

Innovative Fuel Cells & Electrolyzers



Organization

170+

38 Employees Successful R&D Programs

700+

Combined Technical Years of Experience

150+ Patents Issued,

Licensed, or Pending



CASE - Philippines Telecom





Visayas



Mindanao

Philippines over 6 years (over 800 systems) for multiple accounts

Local service center for fast response times.

We see the tendency in multiple Asian countries.

Many lessons learned over the past 4 years of deployment in tropical areas.

Local partners for distribution and fueling. Customer has experience with Hydrogen but experienced the logistic to be quite problematic.

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Methanol Is The Fuel Of Tomorrow, Today

✓ Cost: Methanol is 30% - 80% less expensive than Methanol is **liquid** diesel • easy to store ✓ **CO2 emissions:** Biomethanol cuts emissions by 80% easy to transport even in the most ✓ Future Proof: eMethanol is a low-cost hydrogen carrier of green H2 tomorrow remote locations 7 L 5,5 kg 50 L 63 kg 16 pcs. 96 L, 230 kg **Biomethanol** Lead Acid Batteries Hydrogen

Comparison of Weight & Volume Needed to Deliver ~45MJ of Energy

(H₂ compressed at 200bar)

Methanol – The Fuel of the Future



- Interest in "green" methanol is growing due to its ability to be an extremely low-carbon fuel and chemical
- IRENA projected that by 2050, 250 MMT of emethanol and 135 MMT of bio-methanol will be produced annually
- As a liquid fuel, methanol's handling and utilization is not very different from conventional fuels,
- Conventional methanol plants (natural gas) are able to utilize renewable feedstocks to produce low-carbon methanol
- Existing producers are able to produce low GHG intensity methanol today

www.methanol.org

 \bigcirc Advent

www.advent.energy

Comparison Methanol-Hydrogen(green-grey) vs Diesel



- Methanol reduces CO₂ emissions by 40%
- Biomethanol reduces CO_2 emissions by 85%
- Green Methanol (produced from Green Hydrogen) reduces CO₂ emissions by 100%
- Green methanol is a liquid carrier of hydrogen and the lowest-cost way to transport and distribute green hydrogen off-grid



Global Policies and Investments aim to significantly reduce the costs of green H2 and methanol

ADVENT OFFERS A BETTER OPTION "ANY FUEL - ANYWHERE."

ANY FUEL

HYDROGEN

Fuel for most heavy-duty mobility & industrial markets



METHANOL

- Option for off-grid & portable
- Interim low-cost option for mobility
 MARKET NOW

e-FUELS (H2 carriers)

- Low-cost hydrogen at minimal infrastructure cost
- e-Methanol, DME, LOHC
 MARKET IN NEAR FUTURE





Any Fuel. Anywhere.

Fuel Cells for Telecoms or Critical Power



Ideal for Telecoms, Critical Infrastructure

SereneU Systems with over 1000 deployed

- ✓ DC output from 40-58Vdc
- Liquid Methanol Fuel for easy transportation
- ✓ Monitoring & Control system
- ✓ Replacement for Diesel Generators

Advent Energy is a world leader in Fuel Cell Systems with over 1000 systems deployed

HA I WINSON COMPANY

SereneS-3 G4 48V. Suitable for up to 15kW peak per cabinet

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SereneCHP – Combined Heat & Power



Our current HT-PEM technology is unique in fuel cells which allows heat utilization and using our waste heat.

Adding some components like Heat Pumps and Heat Exchangers allow for excellent gains in efficiency

Examples using 1 SereneU unit:

✓ 3.5kw power and 3kw of heat
✓ 1.5kw of power and 8kw of heat
✓ 13kw of heat

SerenePP – Temporary Power



The serene Power Pack offers green power for temporary energy needs like concerts or constructions yards.

The power pack includes batteries and inverters for high peak power usage. The fuel cell converts the methanol fuel to electrical energy to recharge the batteries when needed. The solution supports internal tank (300kWh) or external tank (up to 18MWh) for long time operation.

✓ Easy deployable✓ Easy Fueling with methanol✓ Resilient

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SereneC – The CONTAINER 30kW-125kW



Idea of deployable power applications as main or back up power, such as construction sites, marine and other applications

Design includes:

- ✓ Methanol tank (up to 7,500L)
- ✓ Electrical systemand inverters
- ✓ Batteriesincluded
- Electrical power demand : variable depending on needs
- Intermittent power supply in (quasi-) stationary applications, ideally below 2.000 h/a
- ✓ Versatile design configurations

Advent Green HiPo

Markets: We are Expanding to Electrolyzers with IPCEI Support



Green HiPo

Innovative Production of HT-PEM Fuel Cells and Electrolyzers in Western Macedonia, Greece

- Advent's Green HiPo is a key IPCEI Hydrogen Technology Project
- IPCEIs aim to achieve economic growth, technological and energy autonomy in the EU
- Total funding of 782.1m €
- Duration **2022-2027** (with ability to recapture certain expenses back to January 2021)
- Under IPCEI Hy2Tech, Advent was one of only eight SMEs to have received ratification
- R&D and Production Facilities
- Direct and indirect cooperation with
 approximately **20 European entities**
- Electrolyzers: **1.5 GW** over 6 years
- Fuel Cells: 120MW over 6 years

Green HiPo Off-Takers



Advent's AEM Electrolyzer Technology



Advantages



No Platinum Unlike PEM electrolyzers, AEM does not require Pt that costs \$100s per kW



No Iridium Unlike PEM electrolyzers, AEM does not require Ir that costs \$100s per kW



Supply Chain Established: Rely on abundant non-precious materials



IP Advent's strong IP in electrodes & membranes & scale-up readiness



Manufacturing Designed for low cost of manufacturing, long lifetime



Thank you for listening

- **Multi-fuel approach** Methanol, Hydrogen (lower purity), Efuels and even Natural Gas with Reformer
- Proven in over 1000 applications using Methanol as a carrier of Hydrogen
- **Ion-Pair**® introduction next year to significantly improve the HT-PEM technology.
- Solves Customers urge for Green Power with improved logistics, low noise and service requirements
- Salt-Water Electrolyser MEA coming up

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www.advent.energy

J ADVENT

Thank you.