INTERNATIONAL STATIONARY FUEL CELL DEMONSTRATION

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Clean, Reliable On-site Energy

SAFE HARBOR STATEMENT

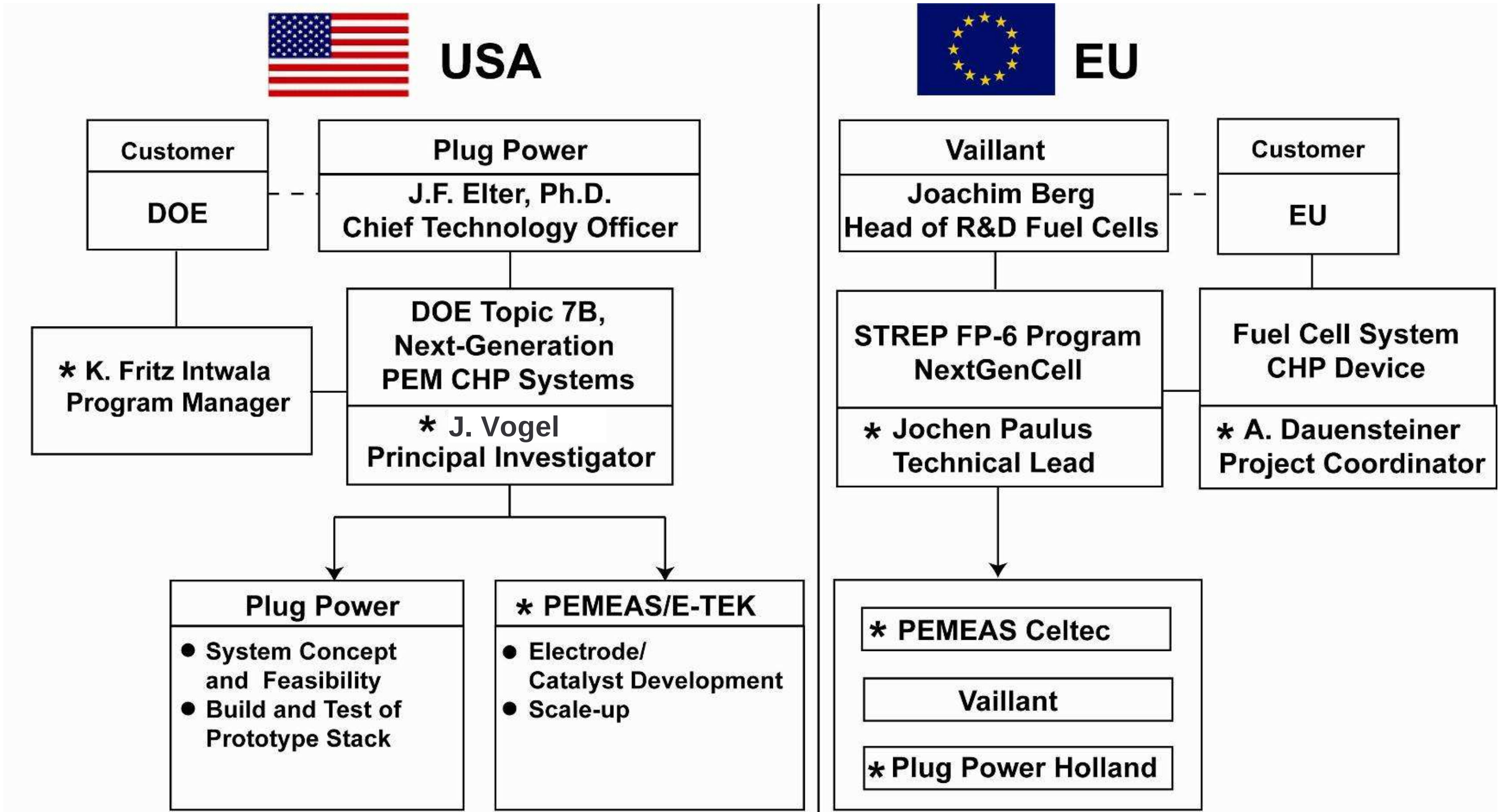
This presentation contains forward-looking statements, including statements regarding the company's future plans and expectations regarding the development and commercialization of fuel cell technology. All forward-looking statements are subject to risks, uncertainties and assumptions that could cause actual results to differ materially from those projected. The forward-looking statements speak only as of the date of this presentation. The company expressly disclaims any obligation or undertaking to release publicly any updates or revisions to any such statements to reflect any change in the company's expectations or any change in the events, conditions or circumstances on which such statement is based.

