



**Rolls-Royce**

# **European Energy Venture Fair**

## **Fuel Cells Business Plan Summary** **October, 2003**

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# Rolls-Royce Fuel Cell Systems Limited

## Rolls-Royce plc

- ✍ Ten years of fuel cell development
- ✍ Applied aero technology to resolving fuel cell cost issues
- ✍ Focused on Solid-Oxide Fuel Cells (SOFC) for stationary power generation
- ✍ \$100m contributed value (\$2003), in cash and technology injected, in-kind contributions and access to ongoing technology
- ✍ Seeking to maintain significant ongoing position in fuel cell technology

## Rolls-Royce Fuel Cell Systems Limited

- ✍ A start-up subsidiary
- ✍ 37 employees (Sept 2003)
- ✍ Owns all appropriate IPR, assets and know-how
- ✍ Located in Derby, UK
- ✍ Product demo in 2004-06
- ✍ Commercial product 2007
- ✍ Potential for billion dollar business (annual sales)

**Require partners for skill-set contribution and funding assistance**

# Fuel Cells Challenge – Cost, Cost and Cost

## Low cost fuel cell

- commercial ceramic
- patented design



CELL DESIGN



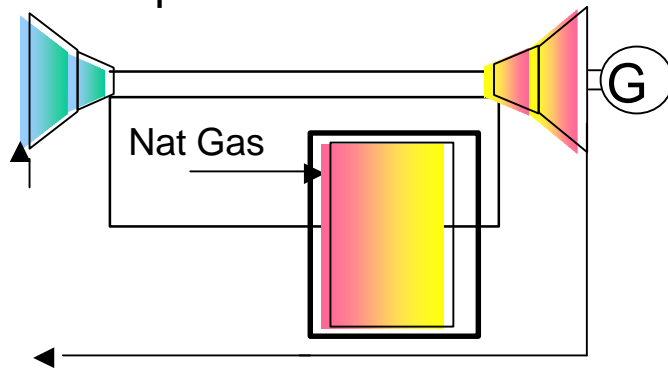
## Low cost manufacture

- screen-printing
- inexpensive
- scalable



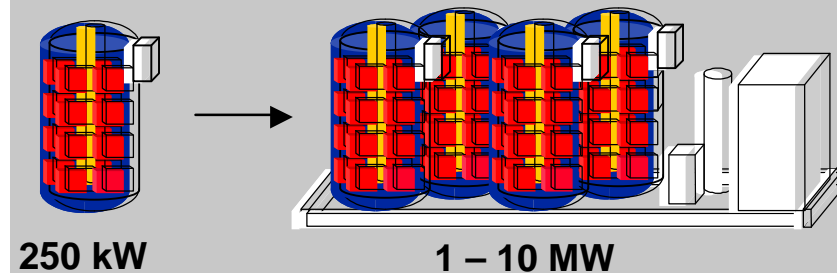
## Low Cost System

- aero know-how (turbocharged)
- less components



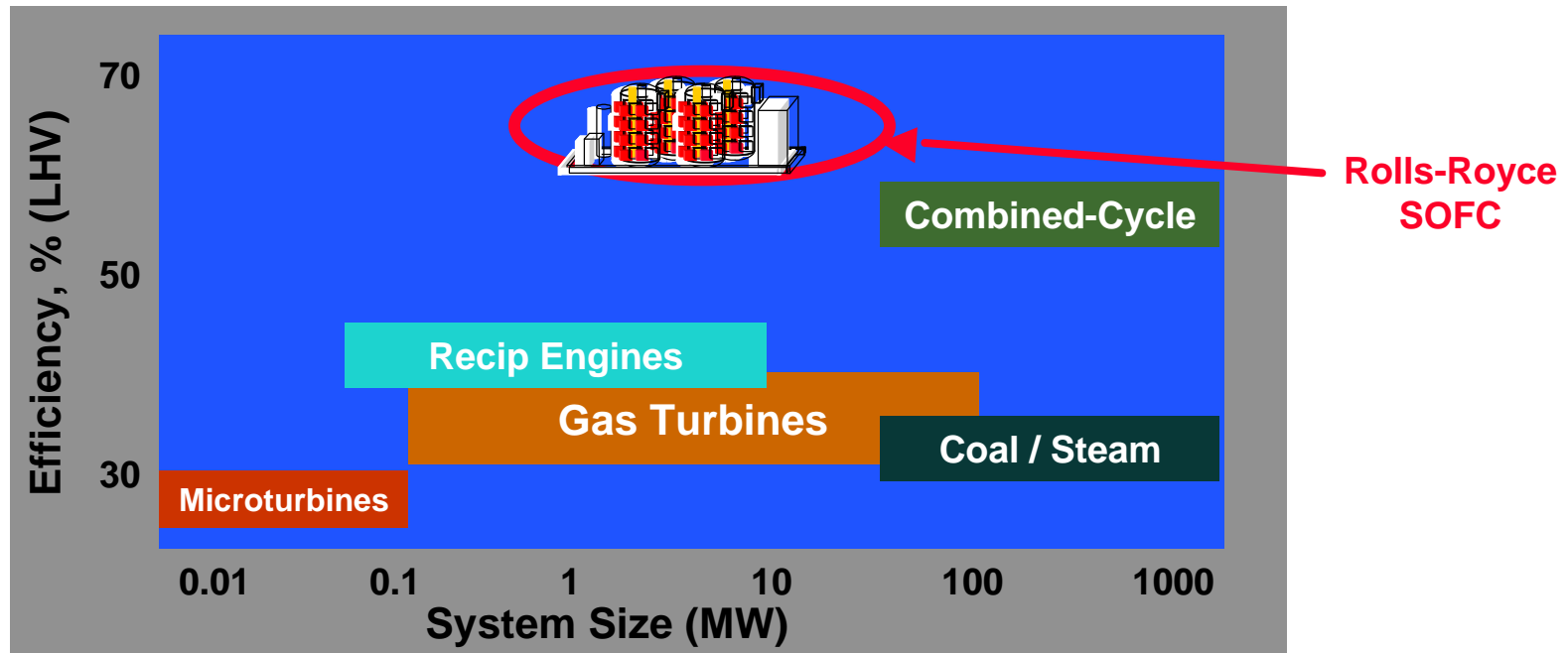
## Modularity and Practicality

- hydrocarbon fuels
- application options (250kW – 10MW)



