Ammonia Cracking for Clean Electric Power Technology ACCEPT

Presentation

for

FUERO Workshop

Gothenburg, 21 June 2001

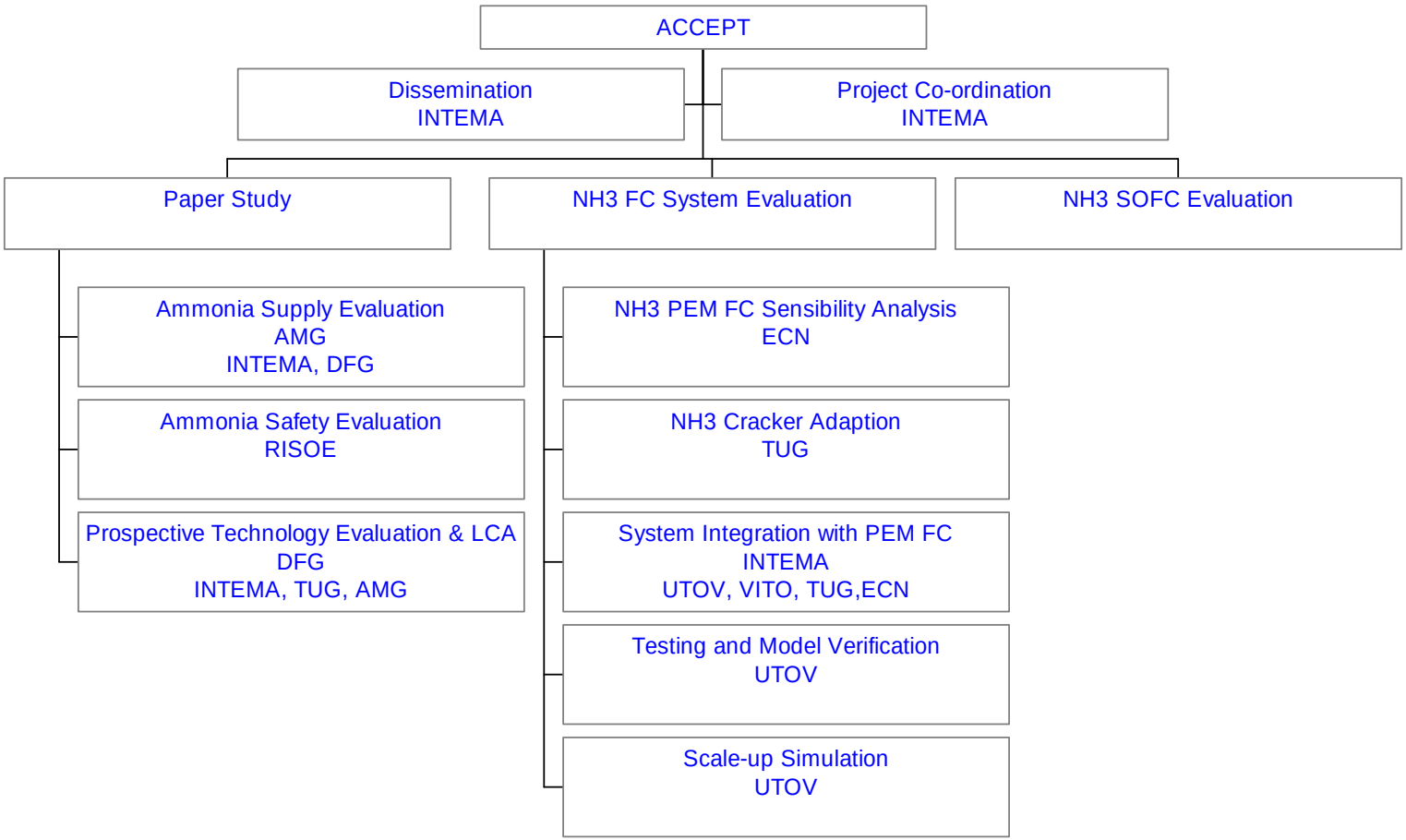
The Rationale

- Relative abundant supply
- No carbon content in the fuel, thus no CO2 emissions at mobile source
- Relatively easy, established technology for thermal cracking
- Proven with AFC and MCFC technology

