



SOFC Funding Assessment Committee Contribution

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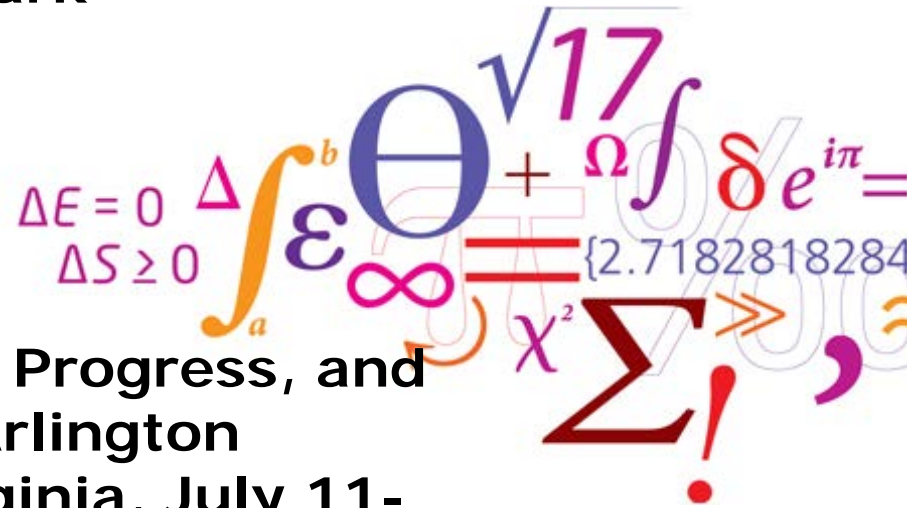
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SOFC Funding Assessment Committee Contribution

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Solid Oxide Fuel Cell Promise, Progress, and
Priorities Workshop, Westin Arlington
Gateway Hotel, Arlington, Virginia, July 11-
12, 2013

DTU Energy Conversion
Department of Energy Conversion and Storage

Current European funding and technology situation



- Main funding is from national budgets; ca. 10 % from EU.
- EU all FC types during latest 7 years (FCH JU program): 381.5 M€ from EU and ca. 400 M€ from industry. About 1/3 for SOC, i.e. in the order of **2-3 M€ per year in EU projects (incl. industry contribution) and ca. 20 M€ per year in total SOC funding including the national budgets.**
- One group in **FZ-Jülich (DE): still > 50 man-year per year (my/y)** in SOC R&D. Several other groups (KIT, other universities, Dresden, EIfER, SunFire ++).
- **Denmark: ca. 80 my/y at DTU (prev. Risø) and ca. 120 my/y at Topsoe Fuel Cell A/S, Haldor Topsoe A/S and other project partners. Topsoe sells PowerBox level to professional partners. General market entry in ca. 2 y.**
- CFCL German factory (and partly German technology?) sells small SOFC systems (few kW). Ceres Power (UK) claims ready for microCHP market.
- SunFire (DE): SOFC and SOEC to be in market from 2016 according to business plan.

Strengths/weaknesses/effectiveness of current SOFC funding arrangements

- **Fundamental research covering the area is important , and this will usually not be specific to only SOFC.**
- **Small university groups may have high strengths in focusing and getting deep understanding in e.g. electrochemical kinetics of anodes or of cathodes; seldom of both.**
- **Centers like FZ-Jülich (DE) and DTU Energy Conversion (Risø Campus, DK) that do both research and development, and from electrochemical kinetics on electrode nano-scale to full stack level are important in order to have above a “critical mass” that is outside industry. Otherwise little public knowledge of actual problems would be available. Smaller groups would not know what the real problems are.**
- **Industrial companies may have problems in efficient communication with very specialized university groups.**

