Hydrogen Energy Systems and a Practical Safety Approach

Bill Ireland – CEO
Logan Energy Limited
Who we are

• 1995: Logan Energy Corp. established in USA
• 2005: Logan Energy Ltd registered in UK as spin off from LEC
• 2008: SSE and Scottish Enterprise invested & become shareholders
• 2016: Dunelm Energy acquires SSE Shares
• 2017: \textit{n-tropy Group} is created \textit{due to supply chain constraints}
  – Logan Energy Ltd remains the group’s engineering consulting business
  – 4 wholly owned subsidiaries by industry segment or activity:
    • \textit{H2Tec Ltd} Hydrogen Energy Systems Manufacturing
    • \textit{EneTec Ltd} Hydrogen Equipment Distribution
    • \textit{FuelCellUK Ltd} Hydrogen Vehicle Systems
    • \textit{ProtonPower Ltd} Hydrogen Facility Operation and Maintenance
  – Manufacturing facility created in Wallyford, East Lothian, Scotland
• 2018: \textit{H2Tec BV} established in Groningen and Drente, Netherlands
What we do

• Scotland & Holland based Energy Solutions Provider
  – Cradle to Grave
• Integrated Energy Systems
  – Energy Storage
  – Hydrogen Production
  – Hydrogen Refuelling
  – Energy Centres
• Manufacturer-independent
• Product Development
• Governmental Policy Adviser
Logan Energy Group - Whole Package Design & Integration

- Design, Integration and Manufacture
- Non-competing strategic fit
- Project management and ongoing support
Key Projects

Fuel Cell CHP/CCHP
- TfL Palestra
- Quadrant 3
- 20 Fenchurch Street

Feasibility Studies
- HySeas I/II
- HySeas Energy System

Refuelling & Electrolyser Installations
- Levenmouth – Fife
- HyTIME – London
- SEAFUEL – Tenerife
- IZES – Saarbrucken
- Belfast bus refueller
- Gencomm – N Ireland

Hydrogen Trailer Maintenance
- Orkney
- Gencomm – N Ireland
Levenmouth Community Energy Project

An islanded network – Running since July 2016, fully operational April 2017

- Increase renewable generation to 910kW
- Increase microgrid network
- Hydrogen energy storage system
- Two hydrogen refuelling stations – PEM and Alkaline ELY
- Energy management system
- Fleet of 17 vehicles

The whole Hydrogen Energy Storage System and the 2 Refuelling Stations are there

All these buildings are powered by the Hydrogen Energy Storage System

Wind and Solar renewable energy is provided by a 750kW wind turbine and 160kW solar panels
Islanded Energy
Levenmouth Community Energy Project
Energy Storage System
Mobile concept
Vehicle and MCP refuelling
HyTIME: Economic *Islanded* HRS

Operational since **July 2018**
- HRS for Veolia operating 2 RCVs Westminster City Council
- 350 bar; >10kg/day
- Compact and Economic design
- Fully assembled and commissioned in factory
- Easy installation on site
IZES (Saarbrucken) - An *islanded* project

**Q3 2019**

- IZES (Saarbrucken, Germany)
  - SOLH2TRANSP
  - Solar $\rightarrow$ Hydrogen $\rightarrow$ Transport
- In production - 700 bar HRS
  - Passenger vehicle refuelling
- 35 kW solar PVs
Assessing Risk

• Defining the release cases

• Case 1: AREA 1: Electrolyser Leak: 30 - 35 bar hydrogen
• Case 2: AREA 2: 450 bar tubing and storage leak: 450 bar
• Case 3: AREA 2: 950 bar tubing and storage leak: 950 bar
• Case 4: AREA 2: Release from PSV: 1045 bar
• Case 5: AREA 2: Release from PSV: 495 bar
• Case 6: AREA 2: Release from manual vent: 950 bar
• Case 7: AREA 2: Release from dispenser: 700 bar
Determining the zones
SEAFUEL: Tenerife *Island* project

**Q4 2019**

- 350 bar HRS for local fleet of FCEVs
- Designed, built, commissioned in Scotland
- Installed and operated in Tenerife

- 51 MW installed renewable generation
- 125 m³/day desalination plant
- 5kg H₂/day 350 bar HRS
Unit design

Compressor, Storage & Dispensing
Electrolyser
Cooling & Water Processing
Controls
Interreg - GENCOMM

Investment Work Packages (WP.I)
- Bioenergy
- Hydrogen
- Power

Implementation Work Packages (WP.T)
- Hydrogen Value Chain (IOM)
- Hydrogen Value Chain (FDMM)
- Long Term Effects (WP.LTE)

Deliverables (WP.I)
- Pilot Plant: Western Isles, UK (Medium Scale, 225 kW)
- Methanation Pilot: Caen, FR (Lab Scale)
- CAPEX & OPEX
- Technology SWOT

Route 1: BIOH2CHP (WP.I1)
- BIO
- H2
- SNG
- Heating
- Methane

Sub-route: Methanation (WP.I1)
- Solar
- Hydrogen
- Transport

Route 2: SOLH2TRANS (WP.I2)
- Solar
- Hydrogen
- Storage

Route 3: WINDH2STO (WP.I3)
- Wind
- Hydrogen
- Storage

Deliverables (WP.I1)
- Pilot Plant: Saarbrieken, DE (Small Scale, 35 kW)
- CAPEX & OPEX
- Technology SWOT

Deliverables (WP.I2)
- Pilot Plant: County Antrim, NI (Large Scale, 500 kW)
- CAPEX & OPEX
- Technology SWOT

WPT1: Hydrogen Value Chain (Integrated Overall Model)
- Technical validation of the renewable hydrogen value chain and its technologies.
- Integrated overall model of community scale hydrogen based energy matrixes (IOM)

WPT2: Hydrogen Value Chain (Financial Model)
- Financial Decision Making Model (FDMM) to simulate the financial performance of a Hydrogen Value Chain.

WP.LTE: Long Term Effects
- Decision Support Tool (DST) encompassing the technical and financial models plus information to implement their results.
- CH2F (Community Forum) platform for stakeholders to adopt hydrogen technologies
GENCOMM Project – Viridian
An Ireland (!) project

- Viridian (County Antrim, NI)
  - WINDH2STO
  - Wind → Hydrogen → Storage
- Tender won to supply & maintain 3 hydrogen trailers
- 500 kWe windfarm electrolyser
GENCOMM Project – IZES
An *islanded* project

- IZES (Saarbrucken, Germany)
  - SOLH2TRANSP
  - Solar → Hydrogen → Transport
- In production - 700 bar HRS
  - Passenger vehicle refuelling
- 35 kW solar PVs
Experiences

- Reliable delivery
- Reliable equipment
- Diversity of suppliers
- Client - education
- Authorities – education
- Consistent standards

- Constantly delayed delivery
- Failures of “proven” equipment
- Sometimes only one!
- ITTs - unachievable/costly
- Default is NO
- Contradictory and limited or non-existent
H₂ Threats & Opportunities

- H₂ is NOT the only fruit!
- Siloed approach – Energy Summit
- Skills shortage – O&G pay scales
- Brain drain – 60% approached
- Capacity – ability to:
  - deliver Reliability
  - scale up: 10T/day ≡ 25MWe ELY 24/7
- Economic viability without statutory intervention
- Low targets – 400% renewables?

- Growth – economic development potential to grow massively
- Export potential – if we catch up (we’re already falling behind)
- Engineering excellence
  Developing standards/approaches
  System engineering advice
- Specialist products
- Specialist vehicle development
Thank you

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