



Good Reasons for Trolley Buses

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Motive Power&Components

Vossloh Group

Rail Infrastructure



- Switch Systems
- Fastening Systems

Motive Power



- Locomotives
- Transportation Systems
- Electrical Systems (Kiepe)

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Vossloh Kiepe : Supplier of electrical systems

- Integrator-

We take responsibility for
the complete electrical system

Electrical Systems

- ▶ Electrical Systems for Rail Vehicles
- ▶ Electrical Systems for Trolley buses
- ▶ Electrical Systems for Hybrid buses
- ▶ Modernization of vehicles
- ▶ Turnkey Projects



12m trolley



18m trolley



24m trolley



Hybrid trolley



Automatic
guided trolley

Engineering
Vehicle control
Traction Inverter
Static Converter
Data management
Energy storages
HVAC
Poles, current collector
Traction motors
Gearboxes
Diesel-Generator set
Video surveillance
Passenger Information Systems
Cabling
Installation
Commisioning

Integration

References

Trolley busses in AC Technology



Salzburg	AT	49	1990 - 1996	MAN/ ÖAF
Innsbruck	AT	10	1992	MAN/ ÖAF
Eberswalde	DE	15	1993 - 1994	MAN/ ÖAF
Budapest	HU	1	1993 - 1995	IKARUS
Arnheim	NL	1	1994	VAN HOOL
Mürztal	DE	1	1996	MAN/ ÖAF
Montreux	CH	18	1995	VAN HOOL
Quito I	EC	54	1995 - 1996	MB/ HISPANO
Bologna I	IT	20	1996	MAN/ AUTODROMO
Parma	IT	8	1997	MAN/ AUTODROMO
Bern I	CH	8	1997 - 1998	NAW/ HESS
Biel	CH	10	1997	NAW/ HESS
Arnheim	NL	8	1997	VAN HOOL
Milan	IT	8	1998	MAN/ AUTODROMO
Lyon	FR	7	1999	MAN/ HESS
Modena	IT	10	1999	MAN/ AUTODROMO
Athens	GR	112	1999 - 2000	ELBO/ NEOPLAN
Bologna II	IT	15	1999	MAN/ AUTODROMO
Bern II	CH	12	1999	NAW/ HESS
Quito II	EC	59	1999	MB/ HISPANO
Linz	AU	19	1999	VOLVO
Salzburg	AU	30	2000	VAN HOOL
Budapest	HU	15	2000	IKARUS
Parma	IT	6	2000	MAN/ AUTODROMO
Esslingen	DE	9	2001 - 2002	VAN HOOL
Riga	LT	10	2001	BELKOMMUNMASH
Merida	VE	45	2001 - 2002	MB/ HISPANO



Trolley busses in AC Technology



Solingen	DE	20	2001 - 2002	VAN HOOL
Lausanne	CH	27	2001 - 2002	NEOPLAN
Budapest	HU	15	2002 - 2003	IKARUS
Fribourg	CH	9	2003	MAN/Hess
Bergen	NO	6	2003	NEOMAN
Athens	GR	142	2003 - 2004	ELBO / NEOPLAN
Luzern	C	8+2	2004	HESS
Vancouver	CA	228	2005 - 2007	NewFlyer
Geneva	CH	38+10	2005 - 2006	HESS
Genoa	IT	17	2006 - 2007	VAN HOOL
Zurich	CH	16+17	2006 - 2007	HESS
Lecce	IT	12	2006 - 2007	VAN HOOL
Lucerne	CH	3	2007	HESS
Modena	IT	3+4	2007	NEOMAN
Philadelphia	US	38	2007 - 2008	NewFlyer
Biel	CH	10	2007 - 2008	HESS
Pescara	IT	6	2008 - 2009	APTS
Solingen	DE	15	2008	HESS
Avelino	IT	11	2009 - 2010	VAN HOOL
St. Gallen	CH	17+7	2009 - 2010	HESS
Rimini	IT	5	2009	VAN HOOL
Milano	IT	15	2009	VAN HOOL
Vancouver	CA	34	2009	NewFlyer
Lucerne	CH	17	2008 - 2010	HESS
Lausanne	CH	31	2009 - 2010	HESS
Neuchatell	CH	24	2010 - 2011	HESS