NH3 Characteristics

- Energy density 5,81 kWh/kg corresponds to:
  - 90% Methanol
  - 52% Gasoline
  - 46% Diesel
- Low pressure storage at ~20 bar
- Chemical substance with the highest production volume ~ 140 Mio. t
- No local CO2 emissions, used as Reduction agent in SCR
- Simple, fast reforming
- Toxic risk in our point of view manageable

Project Structure

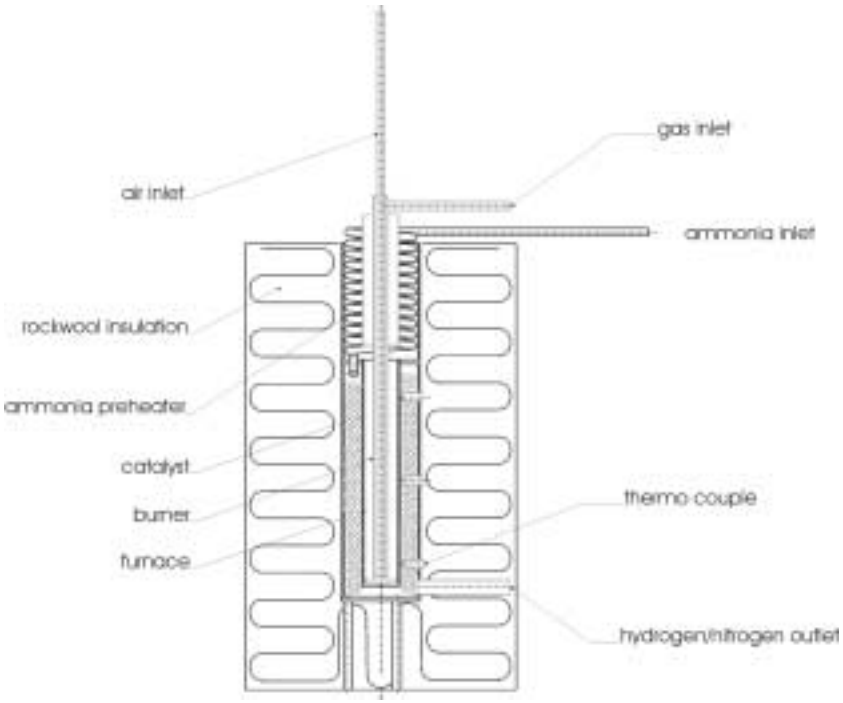


Partners

- **INTEMA Consult Graz**
- **Technical University of Graz**
- **VITO, Mol, B**
- **ECN, Petten, NL**
- **University of Rome „Tor Vergata“, DIM**
- **Advanced Lightweight Engineering**
- **Agrolinz Melamin GmbH**
- **DFG Energie, Munich**
- **Risoe National Laboratories, Danmark**

