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UITP TROLLEYBUS

Workshop
New Wave of Interest in Trolleybus in Turkey and Worldwide
October 2, Malatya, Turkey

MOTAS

The trolleybus – reliable partner

KR Gunter Mackinger, Head of Departement der
A.S.S.-experts kurz ges.m.b.H.

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Where stands the trolleybus today?

Whenever resources are reduced, or the cost of other systems are too high, it recourse to the "reliable partner" the trolleybus

- 1900-1914 as a cheaper substitute of horse trams
  development interrupted through the 1st World War
- after the Great Depression until the 1940's as a replacement for trams or opening up new industrial and residential areas
  supported by the 2nd World War but also partly destroyed
- after the Second World War as part of the economic miracle and the reconstruction and replacement of completely destroyed tramway systems
  "sacrificing“ for the "car-friendly city“, by lacks of environmental awareness and the high innovation cycles of motorbuses
- after the oil crises of the 1970's and 1980's years too tentative attempts to reintroduce
  failed in Western Europe by not perfected technology
- Today in environmental and efficiency awareness and after the failure of "hybrid wave" and the evident limitations of battery buses

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Who uses the "reliable partner" again?

Examples:

The new „1-er“ in Luzern -

One example for network modernization in Switzerland

The „TRAMBÜS“ MALATYA
One expemple for new systems in Turkey

Complete modernization of the fleet and infrastructure in Bratislava (Slovakia)

Network expansion and new acquisitions

in Salzburg und Linz (Austria)

Netherlands Arnhem - network expansion and new acquisitions

Amsterdam – New system?!

Acquisitions and test

Hybridtrolley in Eberswalde (GER)

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Who uses the "reliable partner" again?

Examples:

Departement Öffentlicher
Verkehr und Mobilität

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Who uses the "reliable partner" again?

Exemples:

After years of stagnation and closures of many Trolleybus systems in China, as well as purchases any amount of battery-buses and partially supercap buses a renaissance has now been adopted and implemented:

- Beijing network extensions + 500 trolleybuses
- Shanghai closure was decided in 2015 and 2014 now 290 new trolley buses, reopening of trolleybus lines
- Guangzhou continuous network expansion and ever-new trolleybuses
- Discussion about the reintroduction of O bus in Shenyang
- even very small businesses purchase new trolleybuses

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Who uses the "reliable partner" again?

Exemples:

Seattle 141 new trolleybuses

San Francisco 60 new trolleybuses

Mendoza (Argentinia) 26 new trolleybuses

Rosario new trolleybuses

Sao Paulo (Brasil) permaned renovations on overheads and trolleybuses

Mexico first low floor trolleybus

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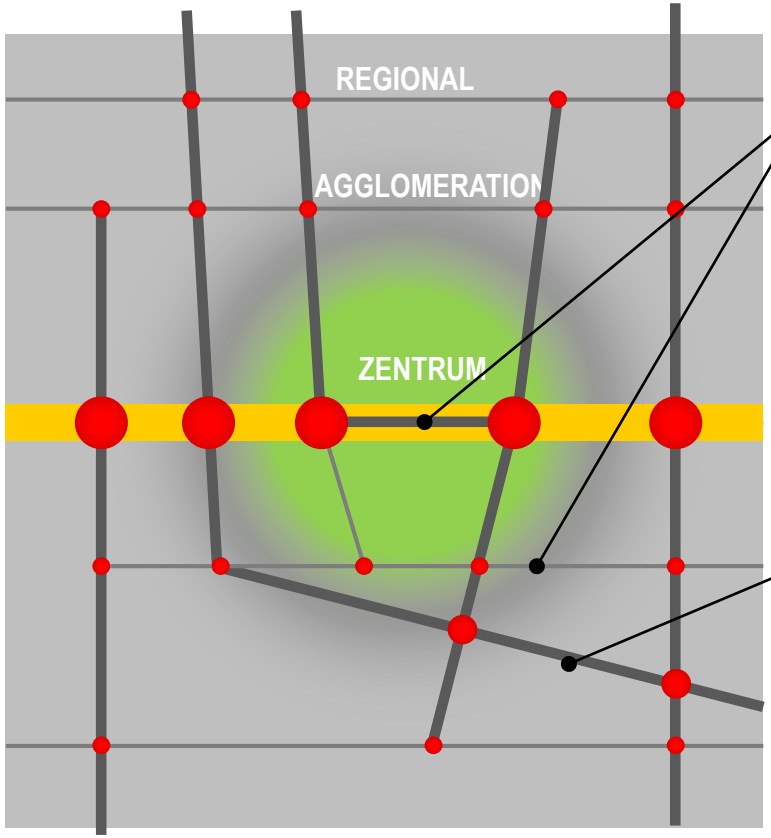
What position does have the trolleybus today?



