New energy applications: challenges and opportunities

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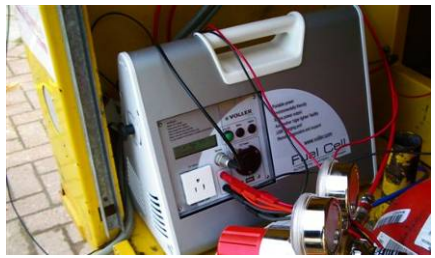
The new political reality : our current carbon based economy is unsustainable

- Climate change presents very serious global risks
  - the scientific evidence is now overwhelming and it demands an urgent global response
- A portfolio of technologies will be required to stabilise emissions
  - new technologies already exist but are currently uncompetitive compared to fossil fuel alternatives
- By 2050 a new market worth over $500+ billion per year will be created
  - driven by the commercial needs for low-carbon, high efficiency goods and services







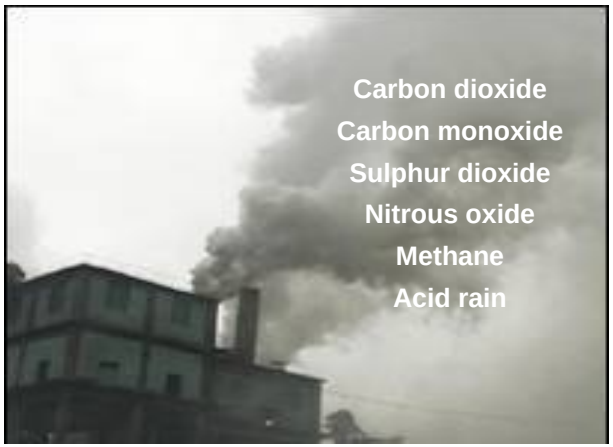
$500bn+ market by 2050

* Source : Stern Review : The Economics of Climate Change (HM Treasury 30 Oct 2006)

Low-carbon energy solution are needed to cover the technology gap

Today's 'high' carbon economy

- High emissions
- Low efficiency



Technology Gap

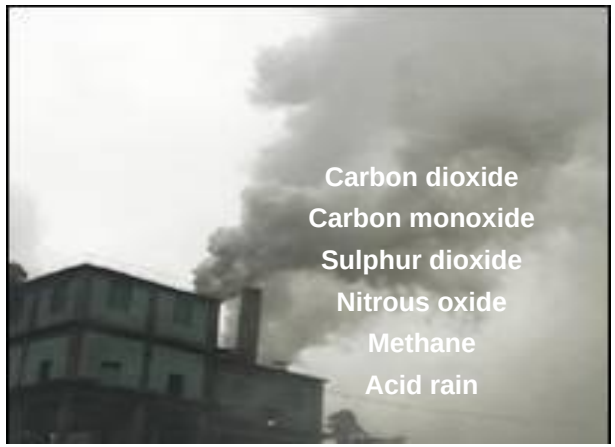
Future 'zero' carbon economy

- Zero emissions
- 100% efficiency

Low Carbon Energy Technologies already exist but…..

		Technical solutions		Issues
Centralised / Grid Power		Wind Solar arrays Hydro-electric Nuclear	Wave/Tidal Geo-thermal Biomass	• Continued problem of grid losses • Grid balance and stability • Cannot benefit from Heat output
Decentralised Micro generation (CHP – combined heat and power)		Wind Solar Biomass CHP Hydrogen Fuel Cell CHP		• Development of local 'heating' network to capture benefits of CHP heating needed • Development of hydrogen fuel infrastructure
Portable power generation		Wind Solar Hydrogen Fuel Cell CHP		• Reliability of supply from renewables • Development of hydrogen fuel infrastructure
Automotive		Electric Hybrid Hydrogen Fuel Cell		• Development of hydrogen fuel infrastructure