FUERO _____ **ACCEPT**

Existing Thermal Cracker TU Graz



Ammonia Cracker Prototype 2kW

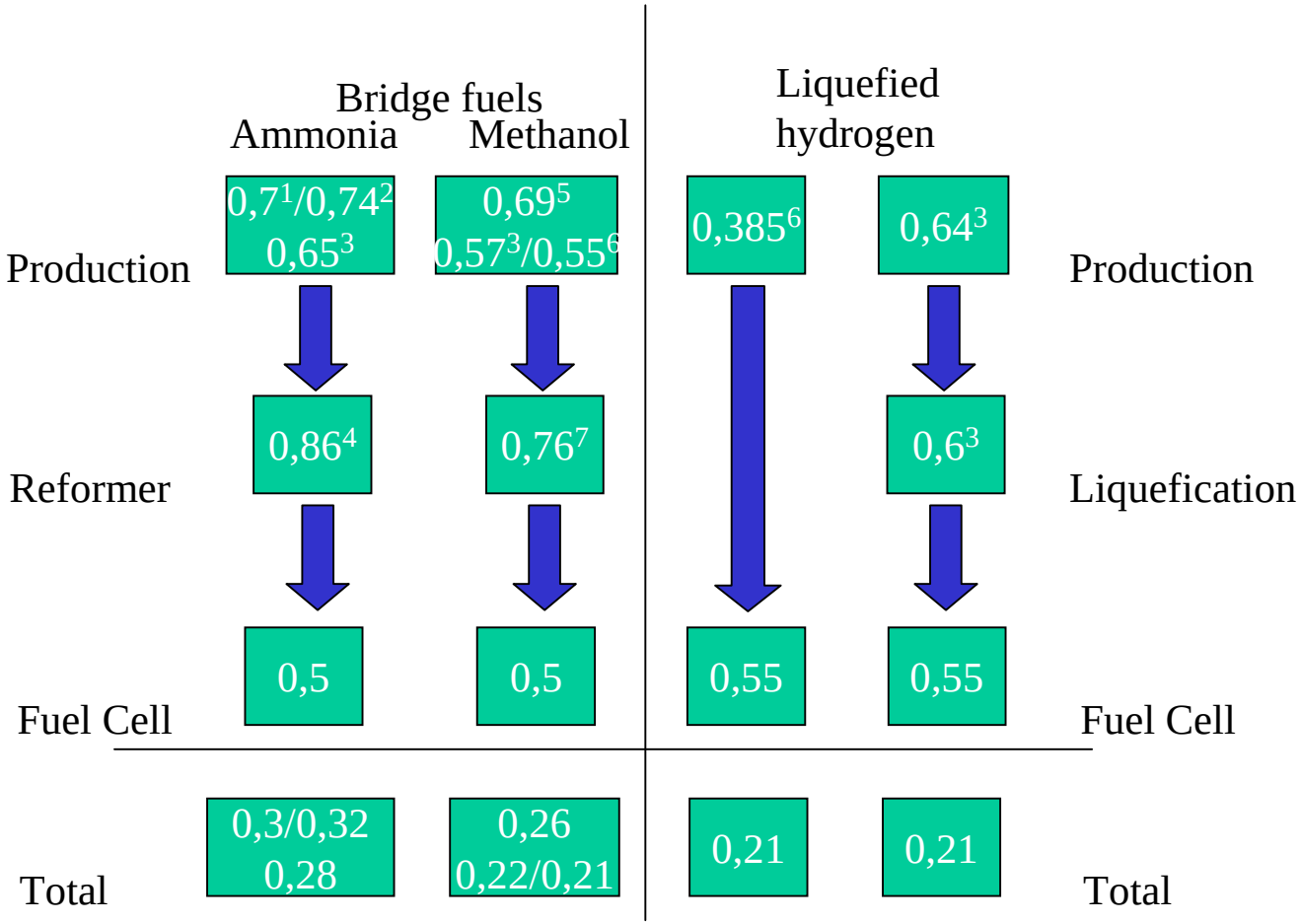
Other Cracker Technologies Integrated

- Electrically Heated Catalyst (INTEMA & TUG, based EMITEC):
  - Fast start up
  - Commercial product
  - Energy efficiency needs optimisation
- Most likely approach:
- Hybrid between EHC and thermal heating using anode off gas

Main Risks

- Purity of Ammonia Reformate PEM FC NH3 sensitivity expected in the 10ppm range, existing thermal cracker @ <50ppm
- Thermal integration (Cracker Temperature ~570-650°C)
- Tank to tailpipe NH3 leakproofing (NH3 is a GHG gas and toxic)

Some Efficiency Comparisons



References:
1: Today's typical. NH3 plant
2: NH3 future targets (standard technology)
3: Lawrence Livermore National Laboratory: „Hydrogen as a transportation fuel: Costs and benefits"
4: TU Graz; based on existing crackers
5:Mark Allard (Methanex); "Issues Associated with Widespread Utilisation of Methanol"; SAE Fuel Cell power 2000; p.35, 6:DFG-Energie
7:Richard Woods et al.; "Fuel-Flexible UOB™ Fuel Processor System Development and Status"; Hydrogen burner Technology DOE 2000 Annual progress report, p. 39 Table 2.

NH3 +SOFC

- Planar type (ASC, ESC)
- Verify direct operation (internal reformation)
- Efficiencies
- Long term viability (3000 hr test)

Paper Study

- Ammonia Production Technology Study
- Ammonia Safety Assessment
- Ammonia on-board Vehicle Tank Feasibility
- Prospective Technology Analysis
- Life Cycle Assessment

Contact details

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