Citybus-System
with connectings to the agglomeration

- Classic motorbus
- **Trolleybus**
- Hybrid
- Batterie
- Gasbus
- In objective is zero-emission in the citycenters

Regional bus

- Classic Motorbus
- Hybrid
- Gasbus

Basis: AGT VDV Die Verkehrsunternehmen

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What position does have the trolleybus today?

In-Motion-Charging (IMC) one new way?

The **Trolleybus with battery-system**

- is technically possible
- removing and moving trolleyboom systems are on the market

Clarification is required on

- for the length of the catenary-free route
- for battery life
- to the battery replacement costs
- Weight and arrangement of batteries
- Maintenance / cooling / heating of the batteries
- Impact on the depot

What will become of rail bonus ???

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What position does of the trolleybus today?

In-Motion-Charging (IMC) one new way?

The application is not new! In China more than 30 years, in Rome for 10 years:

Sad end of batteries Beijing? After only 3 years of use,

parked trolley buses in Rome after 9 years. Because of missing batteries for the second time

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What position does have the trolleybus today?

In-Motion-Charging (IMC) one new way?

Trolleybuses for agglomerations - the Salzburg - Grödig example.
Build of catenary or hybridize of trolleybuses?

		variant 1	variant 2	variant 3
extension	km	0,8	2,4	3,2
Li. 5 Basic	km	9,5	9,5	9,5
total length	km	10,3	11,9	12,7

observation period of the study – 25 years

- services costs

	variant 1	variant 2	variant 3
trolleybus (with smal APU)	€ 20.236.117	€ 21.871.358	€ 25.525.102
trolleybus with APU & supercaps	€ 29.879.891	€ 32.294.428	€ 33.088.095
trolleybus with EPU & supercaps	€ 26.322.761	€ 28.449.853	€ 29.149.036

- energy costs

	variant 1	variant 2	variant 3
trolleybus (with smal APU)	€ 2.349.136	€ 2.538.965	€ 2.963.114
trolleybus with APU & supercaps	€ 4.017.650	€ 5.913.162	€ 6.776.216
trolleybus with EPU & supercaps	€ 3.310.146	€ 3.523.704	€ 3.951.478

- total costs

		variant 1	variant 2	variant 3
trolleybus (with smal APU)	infra + buses	€ 29.247.840	€ 32.838.773	€ 38.595.166
trolleybus with APU & supercaps	buses	€ 43.776.774	€ 48.086.823	€ 50.841.236
trolleybus with EPU & supercaps	infra + buses	€ 42.582.850	€ 44.923.500	€ 47.444.896

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What position does have the trolleybus today?

In-Motion-Charging (IMC) one new way?

One the new TRT trolleys

Beijing answer:

- 9 new trolleybus lines (orange)
- to the existing 18 lines (blue)
- Electrification of 3 BRT lines (-> TRT)
- Re-electrification of catenary lots sections
- Procurement of 500 additional trolleybus (currently just under 800 in stock)
- Conversion of 50 battery buses (procured Olympics) in trolley buses

One of BJD-WG120EK trolley converted from battery bus BK6122EV2

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What can and should the trolley bus to take from the current situation?

From the current tested "E-bus" can participate in the trolleybus:
The development of battery and charging technology will help to reduce cost and weight for "all-electric" trolleybus EPU drives.
With the „all-electric“trolleybus EPU can

- bypassed road contractions (no diesel Reserve Fleet necessary)
- catenaries be limited to the track to the extent necessary for operation,
- the depots are simplified or
- small extensions in connecting to the trolleybus lines routes can make suburbs are developed catenary-less in the agglomeration in advance (leater bulid catenaries)

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Return to the trolleybus?

The bus continuous power supply!

