

Verso una piattaforma italiana per l'idrogeno e le celle a combustibile

**2° WORKSHOP TOSCANO SULL'IDROGENO e TECNOLOGIE COLLEGATE
OPPORTUNITA' e FINANZIAMENTI**

Firenze, 25 Luglio 2014





**A proven enabling technology for generating hydrogen for the
multi-billion dollar Hydrogen Energy Market**

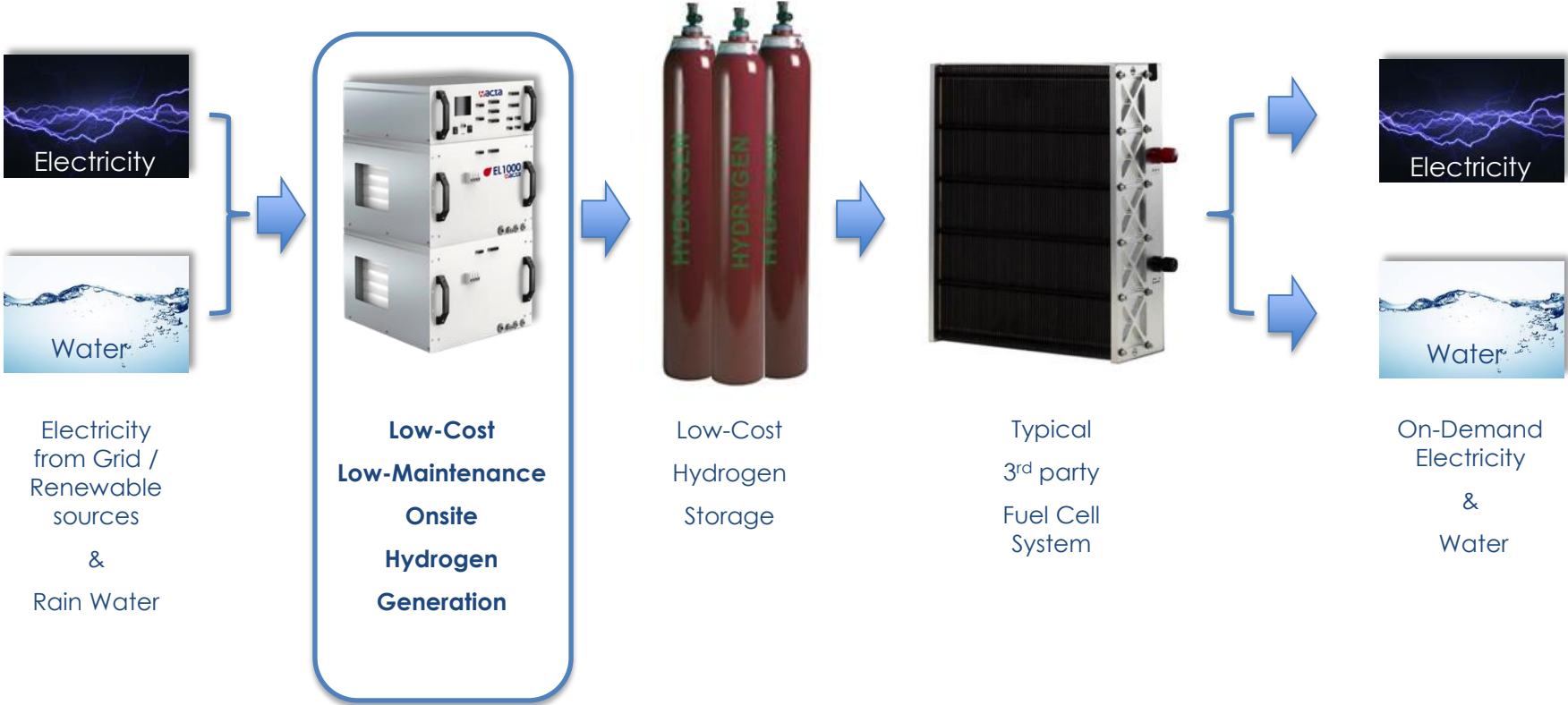
Company Presentation
July 2014



- Global cleantech products business
- Founded in 2004, listed on AIM in 2005, based near Pisa, Italy
- World-leading R&D, extensive IP portfolio
- Proven products, commercial sales
 - Electrolysers
 - Back-up power systems
- Enormous market opportunities
 - Telecom market
 - Renewable energy storage
 - Fuel cell car refueling
- Product adoption is accelerating