DOE TOPIC 7B/EU FP6 PROGRAM

- First of it's kind collaboration between the DOE and the EU
- Goal to develop "high-temperature" (PBI-based) fuel cell heating appliances for residential use worldwide
- Executed through a US/EU consortium:
  - Plug Power (US)/Plug Power (Netherlands)
  - PEMEAS E-TEK US/PEMEAS (Germany)
  - Vaillant (Germany)
  - Domel (Slovenia)
  - Bulgarian Academy of Sciences (Bulgaria)
  - Gaia (Sweden)
  - Imperial College (United Kingdom)

DOE TOPIC 7B/EU FP6 PROGRAM

ORGANIZATIONAL CHART



* Member of TransAtlantic Management Group

PROJECT OVERVIEW AND OBJECTIVES

Develop, test and validate a 5-kW PEM, stationary, reformate-based, CHP, fuel cell system as the first demonstration of a modular, scalable design for a worldwide market.

- Total system cost of < $750/kW in production volumes
- $\eta_{electric}$ = 35% (line of sight to 40%); $\eta_{overall}$ = 85%
- System life = 40,000 hours
- Modular and scalable system and CHP hydraulics concepts

PROGRAM BUDGET

FY	Total	DOE	Cost Share
2007	$3,192,000	$1,595,998	$1,596,002
2008	$3,385,226	$1,692,612	$1,692,614
2009	$524,247	$262,122	$262,125
Total	$7,101,473	$3,550,732	$3,550,741

DOE TECHNICAL BARRIERS

- The DOE technical barriers addressed in this program are:
  - Durability - 40,000 hour system life
  - Cost - < $750/kW system cost in production volumes
  - Performance - $\eta_{electric}$ = 35% (line of sight to 40%); $\eta_{overall}$ = 85%

DOE TECHNICAL TARGETS

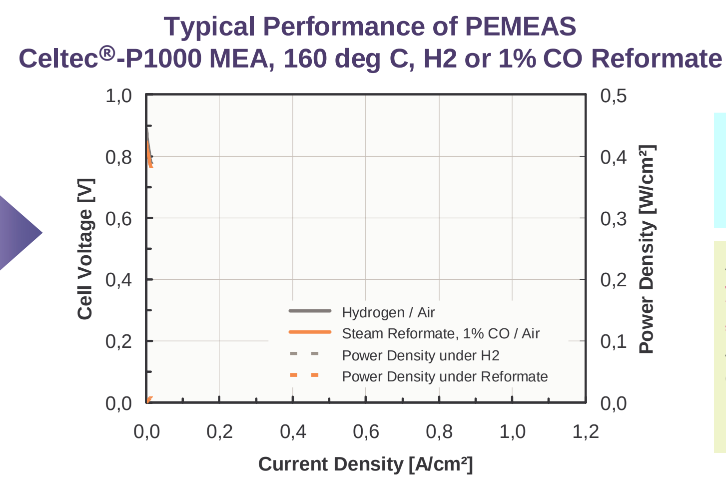
❖ The DOE 2011 technical targets for this program are:

• Electrical efficiency	40%
• CHP efficiency	80%
• Cost	$750/kW
• Durability	40,000 hrs
• Noise	< 55 dB @ 10m