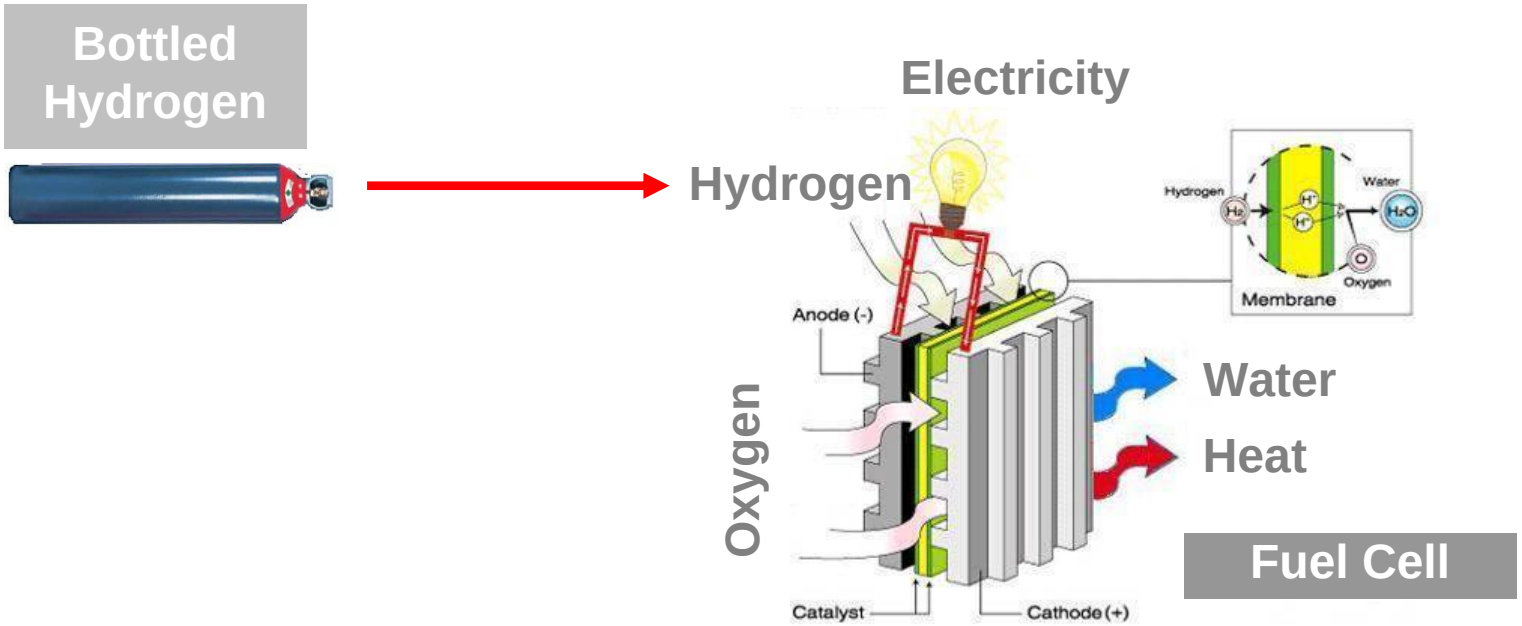
How can Fuel Cells contribute to the low-carbon economy ?



Technology Gap

LPG and fuel cell systems can be combined to provide a bridging technology

Hydrogen Fuel Cells : how they work

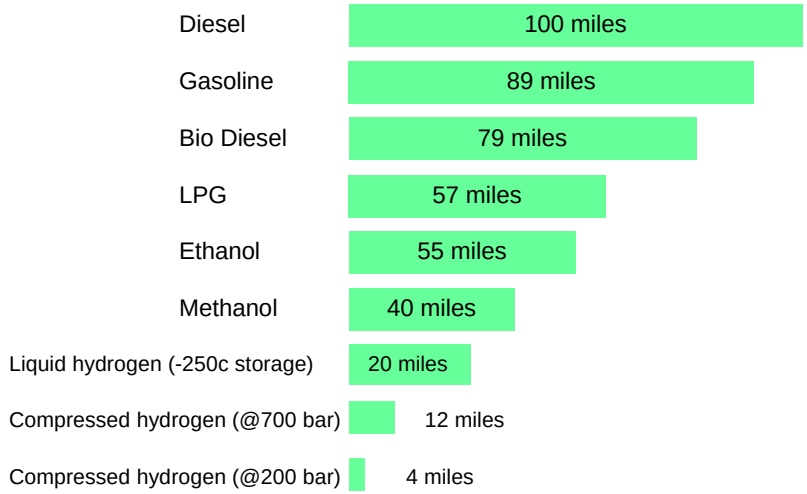


- Hydrogen and oxygen are fed into the fuel cell
- Hydrogen reacts with oxygen in the air over special membrane (PEM fuel cell)
- This electrochemical process produces electricity, heat and water