Acta is commercialising its proven enabling technology for low-cost, onsite hydrogen generation unlocking the multi-billion dollar hydrogen energy market



Industrial Hydrogen

Liquid Electrolyte Electrolyser



- ✓ Industry work-horse
- ✓ No exotic materials

- ✗ High maintenance
- ✗ No renewables
- ✗ No direct pressure
- ✗ Non fit for on-site H₂

Hydrogen for Energy

Solid Membrane Electrolysers



PEM

- ✓ Fit for renewables
- ✓ H₂ compressed >30 bar
- ✓ Low maintenance

- ✗ High cost
- ✗ Exotic materials
- ✗ Lab quality water



Innovative Acta AEM

- ✓ All benefits of PEM, plus:
- ✓ Low cost-no exotic materials
- ✓ Rain water – no extra equipment
- ✓ High electric efficiency
- ✗ New unique technology – time required for adoption

Acta has developed a Solid Alkaline Membrane electrolyser which provides the lowest cost solution to onsite hydrogen generation for energy



Electrolytic stacks

Core Expertise

- Unique patented invention
- World-leading Intellectual Property



Electrolysers

Technology Platform

- Generates hydrogen on-site
- Modular components



200W – 1.1kW



2kW – 5kW

Systems

The Hydrogen Battery™

- Self-recharging fuel cell
- Grid connected or renewable
- Remote management

Commercial validation through customers and partners

One Platform, Many Applications, \$Bn Markets



Back-up Power
Market Value \$2 Billion



Easy refueling for electric
vehicles
Market Value \$1.5 Billion



**Acta addresses multi-billion dollar
markets**



Renewable Energy Storage
Market Value \$10 Billion



Industrial Gas
Market Value \$5 Billion

- **Acta offers a unique fit-for-purpose solution**
- **Growing number of customers and partners**
- Self-recharging Fuel Cell system
- A lowest cost TCO solution
 - Cheaper than battery or diesel
 - Cheaper than hydrogen deliveries
- Powered by renewable or grid energy
- Robust, reliable, efficient
- Proven performance in the field
- Runs on tap water or rain water
- Smart solution vs traditional systems



200W – 1.1kW



2kW – 5kW

- ⇒ Acta's early adopter target market
- ⇒ Back-up power allows continuity of mobile phone service
 - ⇒ 1.2 million base stations worldwide, 100,000+ new p.a.
 - ⇒ 2.9 million Digital Mobile Radio terminals worldwide (including TETRA)
 - ⇒ Telco's spend \$ billions on batteries and diesel
- ⇒ Mains power network instability
 - ⇒ Ave. 6 hours / week black-out in developing countries (IFC)
 - ⇒ Increasing instability in US grid – outages up 124% since 1990's
- ⇒ Adoption of fuel cell back-up power systems is happening now
 - ⇒ Hurricane Sandy: Fuel cells mandated for telecom towers



Telecom Base Station
(mobile network coverage)

