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Hybrid trolleybuses in public transport transport in Gdynia: perspectives for development

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WYDZIAŁ EKONOMICZNY
UNIWERSYTET GDAŃSKI

Electric Mobility Europe

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External environment for trolleybuses

Political:

- EU support;
- friendly environment for electric public transport in Poland (Act on Electromobility), trolleybuses included;

Economic:

- high costs of vehicle purchase, as well as the battery;
- Growing threat of energy cost increase (associated with CO2 emission scheme);

Social:

- high acceptance among citizens;

Environmental:

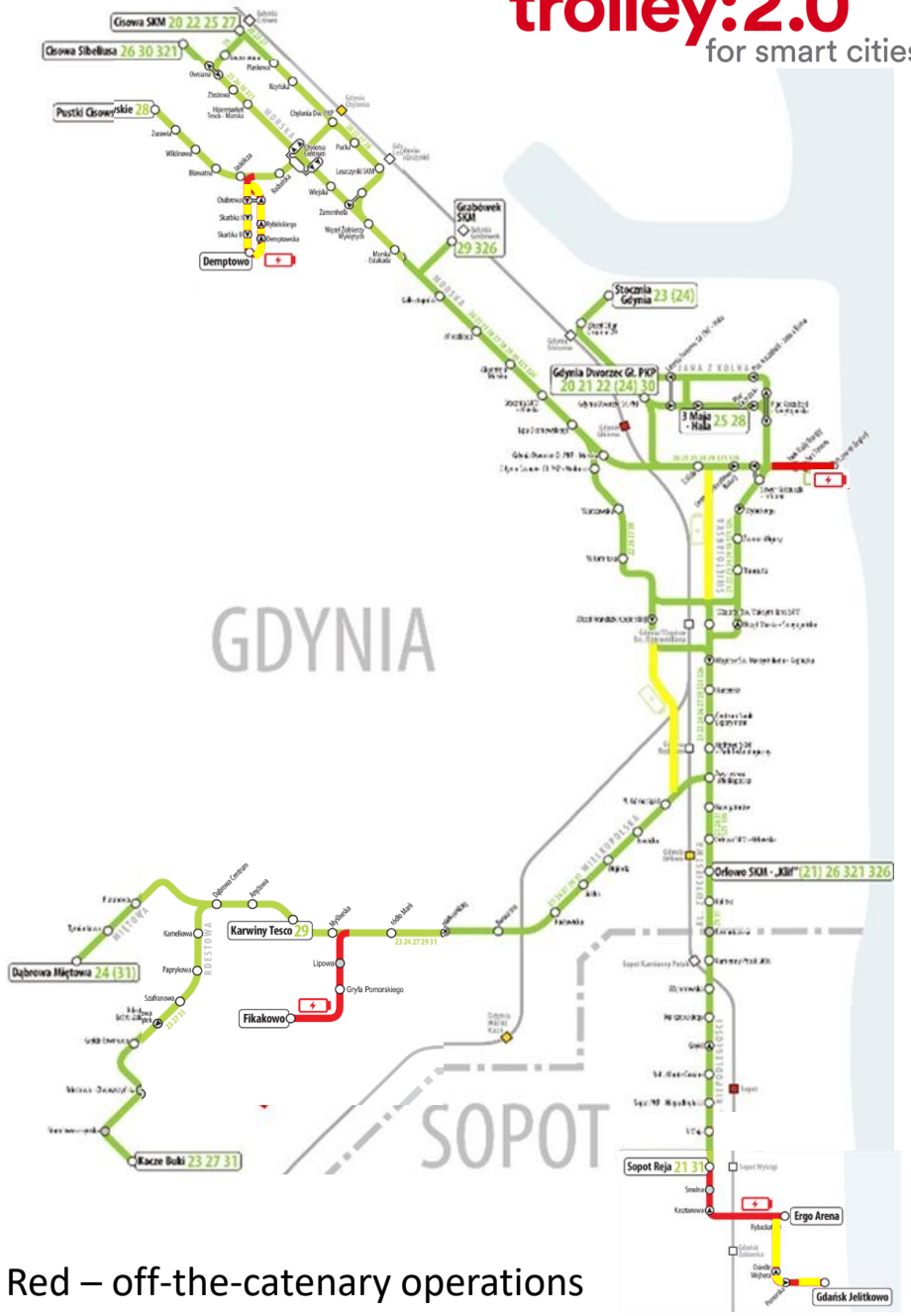
- although electricity mainly produced from coal, lack of local emissions and opportunity to implement photovoltaic farm;
- also increased energy efficiency (recuperation & storage);