# Rolls-Royce Fuel Cell System Advantages

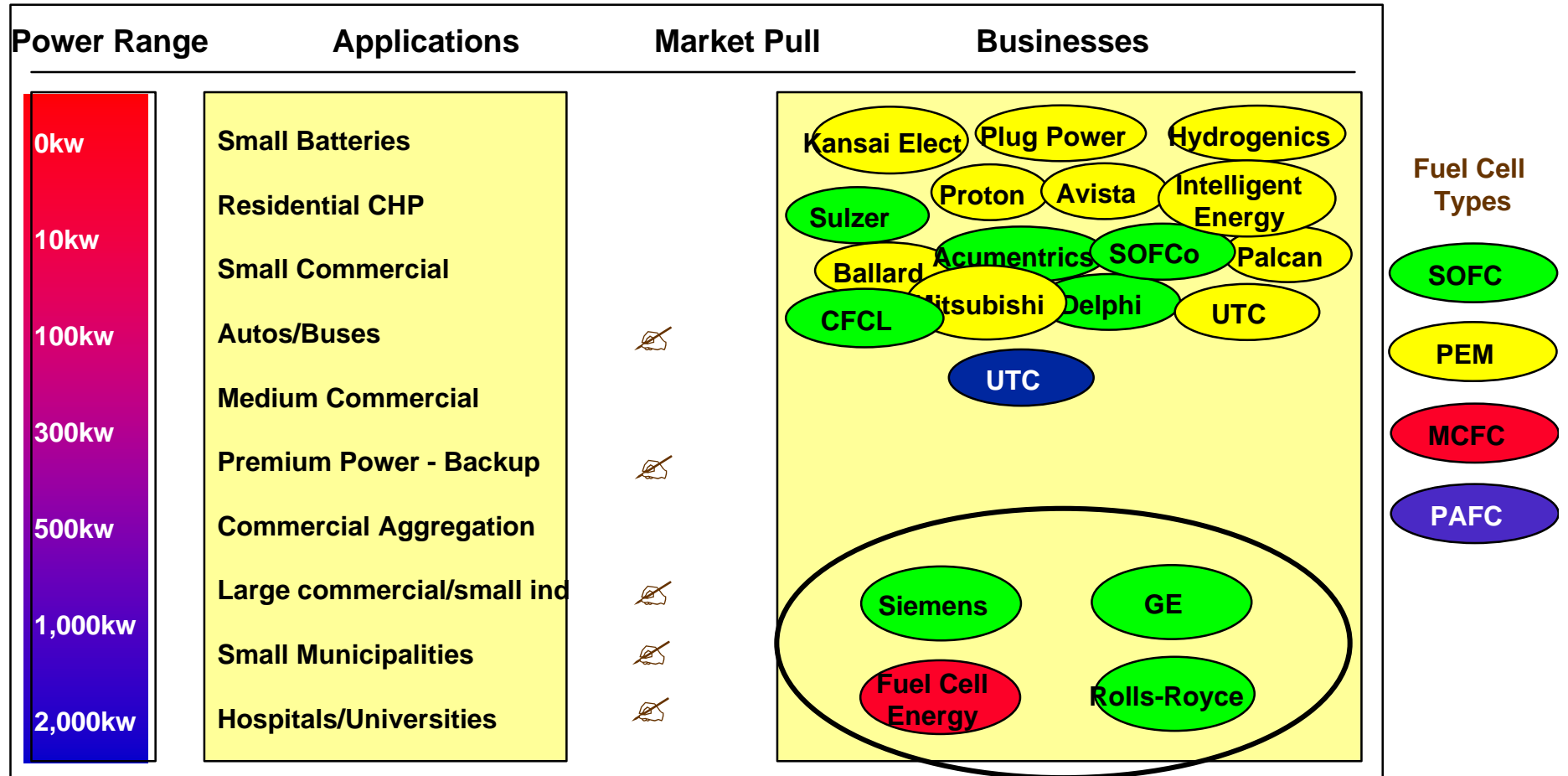
## Power Generation Application



- ✍ Clean and transportable
- ✍ Uses existing hydrocarbon fuel infrastructure
- ✍ Well protected by patents
- ✍ Wins on Cost and re-defines permits

**Precedent setting technology in the Power Generation Industry**

# Power Range Targets of Fuel Cell Businesses



**Few Competitors Emerging at High-end Applications**

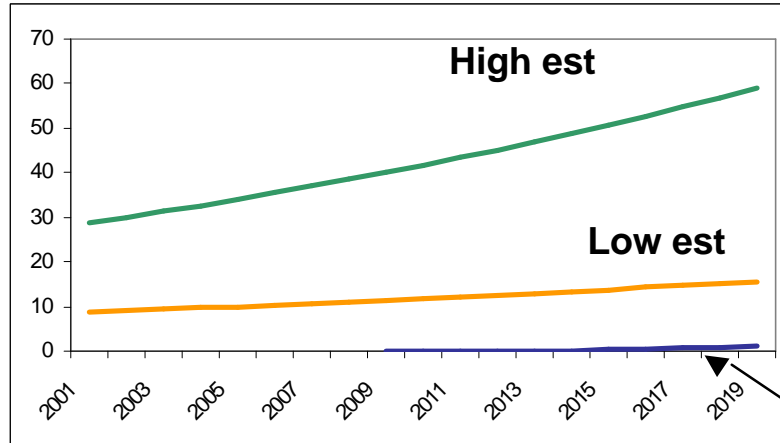
# Key Drivers for Global Distributed Generation Market Growth

- ✍ **Increasing demand for electricity, and particularly within urban areas**
- ✍ **Emissions regulations are tightening, and particularly within urban areas**