PRE-AWARD ACCOMPLISHMENTS

- ❖ DOE DE-RP04-01AL67057: Development of a High-Temperature Fuel Cell Membrane Based on Polybenzimidazole

- ❖ DOE DE-FC04-02AL67606 to E-TEK Division, PEMEAS, “Integrated Manufacturing for Advanced MEAs” Complete 11/30/06



Acceptable performance even in 1% CO

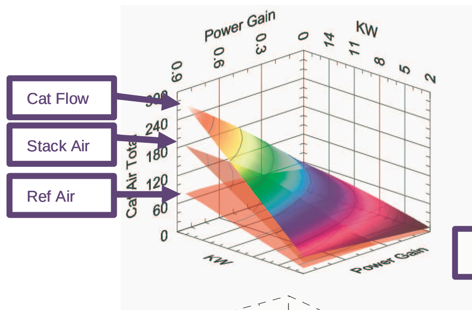
Active area: 50 cm²
Temperature: 160°C
Ambient pressure
Anode: lambda 1.2
Cathode: lambda 2.0
Reformate: 70% H2, 29% CO2, 1%CO

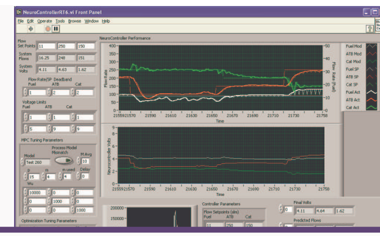
Develop the technologies to produce a commercial MEA.

PRE-AWARD ACCOMPLISHMENTS

❖ NIST ATP 00-00-5836: Low Cost Fuel Cell System Technologies Development – Complete 11/30/06

Air Delivery Controls





MIMO Model Predictive Neural Control

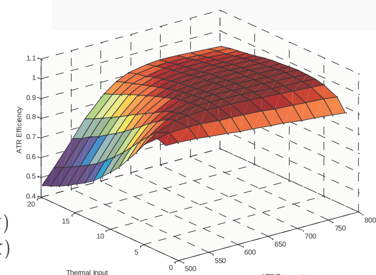
Cost of Energy Algorithms

$$RunningCost = f_{11} + f_{12} + f_{13}$$

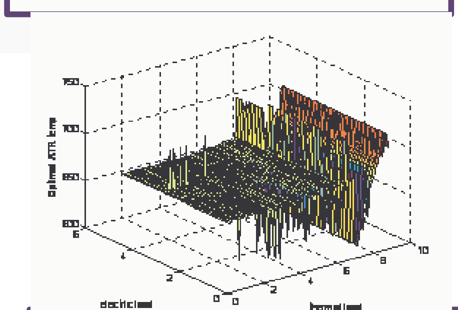
$$f_{11} = fuel\ price * fuel\ used$$

$$f_{12} = elec.\ price * f_E(kW) * Eff(ATR) * Eff(STK)$$

$$f_{13} = fuel\ price * f_H(kW) * Eff(ATR) * Eff(STK)$$



ATR Efficiency Function

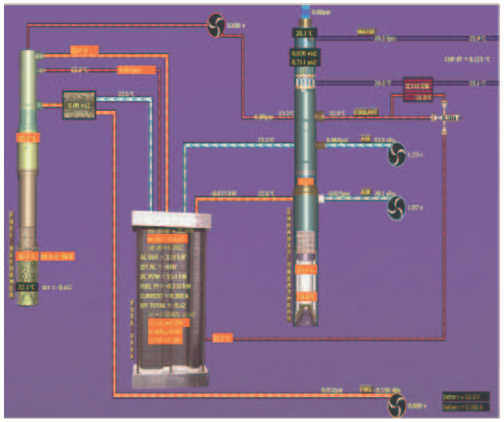


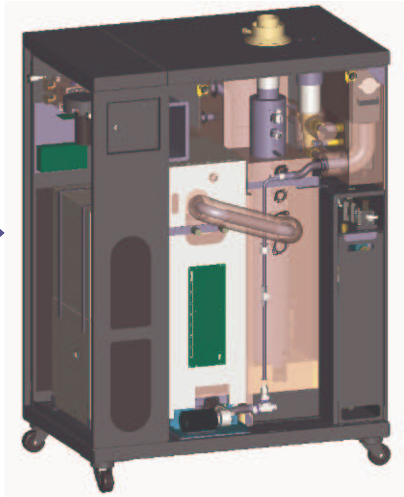
ATR Temp Set Point- Heat Following

Develop system control algorithms to improve cost of energy.

