

# Lastauto Omnibus Zukunfts-kongress 2013



## The MAN Metropolis

A joint project between  
MAN Truck & Bus AG and SUEZ Environnement



Ben Kraaijenhagen, Head of Environment & Trends  
Stuttgart, September 24<sup>th</sup> 2013

# Agenda



1 The environment

2 Joint project MAN Metropolis

3 Outlook

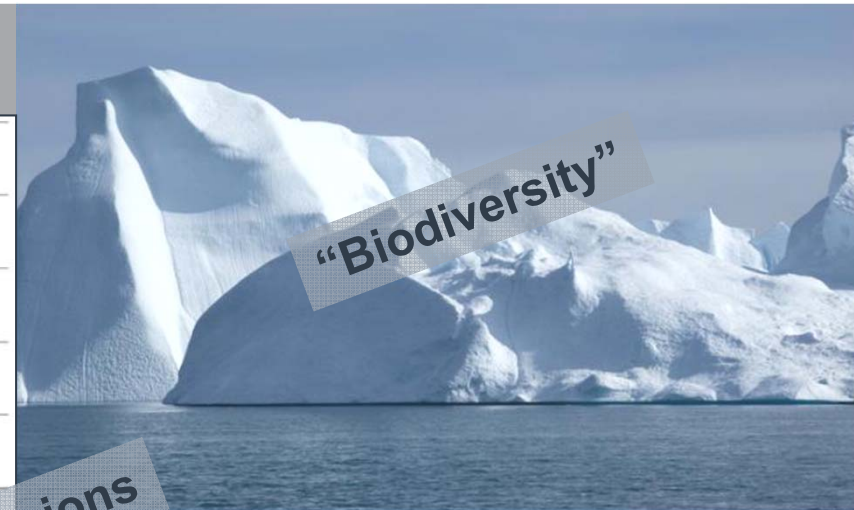
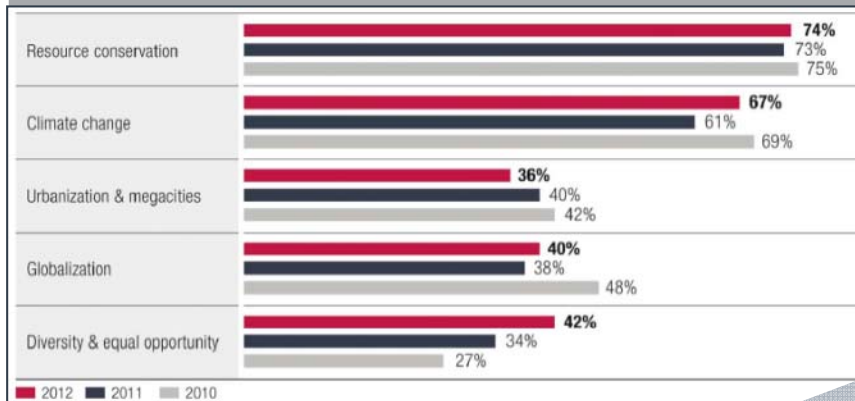


# MAN stakeholders



FROM THE VIEWPOINT OF OUR STAKEHOLDERS

## Challenges for MAN



Source: MAN CR Report 2012

# Suez stakeholders



FROM THE VIEWPOINT OF OUR STAKEHOLDERS  
Challenges for Suez

- Help our clients to better and optimise
  - the water cycle as a whole
  - the management & recovery of waste
- Improve the environmental footprint of our facilities and services
- Improve customer satisfaction and trust