- ✍ **New high voltage transmission systems not economic and difficult to implement**
- ✍ **Electricity system security of supply is important**
- ✍ **Investors will be increasingly reluctant to commit to long investment time horizons**

**Current DG market is \$5 billion, dynamics offer opportunity of annual sales of over \$30 billion**

# Expected Global Market Penetration

GW / year

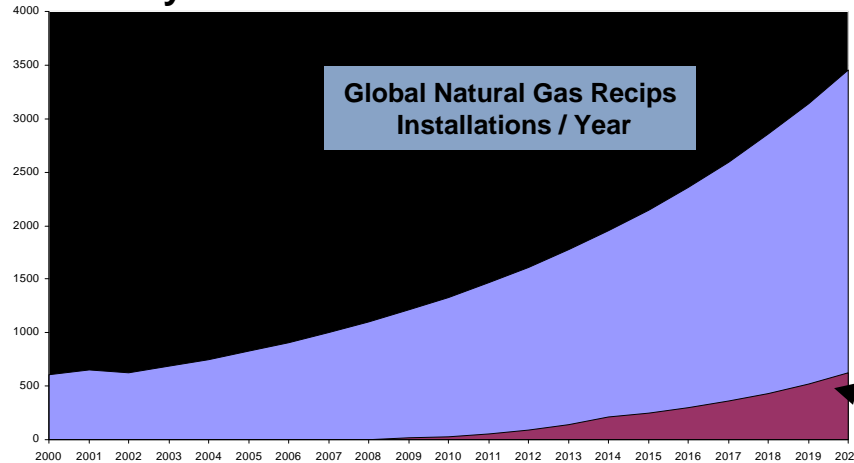


## Total MW's sold

- ✍ 3% North America market penetration of forecast US natural gas capacity additions through 2020
- ✍ <10% market penetration of global distributed generation additions at peak in 2020