The “hydrogen economy” may be an answer but significant challenges remain

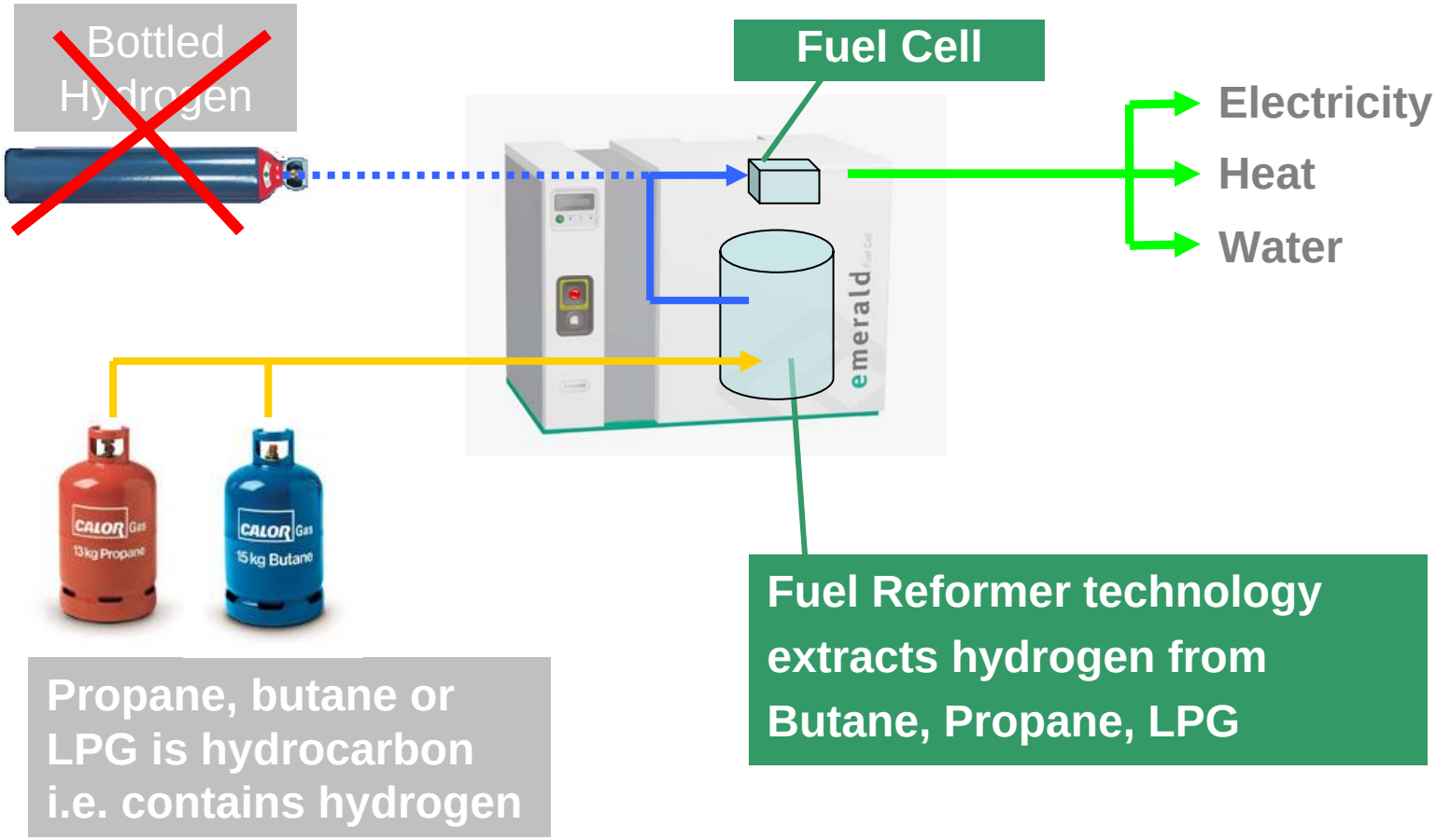
- Hydrogen has a lower fuel density than fossil fuels, this creates practical usage and storage problems
- Hydrogen takes 3,000x more space than gasoline containing an equivalent amount of energy at room temperature
- Cost and logistics of building an infrastructure remain an issue