1367 Trolleybuses in AC Technology
Approx. 350 000 000 km Experience achieved end of 2007

Trolleys : Advantages

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Trolleys have developed

Vancouver/CA 1948-2007



Arnhem/NL 1998



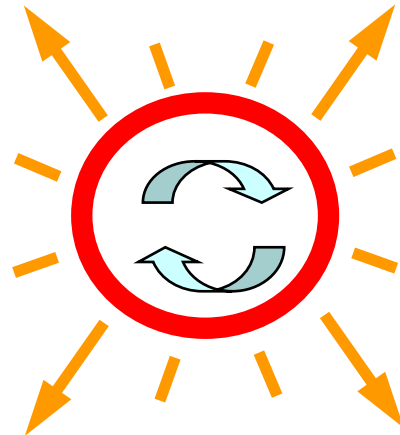
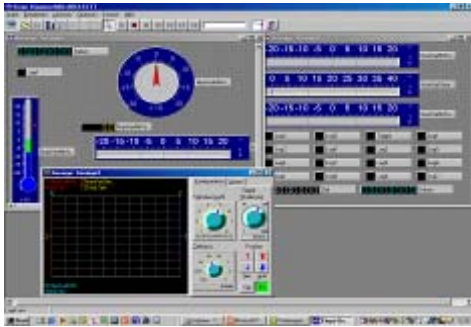
Pescara/I 2008



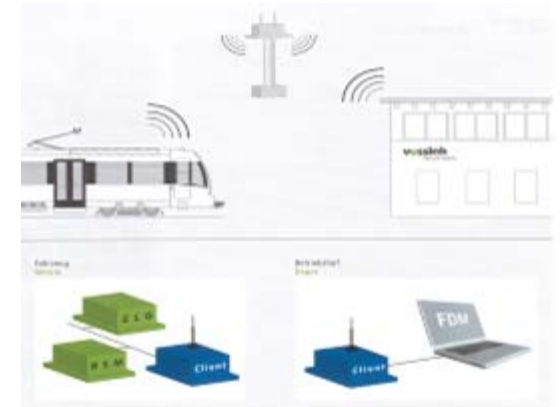
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Equipment development...integration, efficiency, cost

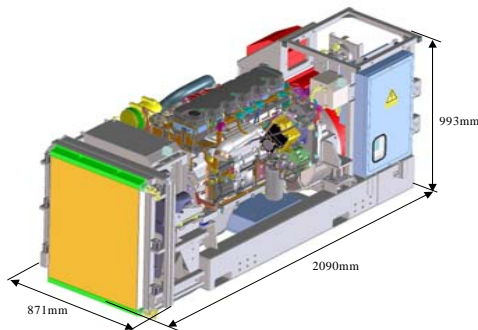
CanOpen Data Bus and Diagnostic systems



Now for trolleys!
Vehicle Data Management FDM



Diesel-Genset in Euro V



Intelligent Pole Systems



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Column of transportation
e.g. Olympic games

Beijing/CH 160 veh.
Summer Games 2008



Athens/GR 142 veh.
Summer Games 2004



Vancouver/CA 228 veh.
Winter Games 2010



Functional Advantages

- Gradeability** → Better dynamical behavior than any diesel bus, better than any LRV/TRAM
- Altitude** → No loss in power, Diesel buses: increase in emissions and loss of power above 400m sea level
- Efficiency** → Recuperation of brake energy
Start-up:
Trolley needs little power-
Diesel needs much power.

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Embedded in the neighborhood

Gent/BE

No visual pollution

No functional handicap

Vancouver/CA



Environmental Advantages

No emission in cities

Lower noise level than diesel busses and LRV

Note:

In addition Diesel buses depend on fuel quality and altitude

Example Quito:

Replacement of 572 Diesel buses with 113 Trolleybuses

Less contamination with:

	<u>per Day</u>	<u>per Year</u>
CO Carbonmonoxide	5396 Kg	1942 T
HC Hydrocarbon	1164 Kg	419 T
NOx Nitrogenoxide	10052 Kg	3618 T
Particles	317 Kg	114 T