Spatial:

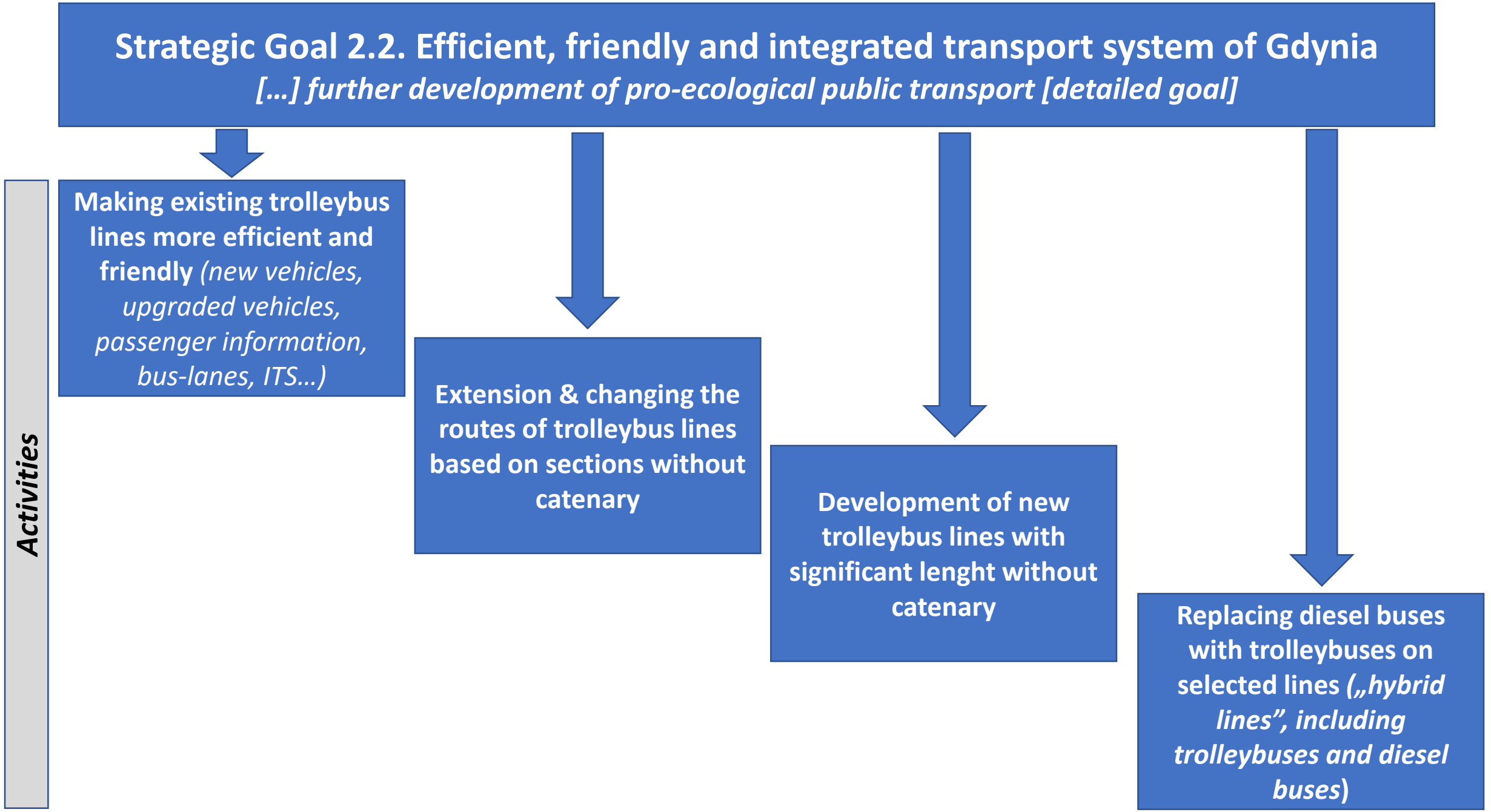
- hybrid trolleybuses enable for penetration of new urban areas without neccessity of catenary development.