# Environment

Responsibility to safeguard life

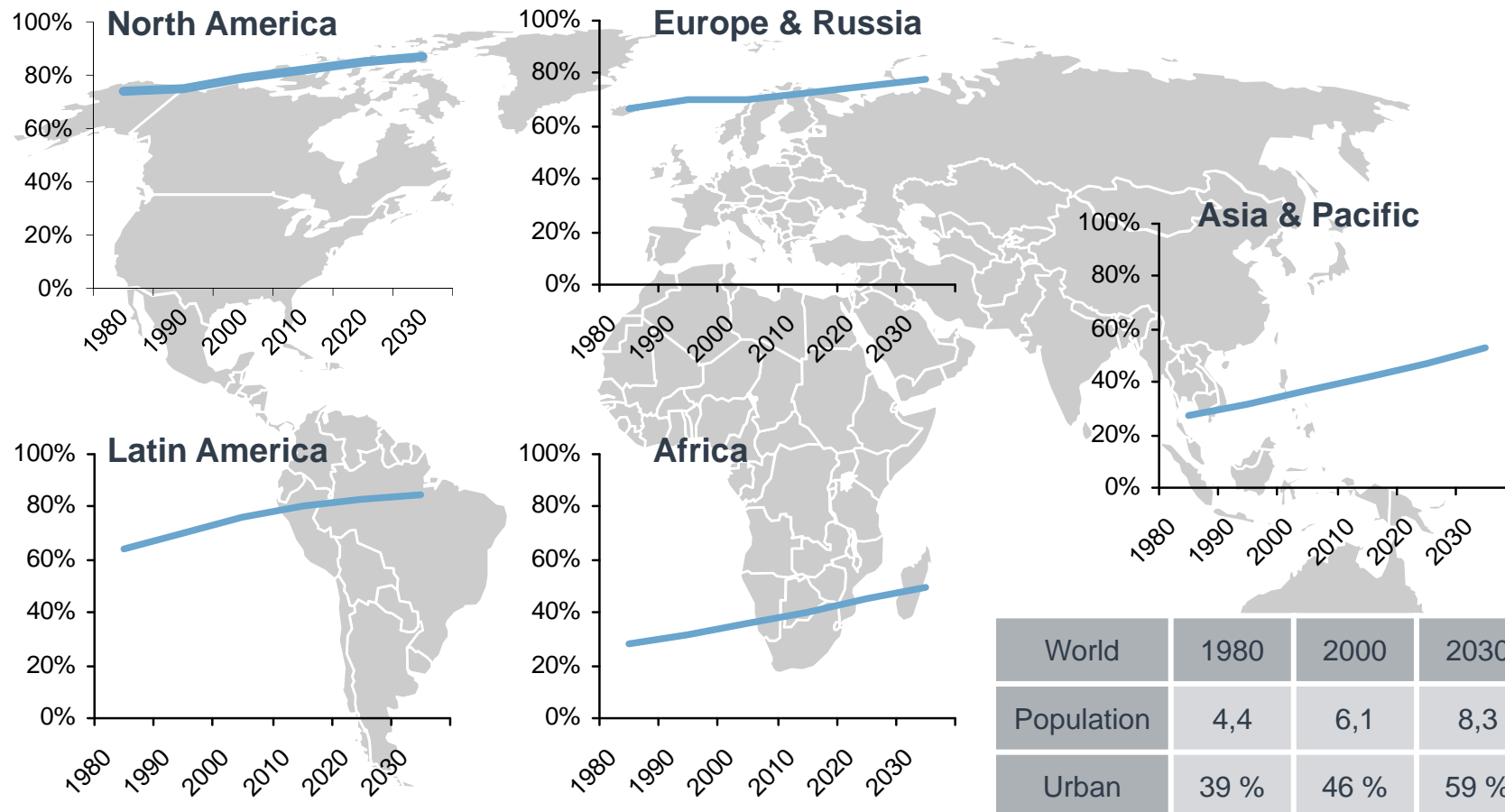


Quelle: MAN internal data, Rockström & Co. 2009



# Economy

Growth forces investment in infrastructure and services



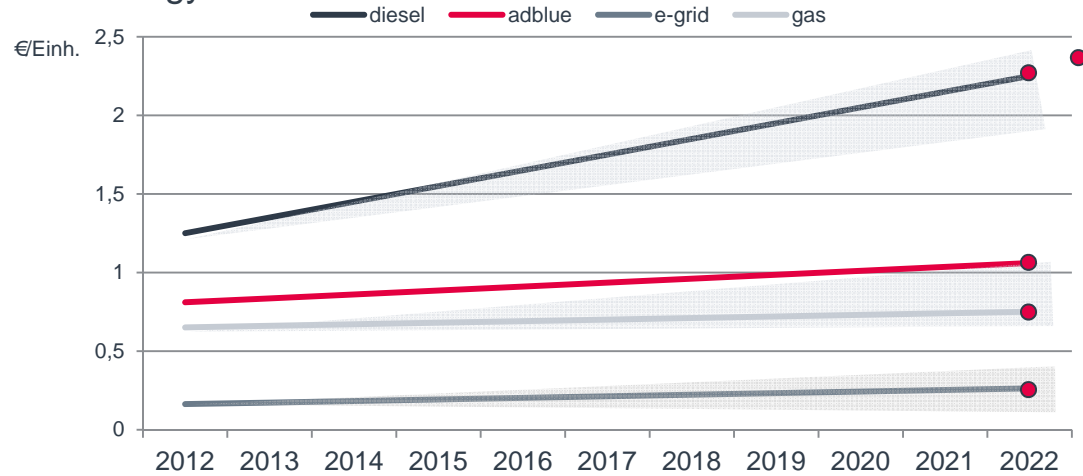
Source: United Nations Population Division, SBI Analysis February 2011.