For the same volume of fuel a cars range would be:



California Fuel Cell Partnership currently has a network of 25 hydrogen refilling stations - compared with an existing network of 10,000 gasoline stations

Voller Energy
Portable Fuel Cell Generator



Drivers for adoption
Conventional Generator v Fuel Cell Generator

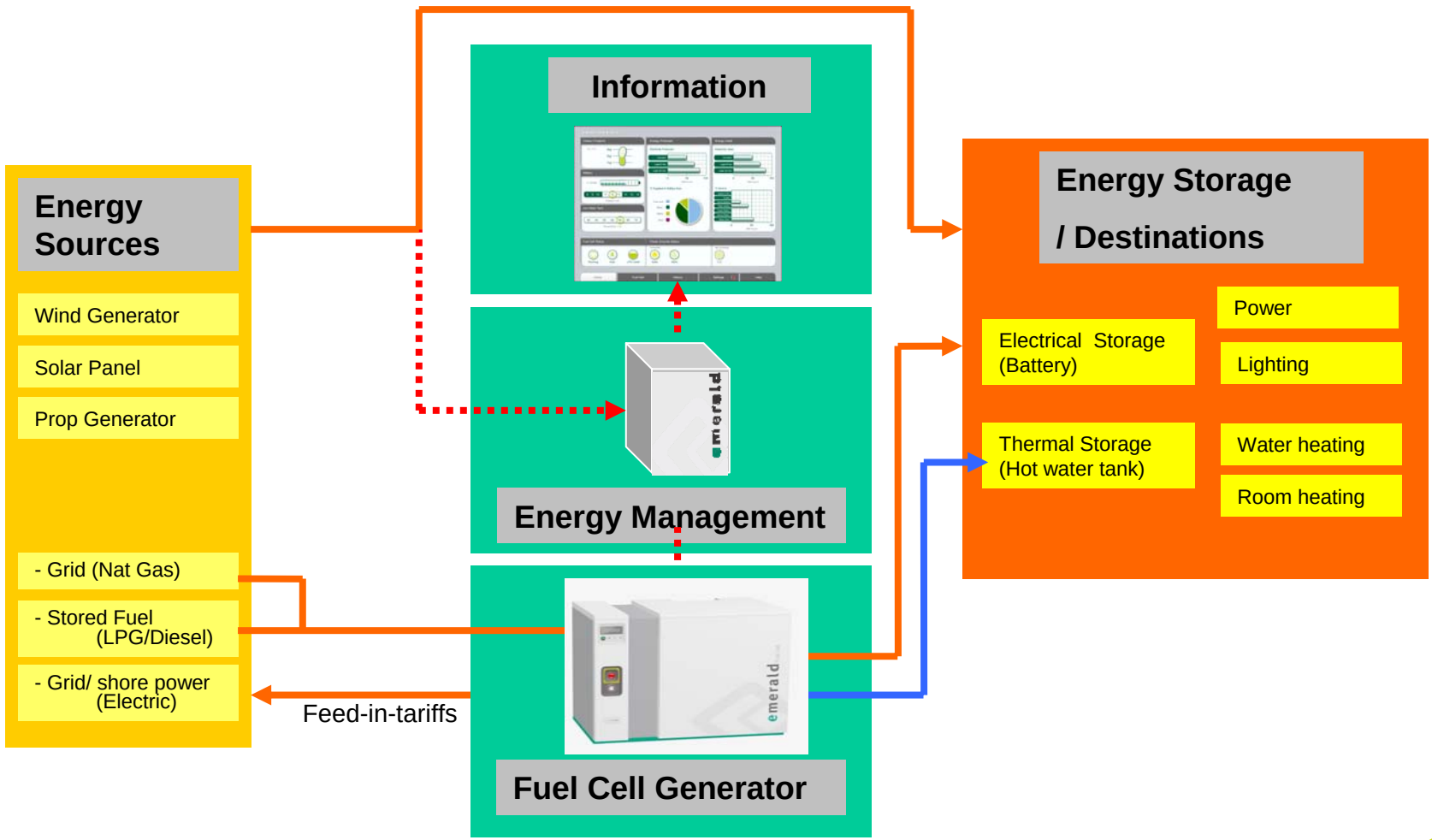
- Noisy
- High emissions, and smells
- Vibration
- High maintenance
- Mature technology
- 10 -20% electrical efficiency
- Low purchase cost – high maintenance and through life

