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1. AdWinMethanol®, AdWinCombined™ technology
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1. AdWinMethanol® and AdWinCombined™ Technology
The technological concept is based on proven technologies

- AdWinMethanol® technology enables methanol production with considerable economic advantages, in particular at large scale capacities from 3,000 t/d up to 10,000 t/d in a single train.

- Approx. 10% less CAPEX and up to 4% less Natural Gas consumption compared to current plant concepts.

- Process: Conventional and/or non conventional short-chain hydrocarbons into syngas via Catalytic Partial Oxidation (ATR) with a high feed stock flexibility. Utilization of isothermal reactors only.

- AdWinCombined™ technology is the highly integrated combination of the advantages of AdWinMethanol® with thyssenkrupp Industrial Solutions’ Uhde Ammonia™ process.

- AdWinCombined™: Highly integrated, very flexible operations, approx. 30% less CAPEX, approx. 10% nat. gas consumptions

- Conventional methanol distillation

AdWinMethanol® - up to 10,000 t/d in a single train
1. AdWinMethanol® and AdWinCombined™ Technology

• Simplified process flow diagram AdWinMethanol®:

• Simplified process flow diagram AdWinCombined™:

AdWinCombined™: up to 30% less CAPEX and approx. 10% less Feedstock consumption
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants

Business Idea

- Storage of green power as green fuel
- Replacement of fossil gasoline
- Decentralized production in direct proximity to power plant substation, no transmission losses
- CO$_2$-compensation
- Production independent from oil or fuel imports
- Increased economics of renewable power generation

Renewable Methanol directly utilized as green fuel
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants

Major Milestones of Partnership SLF / tkIS

- First studies and R&D developments of SLF 2006-2014
- Pilot Plant of SLF in Switzerland 2012-2014
- Feasibility Study network SLF-plants in Switzerland Jun 2016
- Application procedures (qualification as biofuel, tax exemption) 2016-2018
- Signature Cooperation Agreement SLF / tkIS Sep 2016
- First Basic Engineering completed Jun 2017
- Modularization concept completed Aug 2017
- EPC Budget completed Nov 2017
- Project Implementation Agreement Me2Go signed Dec 2017 (5 plants at BKW hydropower sites in Switzerland)
- Site selection Me2Go completed May 2018

SLF / Uhde Methanol plants – tested and ready to be implemented
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants

Advanced plant configuration optimized for small capacities

SLF / UHDE Technology is the most advanced technology for small scale methanol plants
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants

Offsite & Utilities

N₂ Unloading → N₂ Storage → N₂ Evaporation → N₂ Distribution

CO₂ Unloading → CO₂ Storage → CO₂ Evaporation

Power Supply

Fresh Water Supply → Fresh Water Storage → Water Treatment → Cooling System

Water ELEKTROLYSIS & METHANOL PLANT

MeOH Storage → MeOH Loading

Waste Water Storage → Waste Water Treatment/Loading

Surface Water Collection & Disposal

Fire Fighting Water Collection & Disposal

Storm Water Collection & Disposal

Monitoring Gas Detection & CCV

Substation

DCS & ESC

Cooling System
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants
Our additional contribution: H₂ at scale - large water electrolysis plants

Advanced Water Electrolysis by thyssenkrupp
• Alkaline atmospheric
• EPC turnkey installations at large scale
• Established supply chains

Experience cannot be copied.

#1 supplier for electrolytic hydrogen production
49% market share
600 electrochemical plants realized worldwide
over 10 GW of power installed

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2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants
Green H₂ through water electrolysis – New dimensions for renewable energy integration

Water Electrolysis by thyssenkrupp

- Market potential 2017-23 for water electrolysis systems > €1.0 bn
  (Source: own assessment)
- Proven technology, scale economies
- Design for plants larger than 100 MW
- Target applications
  - Power-to-Gas (H₂/energy storage),
  - Power-to-X (e.g. methanol/fuel, ammonia)
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants

Advanced modularized concept optimized for small capacities

Modularization improves economics, all truckable, first capacity template ready to implement
2. SLF / UHDE Technology For Small Scale Renewable Methanol Plants
Typical Figures for a Me2Go-type Modules

- Plant type: Methanol from CO₂ and H₂
- Technology: Methanol: SLF / UHDE Technology
  Water Electrolysis: tkIS
- Production capacity: ~ 12 mtpd fuel grade methanol
- Typical scope of supply: EPC LSTK
- Total Investment: ~ 35 Mio. € (depending on location)

Ready to implement based on available tkIS Electrolysis and SLF/UHDE Methanol technology