APPENDIX F

FUEL CELL VEHICLE PROJECTS
SUPPORTED BY THE EUROPEAN COMMISSION

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THE CONTEXT

- A ten year fuel cell RTD & DEMO strategy for Europe (1995-2005)
- The Action Plan of the Task Force 'Car of Tomorrow' (1996)

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THE STRATEGY GOALS FOR TRANSPORT APPLICATIONS

- Qualitative: Cost reduction
- Quantitative: **2005 - Target is**
  System cost: 200 ECU/kW
  Lifetime up to 5 000 hrs
- Indicative Budget: 160 MECU in 10 years from European Commission (± 10 % of total European effort)

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STRATEGY - TECHNOLOGIES

1. Low cost, low temperature FC

RTD:
- development of advanced SPFC and DMFC systems
- development of fuel cell driven vehicles (buses)
- cheap manufacturing methods for SPFC (up to 100 kW, H_2 and air)

Demo:
- selected applications to show potential of the technology

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EU FUNDING THROUGH JOULE PROGRAMME

- **FP3: ± 5,3 MECU**
  1) Compact reformers (4 projects; ± 1,8 MECU)
  2) Integration of a reformer / fuel cell / electric motor (1 project; ± 1,1 MECU)
  3) Integration within a vehicle (1 project; ± 2,4 MECU)
- **FP4: ± 17,4 MECU (until mid 97)**
  1) Fuel cell stacks (2 projects; ± 6,3 MECU)
  2) Compact reformers (2 projects; ± 3,2 MECU)
  3) Integration within a vehicle (3 projects; ± 7,9 MECU)

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DEVELOPMENT OF FUEL CELL STACKS

(2 projects - FP4)

PROJECT	COORDINATOR	STARTING DATE DURATION	CHARACTERISTICS OF THE SYSTEM					OTHERS	EU FUNDING (MECU)
			RATED POWER (kW)	FUEL	OXIDANT	T° (°C)	COST (ECU/kW)		
Second generation SPFC	Siemens AG	1/01/1996 48 months	3,5	H_2 or purified reformate	air (< 1,5 bar)	60-70	100	emphasis on cost reduction (simplified construction of the cell)	3,5
DMFC: system development and stack construction	Siemens AG	1/01/1996 48 months	1	Me OH	air (< 1,5 bar)	+/- 80	depending on the final application	emphasis on the electrochemistry of the cell	2,8
								TOTAL: MECU	6,3

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COMPACT REFORMERS (6 projects in FP3 and FP4)

PROJECT	COORDINATOR	STARTING DATE/ DURATION	FUEL	REFORMING REACTION	CHARACTERISTICS OF THE SYSTEM		INTEGRATION WITH		VEHICLE MANU-FACTURER INVOLVED	EU FUNDING (MECU)
					RATED POWER (kW)	CO LEVEL TO FC	GCU	FC		
Hydrogen from methanol for fuel cells	Haldor Topsoe A/S (DK)	1/01/1993 28 months	Me OH	Steam reforming	15-20	-	NO	NO	NO	0,33
Electric battery car with small fuel cells	Fraunhofer Institute Solar Energy Dpt. (DE)	1/02/1993 24 months	CNG	-	20	-	YES	5 kW	NO	0,37
Methanol reformer for hydrogen production and SPFC feeding	Ansaldo Ricerche (IT)	1/02/1993 30 months	Me OH	Steam reforming	50	-	YES	NO	NO	0,47

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COMPACT REFORMERS (6 projects in FP3 and FP4) (continued)

PROJECT	COORDINATOR	STARTING DATE/ DURATION	FUEL	REFORMING REACTION	CHARACTERISTICS OF THE SYSTEM		INTEGRATION WITH		VEHICLE MANU-FACTURER INVOLVED	EU FUNDING (MECU)
					RATED POWER (kW)	CO LEVEL TO FC	GCU	FC		
Dynamic response of a methanol reformer for transport	Ansaldo Ricerche (IT)	1/01/1994 24 months	Me OH	Steam reforming	-	-	YES	NO	NO	0,6
Integrated methanol reformer and catalytic gas clean-up	Wellman CJB (UK)	1/01/1996 36 months	Me OH	Steam reforming	20	2	YES	NO	ROVER (UK)	1,98
Compact methanol reformer test design construction and operation	Haldor Topsoe A/S (DK)	1/01/1996 36 months	Me OH	Steam reforming	25	< 10	YES	1 kW	NO	1,24
								TOTAL:	MECU	4,99

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VEHICLE INTEGRATION (5 projects in FP3 and FP4)

PROJECT	COORDI-NATOR	STARTING DATE DURATION	FUEL	REFOR-MER	RATED POWER (kW)	FC	OTHER POWER SOURCES	VEHICLE	COST TARGET (ECU/kW)	VEHICLE MANU-FACTU-RERS	EU FUNDING (MECU)
Brass-board integration of a reformer / fuel cell / battery / electric motor	ECN (NL)	1/12/1992 36 months	Me OH	-	-	Purchased to Ballard	Battery	NO	-	NO	1,15
Fuel Cell powered EV (FEVER)	Renault (FR)	1/01/1994 47 months	LH_2	NO	+/- 32	De Nora (IT) (30 kW)	Battery DAUG Ni-Cd (1,8 kW)	Renault Laguna break	-	Renault (FR) Volvo (SE)	2,43
Second generation PEMFC fed with CH_2 (HYDROGEN)	PSA (FR)	1/01/1996 48 months	CH_2	NO	60	De Nora (IT) (30 kW)	Battery (30 kW)	Citroën Berlingo (small van 5 seats)	200 (stack only)	PSA (FR) Renault (FR)	3,49

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VEHICLE INTEGRATION (5 projects in FP3 and FP4) (continued)

PROJECT	COORDI-NATOR	STARTING DATE DURATION	FUEL	REFOR-MER	RATED POWER (kW)	FC	OTHER POWER SOURCES	VEHICLE	COST TARGET (ECU/kW)	VEHICLE MANU-FACTU-RERS	EU FUNDING (MECU)
Car autothermal process reactor initiative (CAPRI)	VW (DE)	1/01/1996 48 months	Me OH	Auto-thermal process reactor	50	- (15 kW)	Battery NiMH (35 kW)	Golf IV break	-	VW (DE) Volvo (SE)	2,16
Development of full size electric bus with second generation fuel cell stacks (FCBUS)	Ansaldo Ricerche (IT)	1/05/1996 36 months	CH_2	NO	+/- 70	De Nora (IT) (35 kW)	Battery (40 kW)	Neoplan Metro-liner city bus	300	Neoplan (DE)	2,27
									TOTAL:	MECU	11,5

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CONTENT OF FUTURE RTD & DEMO ACTIVITIES ON FCs

Review of the strategy

Current FCs RTD priorities to be maintained, with the possible following new elements:

TRANSPORT APPLICATIONS

- IT-SOFC for transport applications (?)
- Safety aspects of FC vehicles (?)
- Evaluation of fuel processing options and comparative assessment of the competing transportation fuels (?)
- Development of opportunities for SPFC bus fleet demonstration ?

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