The trolleybus was created and flourished, in a time of battery usage!
Many battery systems in the individual traffic, municipal-, delivery- and postal service's nothing left, the O-bus drives and drives ...

Only with the overhead contact line

- is urban mass transportation (ie trams)
- with large-capacity units (up to double-artics and trailer)
- without additional effort for memorie systems
- without energy losses
- with more effective use of feedback

operable!

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What is and remains the trolleybus ?

The trolleybus is for the foreseeable future the only electric public transport transport, that

- is in large bodys executable
- „tracklees“ runs and rail bonus had
- is suitable for all topographical demands
- with regenerative energy operable
- in basic without energy storage
- by the electric power transmission is not dependent on only one energy source
- locally in the urban centers is completely emissions free operable

Trolleybus thus contributes to the significant increase in the quality of life in metropolitan areas!

Trolleybus is energy-efficient and cost-effective in operation!

Trolleybus-technology is durable!!

Cantanries 50 years, sustations 30 years, trolleybuses 25 years,
Experience of 130 years of break-free operation!

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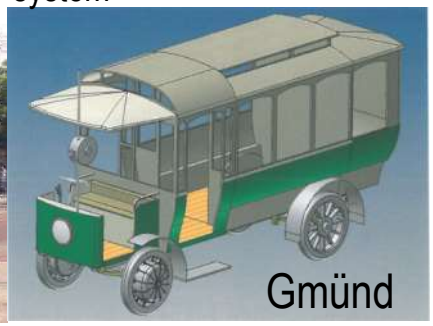
What can the trolleybus today also?

Everybody visible unique selling

- For active and sustainable environmental protection in the communities
- Active and living monument of everyday culture and transport development
- Flagship for a city - The “Trolleybus - city"
- Creates brand awareness



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What can the trolleybus today also?

- For infrastructure systems - such as the trolleybus - there are tenders no obligation!
- With private operators can municipal no saved the environmental goals of cities!

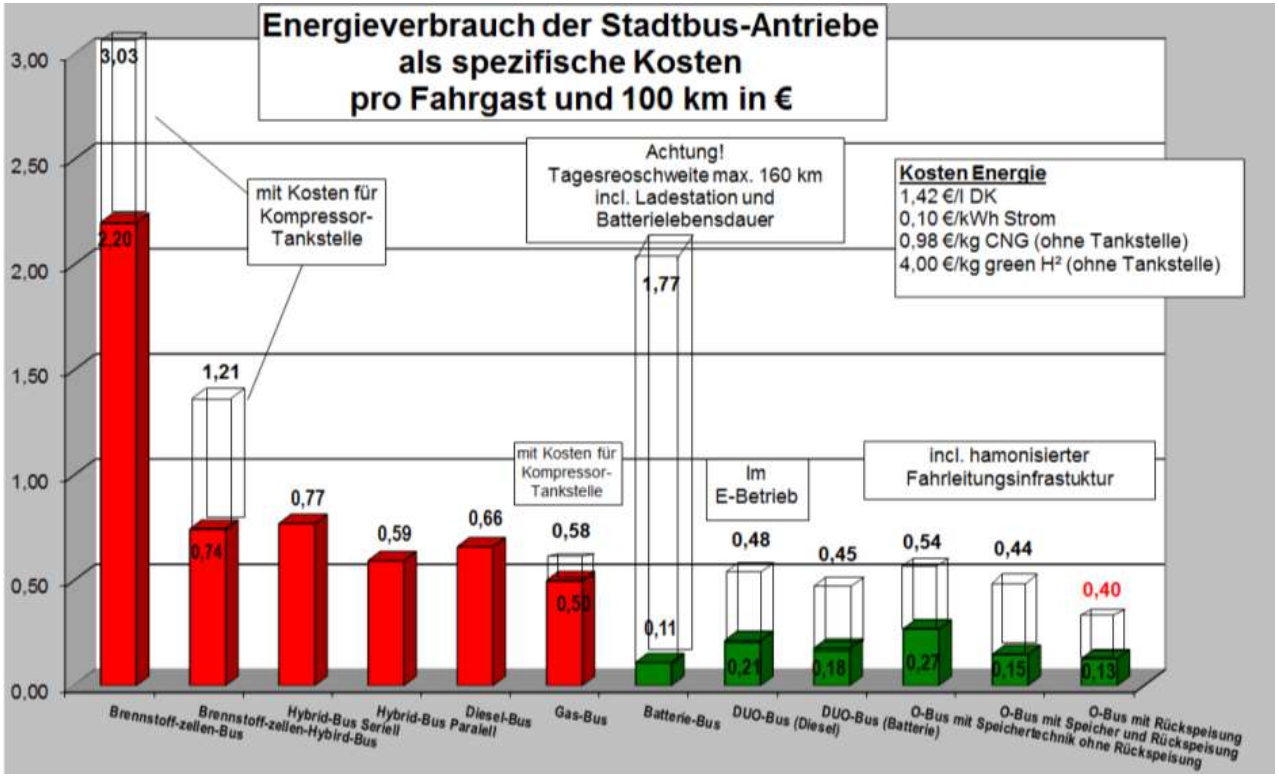
Banska Bystrica – By senseless tender years of Diesel spare traffic and subsequently expensive re-municipalization