# Economy

## Cost of energy and battery systems



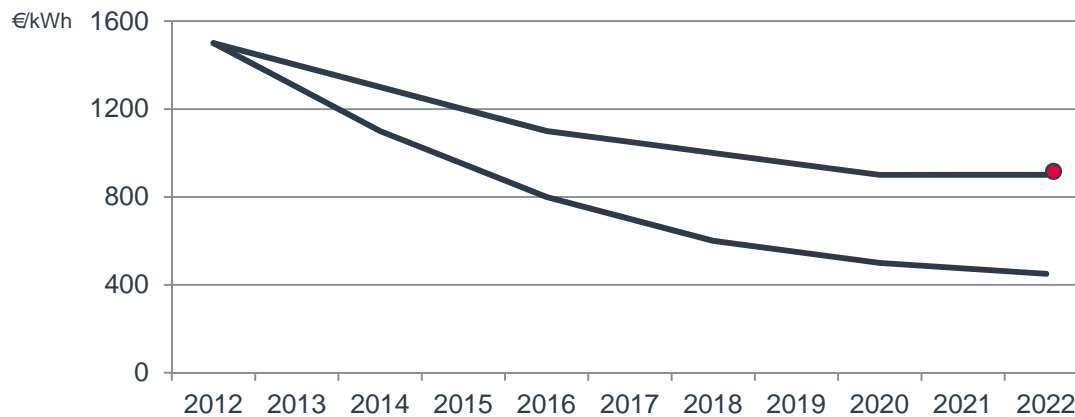
Evolution energy cost



Scenario cost of energy and battery systems used for current TCO (€/t freight) calculation.

The evolution of cost will have a huge influence on  
 - investment  
 - residual value  
 and by that the acceptance of new technologies.

Evolution cost of battery systems



Uncertainty about cost for new infrastructure to enable the use of new technologies

Source: Interne MAN Daten, IEA Energie Outlook

# Agenda



1 The environment

2 Joint project Metropolis

3 Outlook

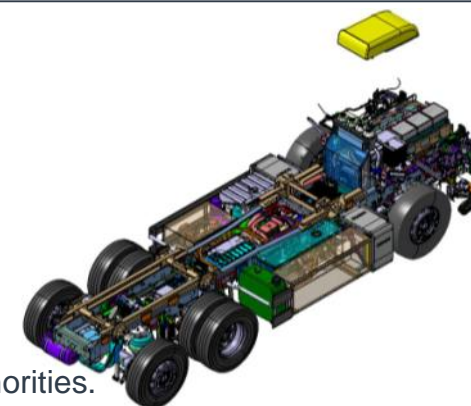


# Milestones of the MAN Metropolis project



## Mutual project activities

- 2009 Aug.    **Initiation of a project to develop a concept truck.**
- 2011 Nov.    **Initiation to install a “bird view” system.**
- 2012 Sep.    Start validation till end Nov 2013; MAN Release for Field test.
- 2013 Sep.    Training and instruction for users SITA Belgium, MAN Belgium and authorities.
- 2014 Jan.    Start Field; area Brussels-Antwerp Belgium, test over 2 years 2014-2015.