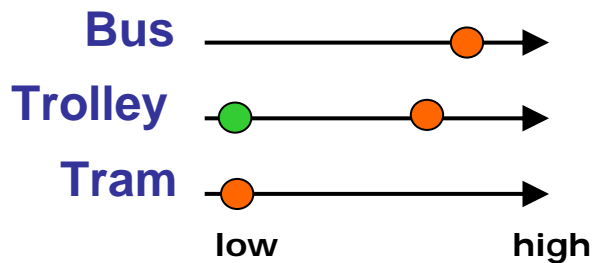
And a reduction in local noise pollution from 90dBA to 74dBA

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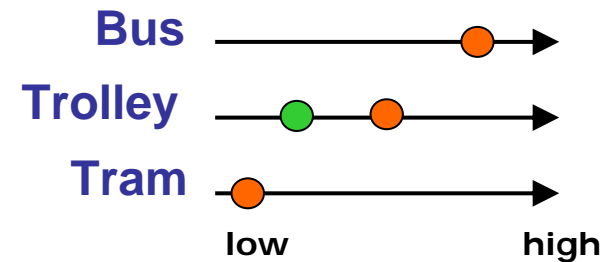
Impact on Planning and Budget

● In former times

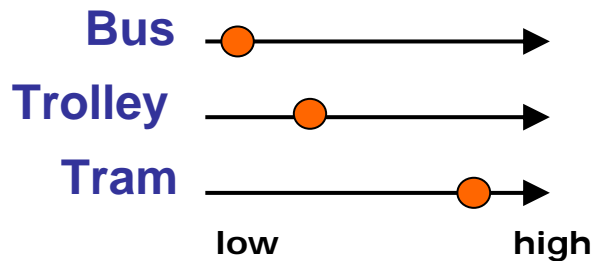
Flexibility in traffic



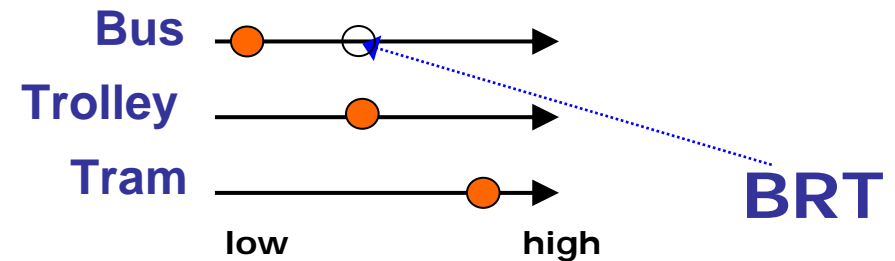
Flexibility in planning



Vehicle Costs per Pass.



Time for construction (ROI)