Landskrona – 10 years 3 operators, buy back the assets and vehicles through the city or PTA

Salzburg – Handing over the 50-year concession by the then Deputy Governor Dr. Haslauer

What can the trolleybus today also?

Save energy with the trolleybuses compared to other bus systems!



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What can the trolleybus today also?

If you want to drive electrically, save specific costs with the trolleybuses!

	length [m]	capacity [n]	costs [M€]	specific costs [€/passanger]
Motorbus	18	150	0,40	2667
Trolleybus	18	150	0,75	5000
DGT	25	200	1,00	5000
Tram sur Pneu	25	200	2,00	10000
Tram	28	170	2,50	14706

Save construction costs for building new of infrastructure!

Trolleybus	0,3 - 1 M€/km
Tram sur Pneu	10 - 17 M€/km
Tram	10 - 25 M€/km

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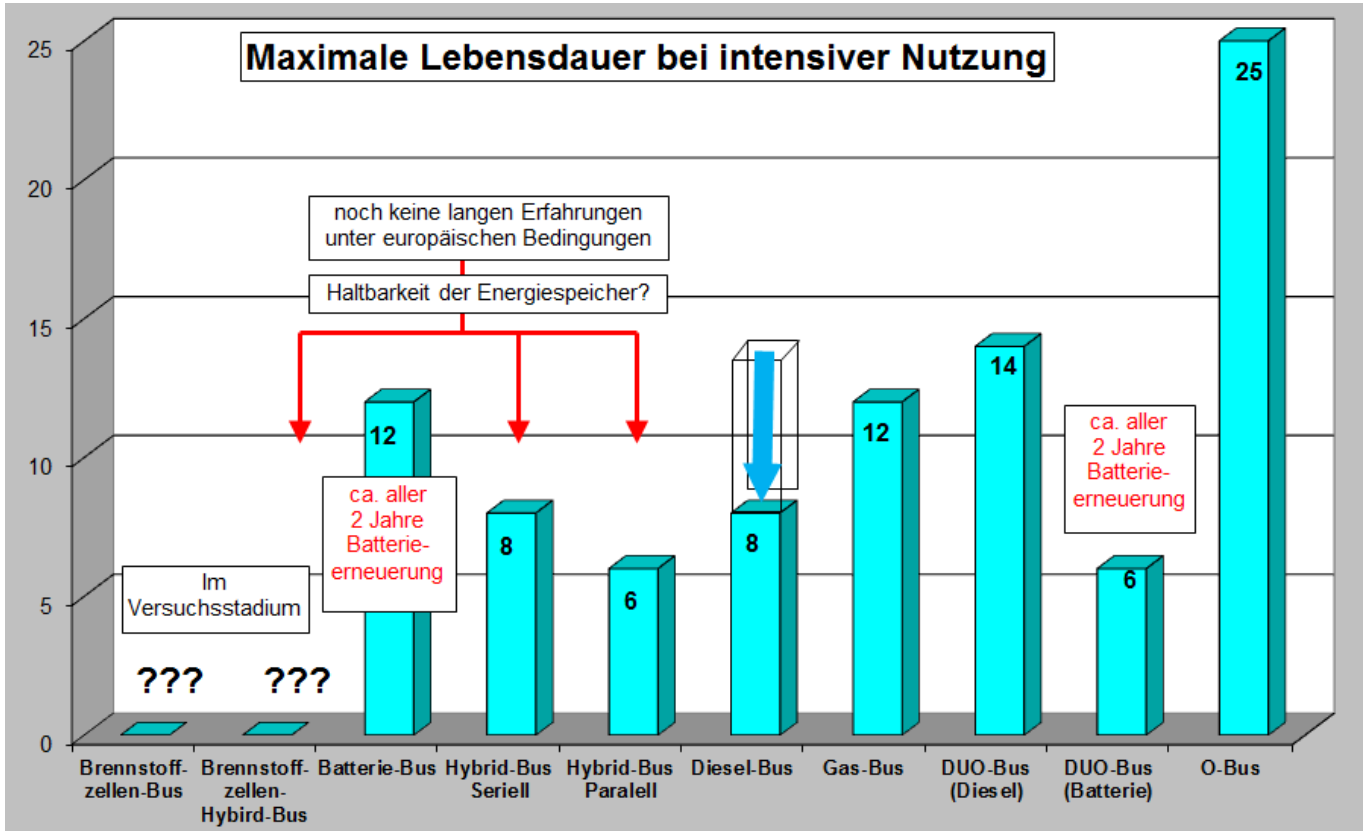
What can the trolleybus today also?