## Mutual market activities

- 2012 Sep.    IAA Hannover; World wide launch of the first e-truck with range extender for heavy transport up to 28t GVW in urban areas
- Oct.    eCarTech; Winner of the “Electric Vehicle Commercial Vehicle Award”
- Nov.    Pollutec, Lyon France; Presentation by SUEZ Environnement and MAN
- 2013 Mai    E-Mobility Day, Berlin; Official ceremony with Ch. A. Merkel



Source: MAN-SUEZ Project team

# Requirements Suez Environnement



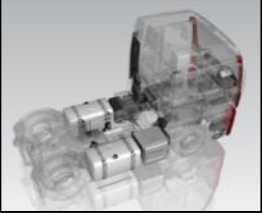







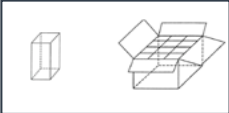
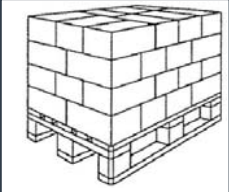





- **Cost neutral** over usage phase of 10 years
- **Payload neutral**, application for urban logistics and services
- Daily operation <150km, 2x15km CO<sub>2</sub> free running, **flexible routing**
- Low noise <65dBA, enabling **night logistics and services**
- Base vehicle 26t GVW, 14t curb weight (incl. body and equipment), **12t payload**
- Optimal **safety** for driver, collecting agents, traffic participants

Source; MAN-SUEZ Project team

# New technologies and systems



$C_w$	Energy	Weight	Friction	Payload volume / mass	Systems
 	  	  	 	 	  

- New technologies and systems dedicated to urban and inter-urban application
- New technologies are available today but not yet affordable
- But they reduce emissions, primary sources, congestion, fatalities and enable maximising efficiency, productivity and safety