- Quiet
- Low emissions
- Low vibration
- Low maintenance
- New technology
- 25-60% efficient (electrical & heat)
- Provides Combined Heat & Power
- Lower through-life costs – despite higher initial cost

Voller Emerald Fuel Cell Generator

- Portable fuel cell generator using widely available propane or LPG
- 12V/24V Automatic battery charger
- 800W electrical output
- 1000w thermal output
- Control panel (option to remotely position)
  - On/Off button, LED lights showing system status
  - Clear illuminated LCD display with rolling status indicator
- Emergency stop button
- Ethernet connection for monitoring and diagnostics
- Hot water and space heating capability
- Quiet, vibration free operation
- Robust construction and outer casing with removable lifting eyelets
- Simple installation using industry standard connections
- Dimensions W80cm H58cm D45cm
- Weight 120kg

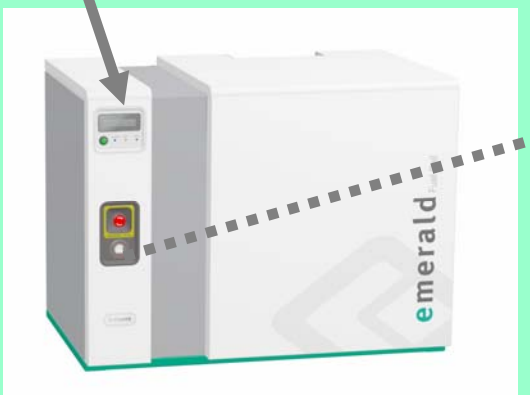
Voller Emerald energy hub



Voller Emerald user interface options

Core Product

LCD control panel – option to position on appliance or remotely via ethernet connector and cable



Enhanced Product (Optional Extra)

External processor devise for running enhanced GUI software and web browser

Remote access option – Marine sector

- Link into on-board navigation equipment using marine industry standard NMEA protocol
- Enhanced presentation level

Remote access option – other sectors

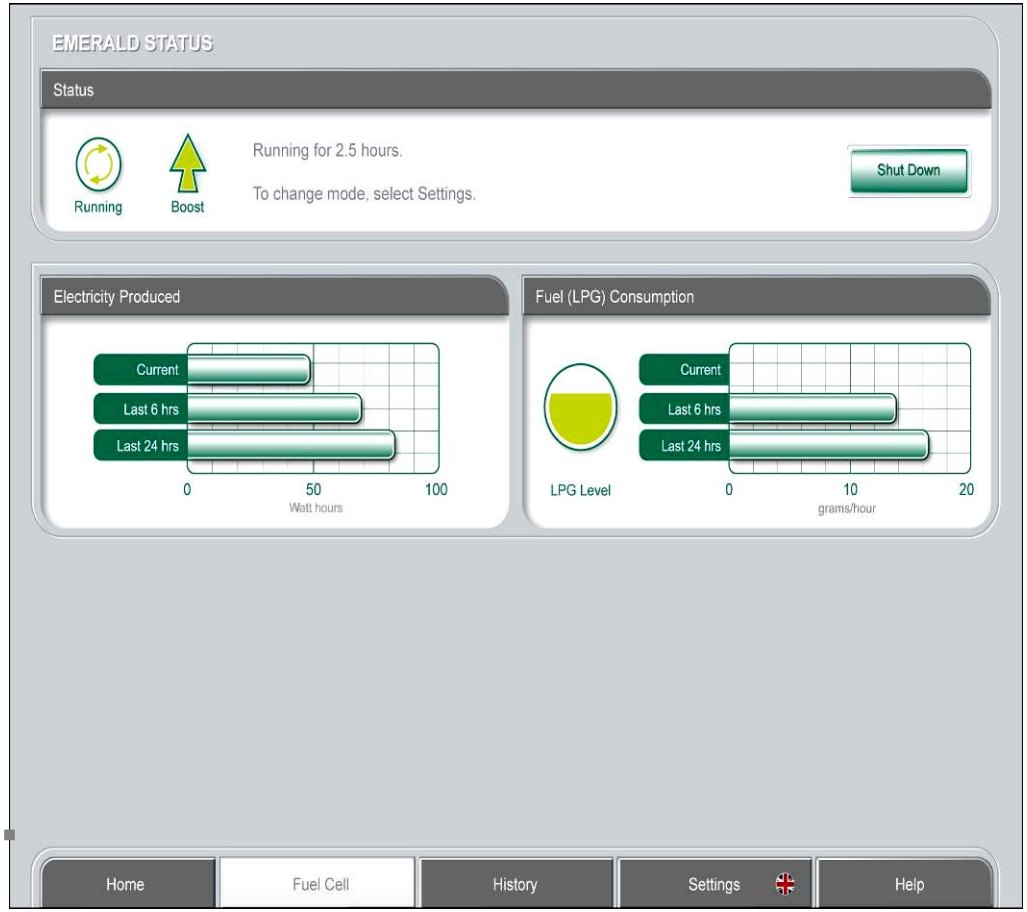
- Link into remotely situated PC's, PDA's and Mobile Devices using Web Browser
- Enhanced presentation level