Save with longer life time placement costs and global resources!



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What can the trolleybus today also?

Save with the trolleybus pollutants!

tep S.p.A.

	Trolley	DIESEL		CNG
		Euro 4	Urban fleet	
DIRECT ENERGY (MJ/Km)	*8,6*	*15,0*	*15,9*	*25,4*
DIRECT EMISSION CO_2 (g/Km)	*58*	*1.092*	*1.160*	*1.292*
TOTAL ENERGY (MJ/Km)	*16,4*	*15,8*	*16,7*	*26,3*
TOTAL EMISSION CO_2 (g/Km)	*1.137*	*1.146*	*1.218*	*1.344*

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What can the trolleybus today also?

Trolleybus technology can also used

- the heavy-duty municipal transport and
- freight services on highways

as the memory technology for these applications is not sufficient!

eHIGHWAY von SIEMENS

waste trucks with trolleybus technology in Bologna

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Attention! The E-bus has one field of application!

Battery- und Hybrid-buses has one field of application

- Citybus-services
- Additional lines to other public transport with lower frequenz
- Services in small citys (p.a. resort towns)
- Interurban services

Only this field of application must not be used for competition with the trolleybus!

What is needed!

- Information campaigns with the politicians - done nothing to tell "(the bear) from the battery“
- Factual description of the catenary as a "signal" for the efficient public transport
- cost coverage of the trolleybus
- Exploiting synergies from and to the tram (Attention! The charging stations have problem with the recuperation!)
- Education about high costs for the replacement of batteries, unclear disposal costs

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Attention! The biggest Batterybus mistakes!

The Batterybus can not

- used without detailed planning, because there is an infrastructure system
- be loaded any power socket
- be loaded on each existing bus terminus or stop because off not sufficient power available
- be loaded - *without any additional effort* - from existing electric transport systems, because the power grid have far too large fluctuations
- go as far as indicating the industry (distance & charging cycles)
- the same capacity transport (weight and space requirements of the batteries)

When purchasing the Batterybus is unclear

- Who pays the procurement of spare batteries?
- How high are the costs of disposal for the batteries?

With the use of Batterybuses the operator has higher costs. He must ask himself, how he gets the delta cost replaced!

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What does the trolleybus today?

1. **The courage to say again trolleybus to the "thing" and consequently a clear commitment the catenary and the railway bonus**
2. **Political decision and promotion**
   - Helps on initial investment
   - Infrastructure and rolling stock Support from of understanding of ecology, economy and longevity
   - Insight into the long-term nature of investments
3. **(Municipal-) operators interested in the trolleybus operation**
   - Exploiting the opportunities for long concession periods in the transport contracts
   - Disclosure of cost / benefit
1. **Industry with good material**
   - No market penetrations
   - Use the experience of the operators

„Research you currently - or are you driving already a proven technology?”

„Everything was already there once, it was named different!”

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Thank you for your attention!

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