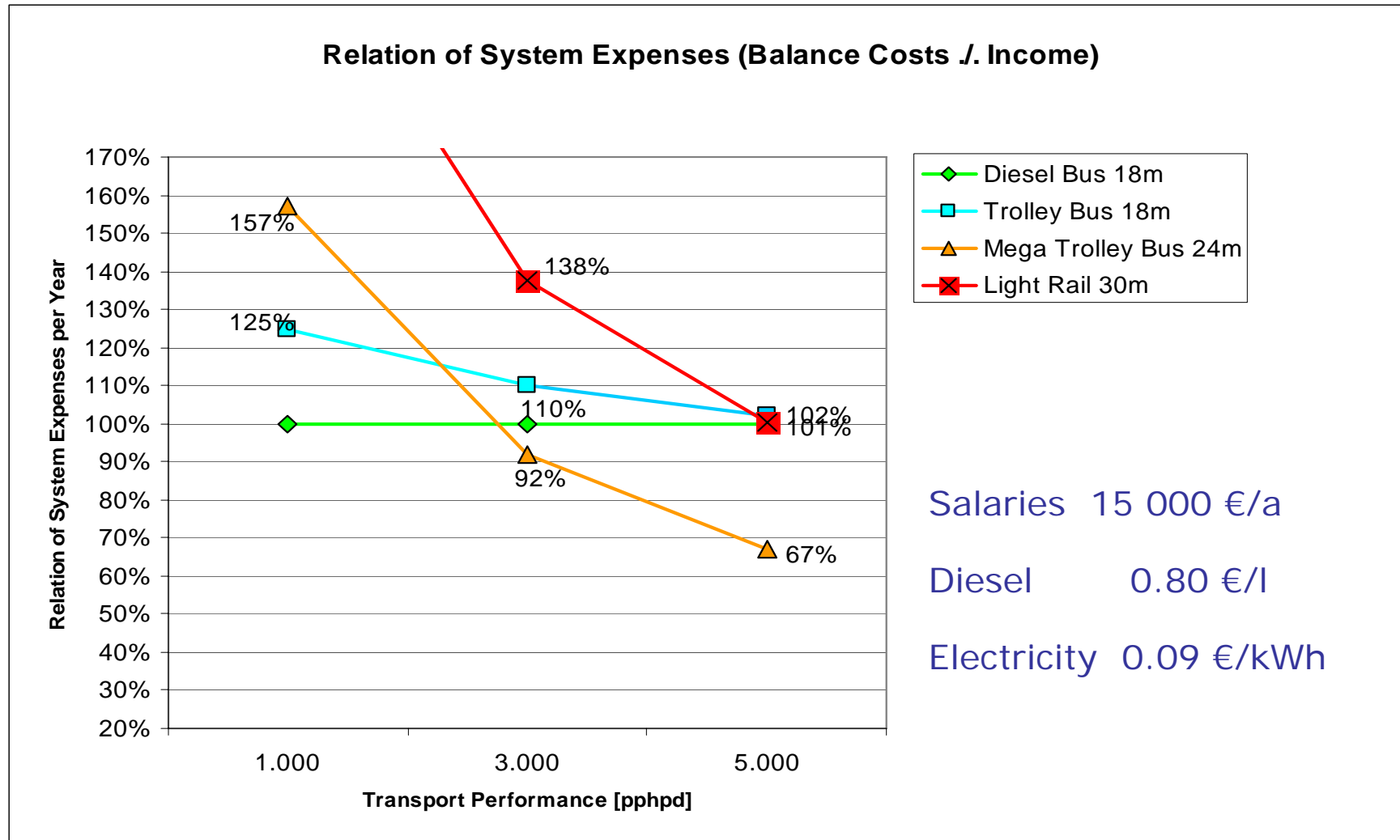


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Total costs analysis:

purchase, maintenance, operation
break-even

**Trolley advantage:
Less energy and maintenance costs**



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Planner require economic stability

Price of electricity keeps more stable than oil price due to mixed energy sources

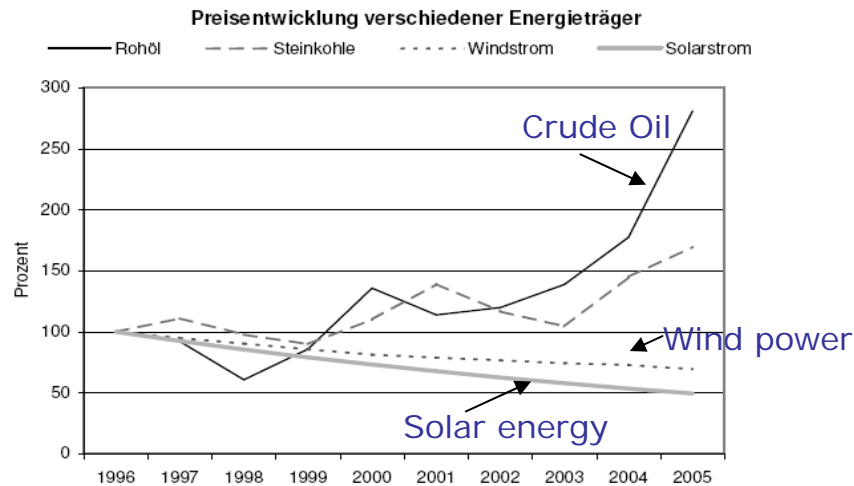
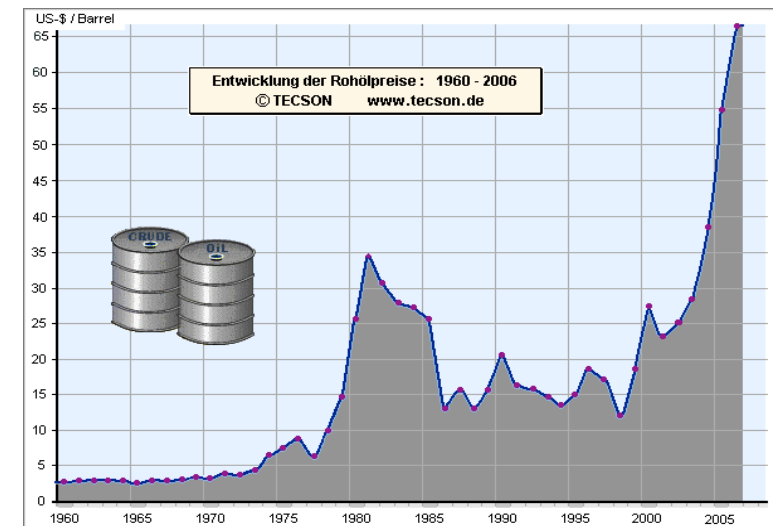
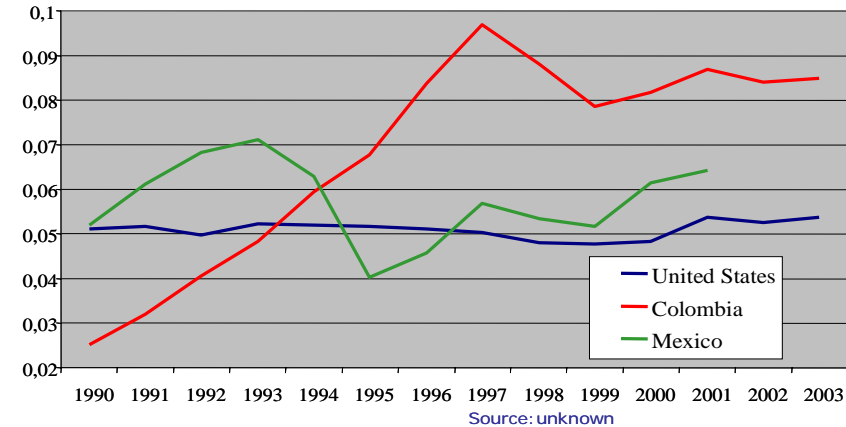


