EFFICIENCY AND ELECTRIFICATION FROM 1970'S TO 2020: THE JOURNEY CONTINUES

VOLVO CARS ELECTRIFICATION



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LONG TRADITION OF INNOVATIONS



1944	Laminated windscreen & Safety cage	2009	City Safety		
1954	Defroster vents for wind screen	2010	Pedestrian Detection with au	uto brake	
1959	3-point seat belt	2012	Worlds first Diesel Plug-in H	lybrid	6
1966	Crumple zones	2014	Roam Delivery		
1971	Reminder safety belts	2014	Animal Detection		7
1972	Rearward–facing child safety seat	2014	Inflatable child seat		2
1977	Lambda sond	2015	Run-off road protection	21.	
1978	Child safety booster cushion	2015	Connected Helmet		
1991	SIPS – Side Impact Protection System	2015	Excellence Child seat		
1997	ROPS – Rollover Protection Structure	2015	Auto brake at intersections	555	
1998	IC – Inflatable Curtain	2015	Slippery road Alert	Driver Alert Time for a break	
1998	WHIPS - Whiplash Protection System			0 D 22℃	6
2006	Collision warning with brake support				
2007	Driver Alert				R

ELECTRIFICATION WITH A HUMAN CENTRIC APPROACH



Safety is the starting point Technology should serve people Electrification should deliver no compromise performance Electric powertrains need to be adapted to suit peoples' lives Volvo Cars will Drive Electrification forward

ELECTRIFICATION WITH A HUMAN CENTRIC APPROACH





40 YEARS OF ELECTRIFICATION AT VOLVO CARS





WHY NOT THEN - WHY NOW ?

- 1970's
- Concerns about fuel price and limited availability of fuel. (Proved to be incorrect!)
- No market request for efficiency but awareness of emissions
- Lack of mature technology
- Knowledge gaps

2015

- Increased public awareness about global warming and energy resource limitations
- Market awareness of possible improved attributes
- Major steps in technology development (batteries, power electronics, machine control)
- Regulations on fuel economy and emissions



1976 VOLVO ELECTRIC CAR



Background

Fuel availability and price. (1970's oil crises)

Objective

Efficient transportation of passengers and goods.

Results

2 versions were built and tested in real traffic. City Taxi Mail delivery vehicle Project cancelled due to unmature technology



Technical data Volvo Ele	ctric Car 1976	
Vehicle Length	2,68	m
Weight	1200	kg
Top speed	70	km/h
Electric drive power	9,5	kW
Electric drive version 1	series wound	72 VDC
Electric drive version 2	Shunt motor with CVT transmission	60 VDC

THE HYBRID EVOLUTION

1990 ISG + DUAL VOLTAGE ARCHITECTURE





Problem

Limitations in power supply for future customer demands

Solutions explored

Dual Voltage system 24/12V and 48/12V. High power alternators ISG (Integrated starter alternators)



Result

Base for development in 12V power supply and mild hybrids Battery sensing, energy management, Power electronics Later used for stop/start investigations Knowledge built up within key technologies for hybridisation

1992 ENVIRONMENTAL CONCEPT CAR



Objective

Meeting the ZEV mandate with a safe, environmentally optimised and comfortable family car for the 21st century



Result

Advanced technology Plug In hybrid Design inspiration for first generation S80 First time electrification was connected to environment. Technical statement for communicating hybrids in faviour of BEV's due to electrified milage.

Inverter

90 kW Electric drive unit

High speed generator

1993-1996 SERIAL HYBRID HEV 98



Objective

Development set up for low volume manufacturing of a Plug-In serial hybrid. (Meeting the ZEV mandate)

Result

Fully integrated hybrid vehicle but at high cost3 cyl 1,5L APU w 38 kW generator90 kW electric drive unit w 2 speed transmissionFuel efficient despite the big weight increase





90 KW Drive system, 2 stage transmission

Under hood layout

1999 DESIREE - POWER SPLIT



S40 hybrid - Geneva Auto Show 1999



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Objective

Fuel economy major focus Study vehicle attributes and system implications of power split technology in VCC platforms.

Results

The S40/V40 Desiree vehicle - Ford Escape Hybrid

Technical summary Power Split Hybrid 1999					
Concept	Power split				
Added Weight	1513 kg (+183 kg added)				
Engine	3 cyl. petrol 56 kW				
Generator	25 kW PM Machine				
Electric motor	55 kW PM Machine				
Battery	NiMh 2,5 kWh, 55 kW,				
System Voltage	300V				
Performance	0-100 km/h in 13,5 sec.				
Fuel efficiency	-44%/-40% in NEDC				
	(5,2 L/100 km measured)				

1998-2001 42V SOFT HYBRID VEHICLE



ISG Soft Hybrid

ISG (Integrated Starter Generator) 42V/12V Dual Voltage System





Results

Fuel consumption reduction: -11% on Auto, -15% on Manual versus base vehicle Demonstrated for 150 Journalists Seville, Spain 2001. First time technology mature enough for production but with high cost

PLUG-IN RESEARCH STUDIES





Objective

Plug-In technology research Study customer acceptance and driving behaviour



Results

C30 Re-Charge - Range extender serial hybrid. City commuting 0-100 km/h in 9 seconds

<u>V70 PHEV – Parallel Hybrid test fleet</u>. Feedback from driving under real conditions Input for development programs

2010: C30 ELECTRIC - CUSTOMER LEASING





2012: V60 TWIN ENGINE AWD







CUSTOMER INSIGHTS

The customers really appreciate Electrification

- Low Speed refinement
- Initial response
- Sound of silence



OLV

ELECTRIFICATION MUST MEET PEOPLES' NEEDS



JOLVO

TWIN ENGINE TECHNICAL PRINCIPLE





TWIN ENGINE TECHNICAL PRINCIPLE



3 CARS IN ONE



SCALABLE PRODUCT ARCHITECTURE





TWIN ENGINE AWD POWERTRAIN ON SPA



OLV

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NEW COMPACT MODULAR ARCHITECTURE (CMA)





NEW TWIN ENGINE POWERTRAIN ON CMA





100% VOLVO ARCHITECTURES



All with electrification built in from the start



THE FUTURE - DRIVING EXPERIENCE

MLB 090

TWIN ENGINE - DELIVERING BENEFITS TODAY



JOLVO



CUSTOMER ACCEPTANCE & CUSTOMER DESIRE



JOLVO



PURE ELECTRIC VOLVO









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