RRFCS Bus Plan

# units / year






## Number of units sold

- ✍ Conservative growth rates through 2012, then disruptive effect brings high growth
- ✍ In 2020 total penetration of global 1MW nat gas recip engine market < 10%




RRFCS 1MW Units / Year

# Rolls-Royce Funding Program

## **Funds Needed (Tranche 1) - US\$50 million**

-  Sustains business over 24 months
-  Milestone - demonstration of technology and transparency of risk management program
-  Rolls-Royce plc, strategic partners and grants contributing \$40 million

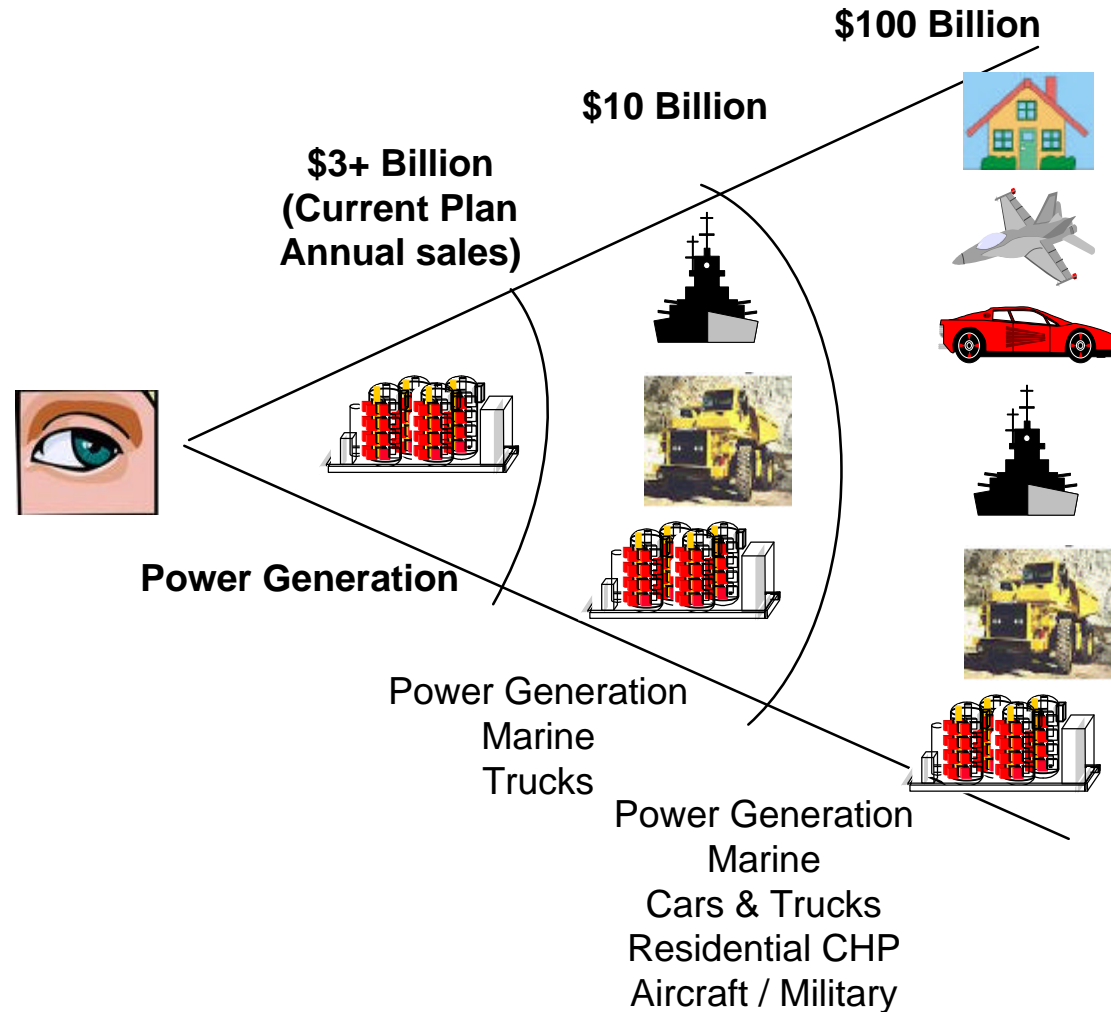
## **VC Funds Needed (Tranche 1) – US\$10 million**

-  IRR of 30%+ in core business case
-  Opportunity to go higher with application optionality
-  Rolls-Royce plc and partners willing to discuss control rights and liquidity options

## **Other funding routes should be opened in Tranche 2 as the business gets closer to commercialisation**

# Vision – Displacing the Heat Engine

Opportunity to participate in an industry with tremendous growth potential



**Early Entry Provides Potential for Enormous Upside**