PRE-AWARD ACCOMPLISHMENTS

- ❖ New York State Energy Research and Development Association (NYSERDA) 7270: Development of High Temperature Combined Heat and Power PEM Fuel Cell Systems – Complete 12/15/06





Develop system concept through prototype design, build, test.

PRE-AWARD ACCOMPLISHMENTS

- Gas Diffusion Electrode Developmental Coater for Both Hi & Low Temperature MEAs

- High Temperature MEA Pilot Manufacturing Line- Frankfurt, DE

APPROACH

	DOE		EU		
	Plug Power US	PEMEAS E-TEK	Vaillant	Plug Power Holland	PEMEAS Germany
DOE Program Management (Lead)	■				
Task 1.0 Modular/Scalable Architecture	■				
Task 2.0 Catalyst Development		■			
Task 3.0 Cathode Development		■			
Task 4.0 Anode Pt. Reduction		■			
Task 5.0 Cathode/Anode Scale-up		■			
Task 6.0 Stack Development	■				
Task 7.0 Thermal Management Module	■				
Task 8.0 Inverter Design	■				
Task 9.0 Software and Controls	■				
Task 10.0 Fuel Cell System Integrated Design	■			■	
Task 11.0 System Build Verification	■				
Task 12.0 6 Month Demonstration	■		■	■	
European Program Management (Lead)			■		
Task 13.0 Membrane improvements					■
Task 14.0 Sulfur Tolerance				■	■
Task 15.0 Fuel Processing Design and Development				■	
Task 16.0 Gas and Air Delivery				■	
Task 17.0 European Inverter, Energy Manager, CHP Integration			■		