Voller Emerald control panel

- Simple user interface on product
- Single button operation
- LED system status lights
- LCD screen display with rolling system status information
- Option for remote location via cable

Voller Emerald enhanced user interface

- Enhanced user interface and energy management via external Voller Emerald processor device (optional)
- Compatible with web browser and NMEA marine protocol



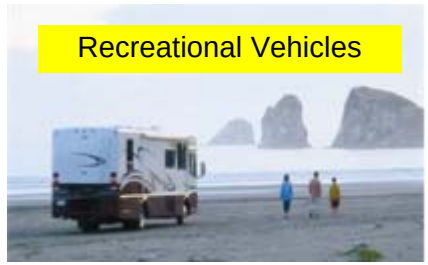
Voller Emerald
Energy Hub (energy management display)

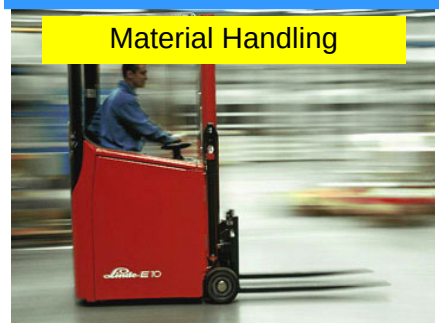
- Localised system set up/ configuration using ‘drag-and-drop’ menu
  - Language options
  - Energy sources
  - Energy destinations

Voller Emerald
Energy Hub (energy management display)

- Device monitors and displays all system energy sources and energy destinations
- Calculates and displays Carbon footprint

Portable Fuel Cell Applications





Construction Industry Cabins

Definition and key facts

- Construction site cabin for use as welfare cabins or offices
- Often leased or hired for duration of build
- Typically use 5.5 – 12 kW petrol or diesel genset to power lighting, water and space heating, cooking
- Typical genset usage patterns lead to low fuel efficiency levels and frequent maintenance needs
- LPG is sometimes used for cooking and space heating
- Diesel generators are disliked for environmental reasons (spillage) and fire risk.
- High through life costs due to maintenance and reliability issues

Value added proposition

- Low maintenance
- Improved air quality and less noise pollution
- Improved energy efficiency
- Supports onboard hot water and space heating needs
- Safe and environmentally friendly – avoids costly diesel spillage
- Combines with other renewable energy sources to provide intelligent power management

Remote Power & Heating

Definition and key facts

- Required to meet remote off grid (gas and/or mains electric) electrical power needs
- LPG widely used for cooking and heating
- Customers are looking for fuel independence
- Electricity produced typically using 4 – 10 kW petrol or diesel genset for lighting
- Petrol / diesel generators are disliked for environmental reasons (spillage) and fire risk.
- High in service costs due to maintenance and reliability issues

Value added proposition

- Low maintenance
- Improved air quality and less noise pollution
- Improved energy efficiency
- Safe and environmentally friendly
- Un-interupted power supply
- Combines with other renewable energy sources to provide intelligent power management