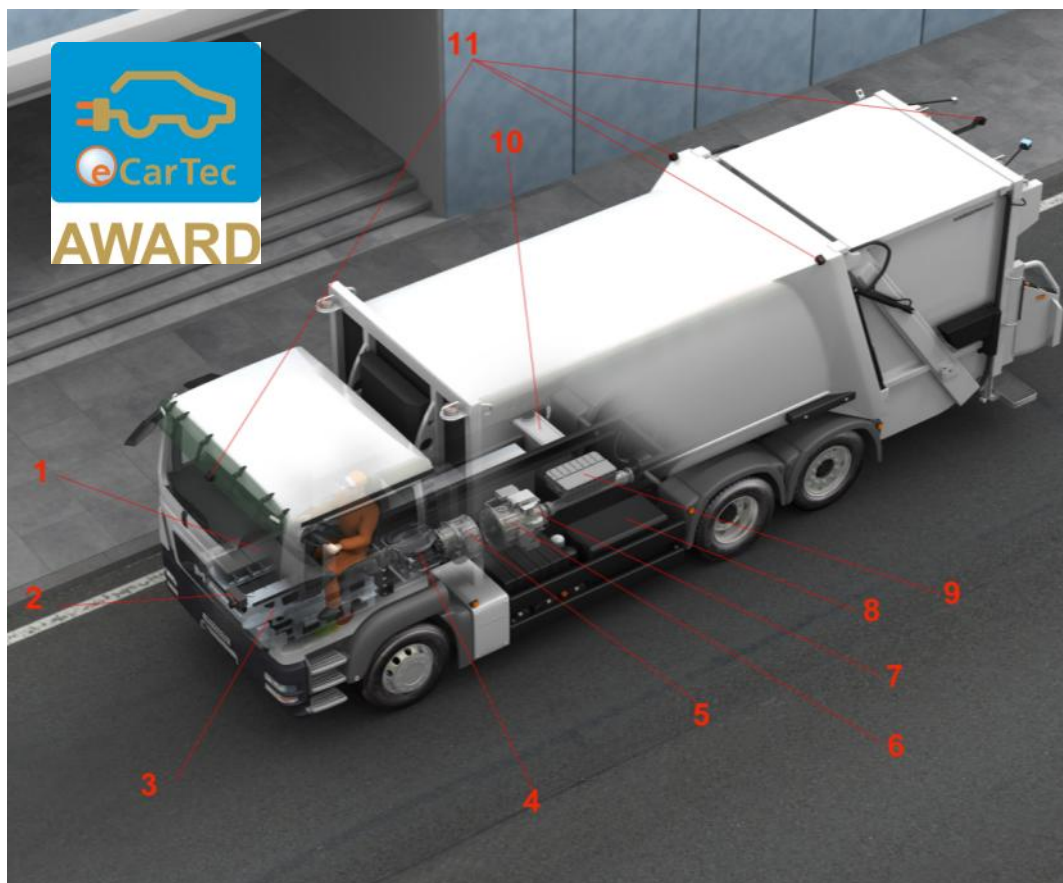
Source; MAN foresight study 2010-2012

# Solution concept e-truck

MAN Metropolis lay out



A battery electric vehicle with range extender



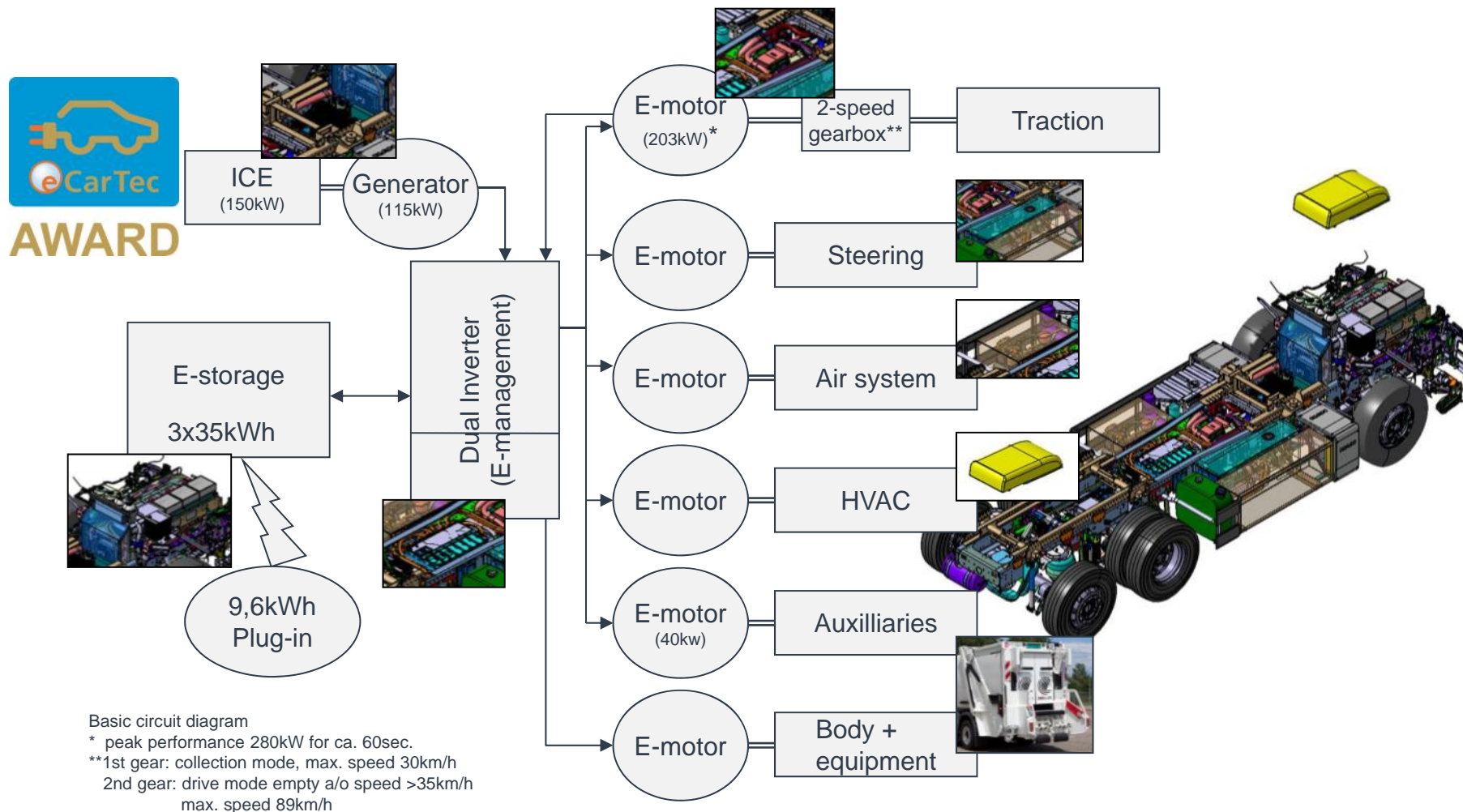
- 1+2 Plug-in with on-board charger enables usage of „green“ electricity
- 3 Battery system, 105kWh (3x35kWh), for
  - maximum **safety** and
  - optimal **load distribution**
- 4+5+10 Range Extender, 115kW, to ensure **flexible operation**
- 6+7 E-Motor, 203kW with 2-speed gearbox
  - 1<sup>st</sup> gear <35km/h **CO2 free operation**,
  - 2<sup>nd</sup> gear **0-90km/h opt. support REX**
- 8+9 **Electric operation** of all functions vehicle and body
- 11 A „Bird View“ System enables **360grd view** for maximum safety

Source; MAN-SUEZ Project team



# Solution concept e-truck, Mai 2011

MAN Metropolis lay out



Basic circuit diagram

\* peak performance 280kW for ca. 60sec.