APPROACH

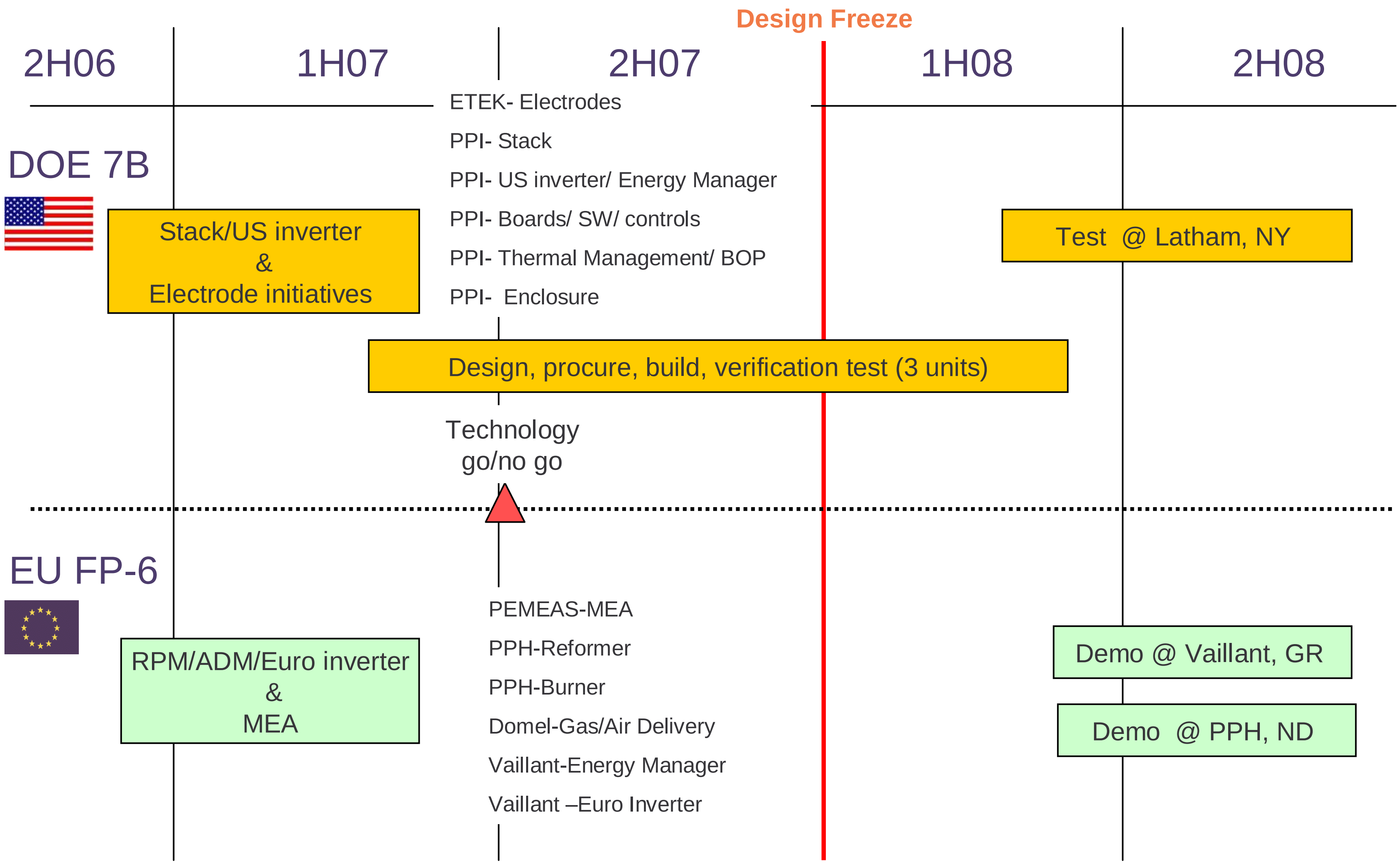
❖ System development and demonstration tasks; Plug Power:

- Modular/scalable system design
- Stack development
- Thermal management module
- Inverter design and grid connect
- Software and controls development
- Integrated system design
- Fuel cell system build, verification and test
- System demonstration

❖ MEA development tasks; PEMEAS E-TEK:

- Catalyst development
- Cathode development
- Anode Pt reduction
- Electrode scale-up

SCHEDULE


Design Freeze
2H06
1H07
2H07
1H08
2H08
DOE 7B
Stack/US inverter & Electrode initiatives
ETEK- Electrodes
PPI- Stack
PPI- US inverter/ Energy Manager
PPI- Boards/ SW/ controls
PPI- Thermal Management/ BOP
PPI- Enclosure
Test @ Latham, NY
Design, procure, build, verification test (3 units)
Technology go/no go
EU FP-6
RPM/ADM/Euro inverter & MEA
PEMEAS-MEA
PPH-Reformer
PPH-Burner
Domel-Gas/Air Delivery
Vaillant-Energy Manager
Vaillant –Euro Inverter
Demo @ Vaillant, GR
Demo @ PPH, ND

PRELIMINARY WORK ON CATALYSTS, ELECTRODES AND MEMBRANES

- E-TEK has explored and identified corrosion resistant carbon candidates from last DOE project DE-FC04-02AL67606.
- During the initial stage of this project the catalysts prepared on these supports showed much improved performance/durability, far exceeding conventional carbon. Scale-up needed
- Testing protocol established for carbon corrosion stability and catalyst stability under shutdown/cycling condition at PEMEAS Frankfurt.
- Preliminary work on exploring mechanical stronger and thermally more stable membrane showed promising results
- Proof of principle of anode with 30% less Pt than 1st generation
- Current roll-to-roll electrode coating technology expected to be easily adapted to future generation

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