Global opportunities for Acta in conjunction with fuel cell systems

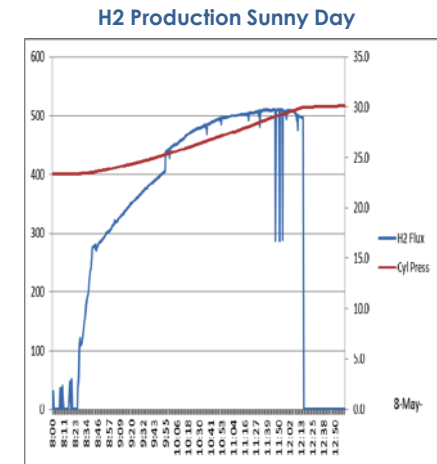
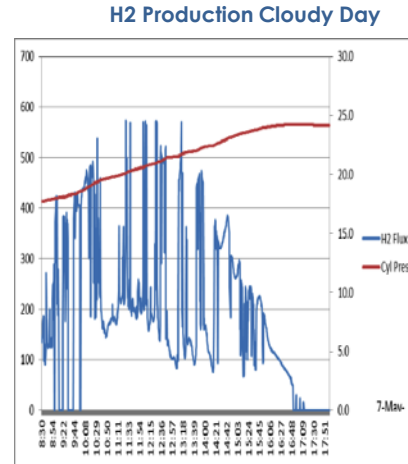
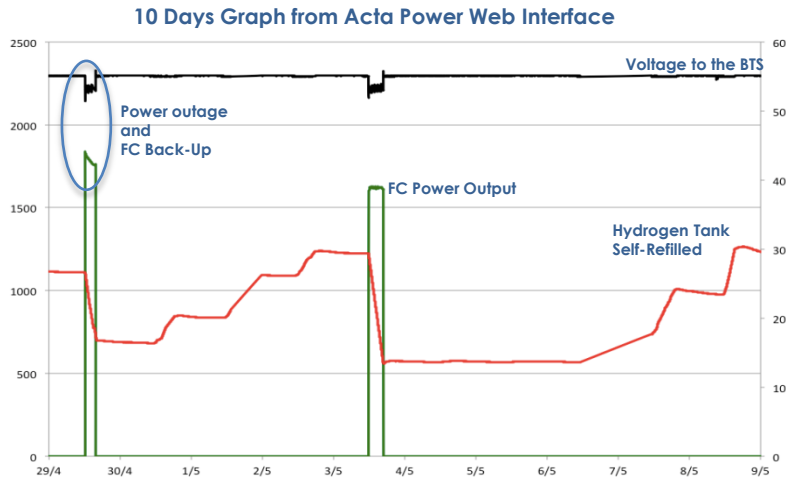
The Acta Power in Action



Acta has a proven enabling technology for the hydrogen energy market: the Acta Power self recharging FC

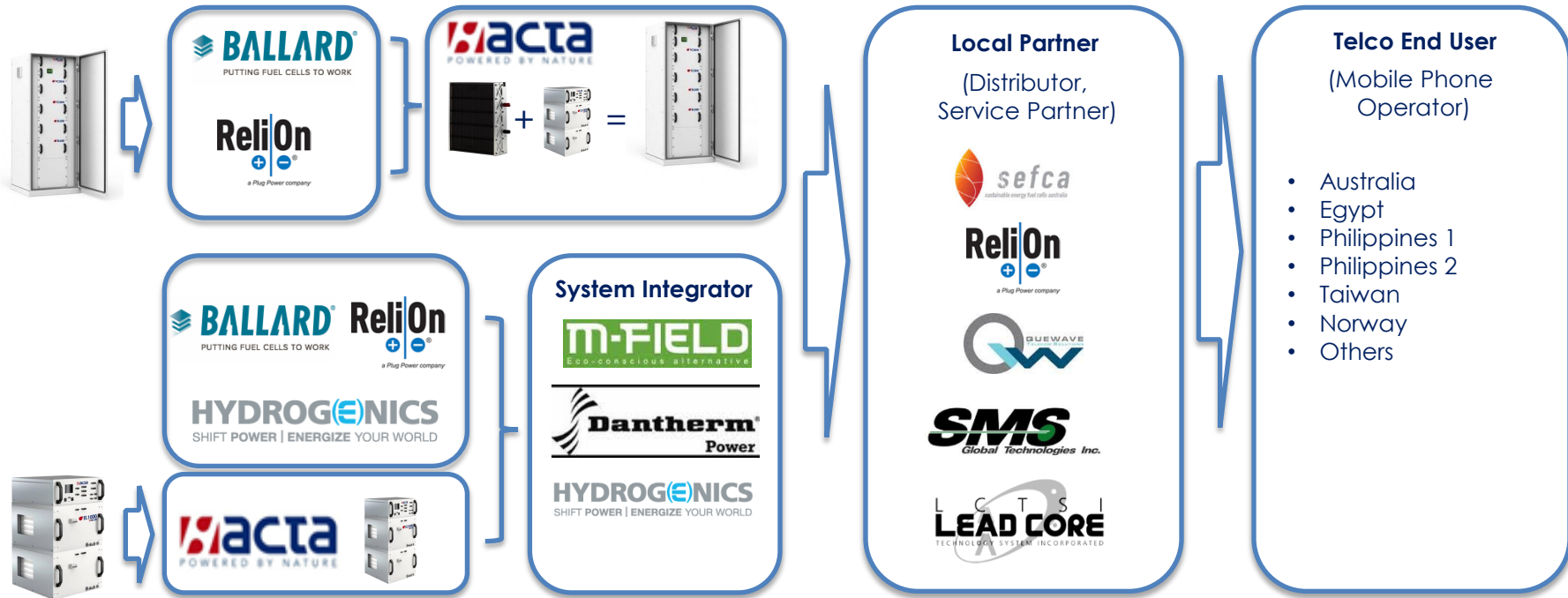
- Low cost, reliable, efficient
- Renewable, grid or intermittent power
- Designed for in-field installation