\*\*1st gear: collection mode, max. speed 30km/h

2nd gear: drive mode empty a/o speed >35km/h  
max. speed 89km/h

Source; MAN-SUEZ Project team

# Solution concept e-truck

MAN Metropolis with a “bird view” system



The “Bird View” system enables 360grd view for maximum safety



Turn right



Shunting



## Camera based system

- Four camera surround view system. (front, rear, left side, right side)
- The driver has a 360-degrees view.
- Surroundings can be seen top-down from a bird’s eye view perspective.
- Input images from the cameras are processed and stitched together.
- Maximum view when cornering, shunting, loading, etc..

Source; MAN-SUEZ Project team

# Comparison concept e-truck

MAN Metropolis



Technology drive mode	Diesel	Diesel-Electric	Diesel	Electric	Electric
Technology collection mode	Diesel	Diesel-Electric	Diesel-Electric	Electric	Electric
Operation body & equipement	hydraulic	hydraulic	electric	electric	electric
Battery capacity	na	2,5+20kWh	super cap	105kWh	255kWh
Battery - back up	na	Diesel	Diesel	REX ✓	none
Payload	12t	10,2t	10,4t	12t ✓	9t
CO <sub>2</sub> free operation	no	<20km/h	no	collection ✓	always
Low noise <65dBA	no	<20km/h	collection	always ✓	always
Operation	Day	Day	Day	Day & night ✓	Day & night

REX; Range Extender small Diesel engine with generator

Source; MAN CoC Hybrid and GPE

# Solution concept e-truck

MAN Metropolis, assessment of curb weight and GHG



Curb weight 7660 kg (chassis)



Curb weight 7690 kg (chassis)

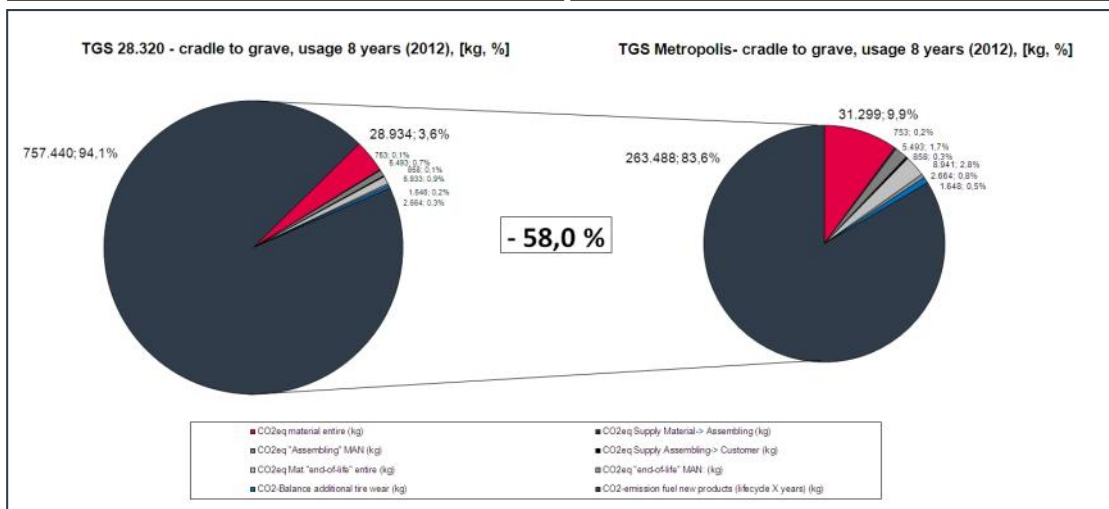
## Curb weight

Concept truck chassis is as light as a standard chassis having a further potential of 500kg!

## GHG reduction

The LCA analysis shows an overall reduction of 58% (base 8years and 2 cycle a day)

The usage phase reduces the GHG emissions up to 65% based on German e-mix. Reduction Diesel consumption up to 80%.





