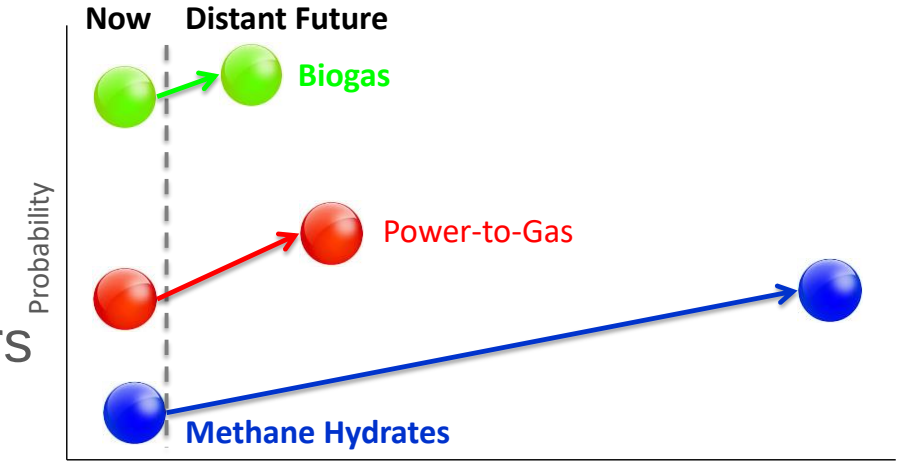
Several types of new sources available

- **Locally**: Shale and biogas
  - Every country likes home-made energy!
  - Where shale may meet resistance, biogas can open new doors
- **Internationally**: New sources and routes
  - More countries importing LNG – sourced globally
  - More infrastructure: LNG/virtual pipelines and traditional pipelines

- Natural gas more **competitive**
  - Lower prices/new pricing models
    - Easier to risk manage
  - Competition & wider choice of suppliers



From shortage to overflow – full picture perspective

- While gas was considered in short supply, and expensive...
- ...post Paris, and with much new LNG, the picture is different!
- **Biogas** cuts methane emissions and can replace other fuels
- **Power-to-gas** driven by renewables for easier energy storage
    - To hydrogen or methane - for storage or use
- Large emissions potentially from **methane hydrates**:
    - About 1 GT in northern tundras!
    - Extracting before «popping» (or keeping it cold): Valuable!
    - Climate payability for this?

Biogas, green, local and circular – what's not to like?

- Sewage, organic waste and other rotting material emit methane
  - This can be collected and used – to replace more emitting fuels
- Climate neutral or even «climate negative»: 179% better than diesel!
- Fits most sustainability targets when from waste
- High growth in Europe and globally
  - France will replace all natural gas w green gas!
- Still – not many aware of it – yet!
  - Oil industry, gas companies: Too small?
  - Producers less familiar with gas markets
  - Upgraded = blend in or replace gas/LNG
  - Benefit to natural gas!

It takes 5 cows or 30 pigs to heat a typical home in Denmark for one year.
Source: NGF Nature Energy

LNG for bunkering – several stages of development

- ECA zones to reduce sulfur emissions
  - MGO, scrubbers or LNG
  - Cruise ships favour LNG, better for passengers!
    - Competitive edge for some already

- IMO now reducing CO2-emissions – possible taxation/fee
  - LNG better than oil products (30%)
  - Bio LNG could make ships carbon neutral, or even negative

Next step power to gas?

- Balancing power market by «eating» over supply
- Batteries one option – costs falling, but still high
- Natural gas infrastructure of pipelines and storage – much larger

- Power to which gas?
  - First step would be hydrogen from electrolysis
  - Add CO2 for converting hydrogen to methane
  - Some methane converted to hydrogen – giving spare CO2?

Methane hydrates – powerful pops!

- Methane hydrates are like snow-balls
  - Frozen, compact, mainly underground
- Tundras melting now
  - Expanding methane leaves craters
  - Mapped possible emissions 1 GT CH4!
- IF captured, would it be considered green?
  - Better to use than direct emissions!