29 Apr- 9 May Operating data from in-field Acta Power



Cost-effective practical solutions for onsite hydrogen generation

Routes to Market (Back-Up Power)



Commercial partners (System Integrators, Fuel Cell Companies)

- ReliOn Inc (5,000 fuel cell stacks shipped to date)
- M-Field / SEFCA / Others (100+ products sold)
- Ballard Inc (150MW fuel cells shipped to date)
- Hydrogenics (2,000 hydrogen and fuel cell products shipped to date)

- Commercial launch of Hydrogen powered cars in 2015
 - Audi, BMW, Daimler, FIAT, Ford, GM, Honda, Hyundai, Mazda, Nissan, Renault, Suzuki, Toyota, Volvo, VW
 - Superiority over all battery powered cars
- Domestic fuel cell car refuelling system
 - Powered by renewables
 - Ideal for commercial / municipal fleets
- Commercial Partner; Taiwan scooter trial (APFCT)
 - 3,000 road-certified fuel cell scooters being produced
 - Mandated refuelling strategy: onsite hydrogen generation from renewables
 - Acta is strategic project partner
 - (8 units shipped to date / large scale roll-out expected in 2015-2016)



Honda fuel cell car
(Hannover April 2014)



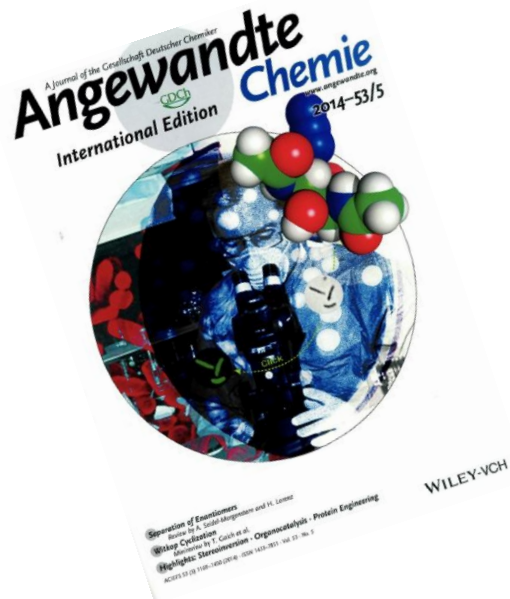
Acta refuelling fuel cell scooters
(Taiwan)



Installed production capacity for 2014 / 2015 volumes

- ◆ Hydrogen is the successor to fossil fuels
- ◆ Fuel cell adoption is accelerating as illustrated from US sector performance
- ◆ Low-cost, on-site hydrogen generation is the key to the hydrogen energy market
- ◆ Acta provides a lowest cost, proven enabling solution
- ◆ Growing number of repeat orders, increasing order values and new strategic partners
- ◆ Near and long-term multi billion dollar target markets
- ◆ Product adoption is accelerating

Acta – a hydrogen energy company



Angewandte
Communications

Hydrogen Production

Highly Efficient Platinum Group Metal Free Based Membrane-Electrode Assembly for Anion Exchange Membrane Water Electrolysis**

Claudio C. Pavel, Franco Cecconi, Chiara Emiliani, Serena Santiccioli, Adriana Scaffidi, Stefano Catanorchi, and Massimiliano Comotti*

Abstract: Low-temperature electricity-driven water splitting is an established technology for hydrogen production. However, the two main types, namely proton exchange membrane (PEM) and liquid alkaline electrolysis, have limitations. For instance, PEM electrolysis requires a high amount of costly

well as some limitations. Liquid alkaline electrolysis for instance, is a very robust technique and employs non-precious metal or oxides as electro-catalysts. However, it is not very suitable for intermittent power operation since its balance of plant is quite complex and difficult to manage under these conditions. For the other hand, PEM electrolysis would

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