# Agenda



1 The environment

2 Joint project Metropolis

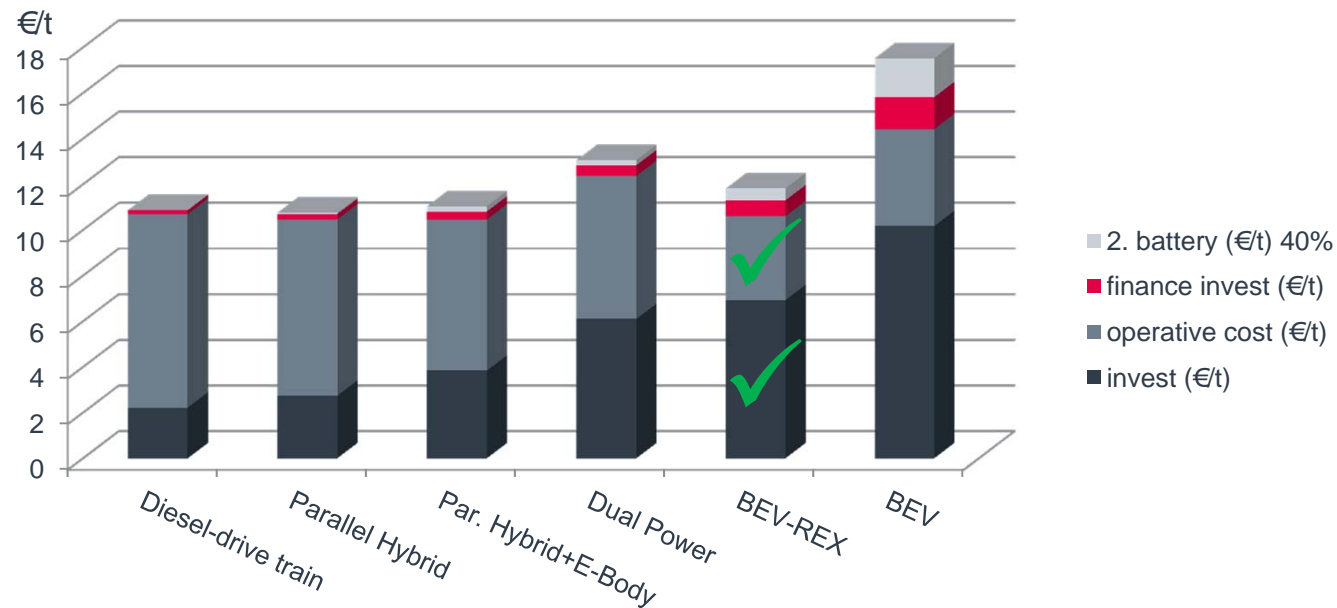
3 Outlook

# Pay off: it could become a business case



Cost over 10 years.

Operative cost and invest are at lowest level due to low energy cost



Finance cost and 2<sup>nd</sup> battery do increase the total cost significantly

- Finance cost due to high invest of technology
- Battery cost in case a second battery is needed

Source: Study of different drive trains

Cost in €/t waste. Use case based on 10 years, 300 days/yr, 2 cycles/day, average duty (energy equivalent ca. 175kWh for a day cycle)

One battery pack, life time assumption DOD 80% 6-8years (DOD depth of discharge), second battery pack calculated at 40% of invest

Operative cost includes price projection over 10 years for diesel, Adblue and electricity, std tax, std insurance, no CO<sub>2</sub> charges, no funds

Source; MAN CoC Hybrid and GPE

# Pay off: it could become a business case



E-trucks require full service package to **manage cost**.  
**Willingness to pay more** for sustainable transport & mobility is still open.



TCO: Total Cost of Ownership

\*Assumption cost of battery and system are managed

Source; MAN-SUEZ Project team



## Field test

- Start field test in real praxis, January 2014
- Duration of field test is 2 years, 2014-2015
- A data recorder will be installed

*An independent institute will analyse the data and report on a regular base the findings on performances regarding the operation and energy consumption*

## Concept and business model

MAN Truck & Bus AG and SUEZ Environnement will continue to look at

- improvements of the current concept (safety, weight, cost)
- business model of a e-truck (financing and handling of invest and battery)



# Lastauto Omnibus Zukunfts-kongress 2013



**Ben Kraaijenhagen**  
Vice President  
Head of Environment & Trends  
Product Management & Strategy

MAN Truck & Bus AG  
ben.kraaijenhagen@man.eu