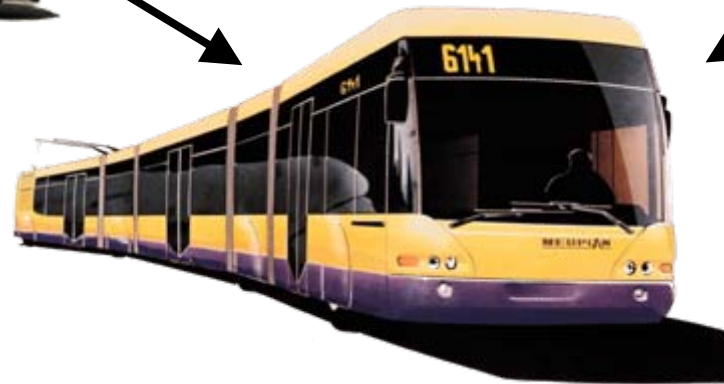
Abbildung 1: Preisentwicklung verschiedener Energieträger in den letzten 10 Jahren
 Quellen: BAFA, Tecson, BWE, UVS (Stand: Juli 2005)

Electricity in US\$ per kWh



Transportation Idea: New Vehicle Concept

System Advantages



- High passenger capacity
- High average speed
- Positive passenger image
- Image of reliability
- Zero emission

+

- Electrical traction
- Flexible around obstacles
- Easy integration into existing infrastructures
- Low noise emission
- Can cope with steep grades
- Proven and reliable

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Mega-Trolleybus

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Double articulated trolley's

Contracts in place:

10 Geneva

3 Lucerne

17 Zurich

7 St. Gallen



Our vision for the future



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Project Quito

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Electrical BRT example:

Quito/Ecuador 1999: after 3 years of operation



54 trolley busses transported in 3 years with
10 million Kilometers of mileage
Over 150 Million Passengers



Nowadays more than
70 million passengers per year
with only 113 vehicles

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Actual Projects

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Trolley Bus Update, Vancouver



Trolley Bus Update, Genf, Luzern, Zürich, Biel, St Gallen, Solingen



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Trolley Bus Update, Genua



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Trolley Bus Update, Lecce, Avellino



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Trolley Bus Update, Philadelphia



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Trolley Bus Update, Kiepe Hybrid (Zug)



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Trolley Bus Update, Mailand



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Trolley Bus Update, Pescara



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