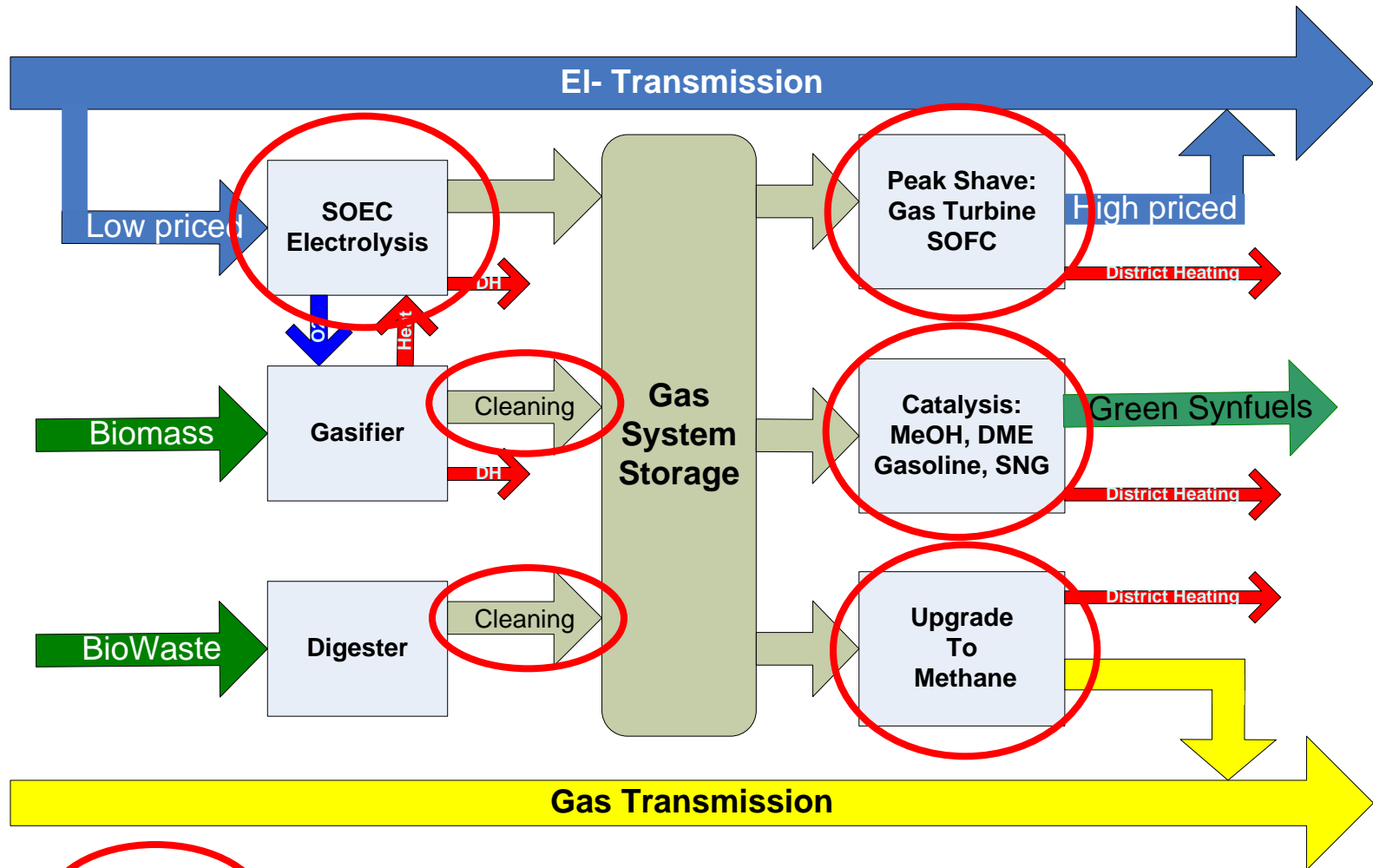
SOFC applied research and technical development


- Long term stable cooperation between academia and industry very advantageous; good relations on person level is extremely important!
- A consortium should have university and industry partners that have equal rights and mutual respect for each other. The industry people, naturally, want help for trouble shooting, but such short term jumping from one problem this week to another next week, will kill real research and sometimes also development. Therefore, the university groups should not be financially or in any other ways be controlled by industry, but the researches must prove that the seriously cooperate with industry.
- Regular educational programs of industry personnel on subjects that the industrial company decides and with confidentiality agreement may solve the industry's need for "immediate" (within few weeks) advise and help them in the trouble shooting.

Importance of political commitment

- The Danish answer:
- Denmark aims to become independent of fossil fuel by 2050. Energy strategy 2050 - from coal, oil and gas to green energy, The Danish Government, February 2011, http://www.ens.dk/Documents/Netboghandel%20-%20publikationer/2011/Energy_Strategy_2050.pdf
- By 2035 all electricity production must come from renewables
- By 2020 50 % of electricity production must be renewable energy - now 25 – 28 % is from renewables; subsidies are necessary.
- This is in continuation of an almost unanimous parliament policy since ca. 1980. Denmark double its industrial production from 2080 to 2000 without increasing fossil fuel consumption.
- Denmark has 5.5 mill. inhabitants only!

Energinet.dk's vision for fossil fuel free Denmark in 2050 – The Wind Scenario



 = Topsøe Technology
 DTU Energy Conversion, Technical University of Denmark

Thank you for your attention