Trolleybus transport in Gdynia

- Since 1943;
- 1 separate trolleybus operator, the PKT Gdynia sp. z o.o., owned by the City of Gdynia;
- Over 5.2 mio. veh-kms per year, 26% of share in PT supply in Gdynia (and 29.5% share in the number of passengers);
- 90 vehicles;
- Cost of vehicle-km: 8,78 PLN = 2.03 EUR/ veh-km for standard 12m trolleybus (2017);
- Supported by the EU projects (TROLLEY, ACTUATE, CIVITAS DYNAMO, ELIPTIC – ongoing, TROLLEY 2.0);
- REGIOSTARS 2014 award;
- 3 trolleybus lines operating part of the route without catenary (1.8 to 3.5 kms);
- Plans for further extension of services without catenary.



Red – off-the-catenary operations
Yellow – analysed off-the-catenary operations


Strategic Goal 2.2. Efficient, friendly and integrated transport system of Gdynia
[…] further development of pro-ecological public transport [detailed goal]
Activities
Making existing trolleybus lines more efficient and friendly (new vehicles, upgraded vehicles, passenger information, bus-lanes, ITS…)
Extension & changing the routes of trolleybus lines based on sections without catenary
Development of new trolleybus lines with significant lenght without catenary
Replacing diesel buses with trolleybuses on selected lines („hybrid lines", including trolleybuses and diesel buses)

Current status of hybrid trolleybuses in Gdynia

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Vehicle type	2017	2018	2019	2020
Number of trolleybuses with Li-Ion battery	7	7	28 (acquisition of 21 separate battery packs)	28
Number of trolleybuses with LTO battery	0	1	30	30
Number of trolleybus-electric bus (GEPARD national scheme)	0	0	0	6
Total number of hybrid trolleybuses in PKT Gdynia	7	8	58	>64
Share in the total trolleybus fleet [%]	**8%**	**9%**	**64%**	**> 67%**


The newest Solaris Trollino hybrid trolleybus already in the service in Gdynia, 11.2018

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Leaving the catenary in Gdynia (Poland)

- Operations without catenary started in May 2015;
- Currently three trolleybus lines leave catenary for short sections (ca. 2 kms);
- Share of vehicle-kms without catenary amounted to 1.44% of total trolleybus supply in 2017;
- Next trolleybus lines with sections without catenary to be added in 2019;
- Some bus lines analysed to be partially or fully electrified with hybrid trolleybuses.

Trolley

Identification of trolleybus potential, i.e. recuperation and conversion from diesel buses

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2020 CiViTAS Cleaner and better transport in cities

THE CIVITAS INITIATIVE IS CO-FINANCED BY THE EUROPEAN UNION

First separation from catenary (May 2015), smart grid management, 1 substation with supercap

eLIPTIC

Further development of hybrid-trolleybuses (analysis – model, 2nd line partially unwired since Dec. 2016)

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Further development of hybrid-trolleybuses (3rd line to leave catenary on some part – Oct. 2018).
Conditions for the introduction of e-buses in cities with trolleybus fleet.

A model approach towards Cost Benefit Analysis: an evolution from Trolley via ELIPTIC to TROLLEY 2.0 projects

- Enables for analysis of different transport systems, according to i.e., share of electric vehicles, mileage, energy-mix;
- Unified input – enables comparison;
- Standardisation of data makes data collection process easier;
- Possible to implement different cost categories;
- Possible to develop.

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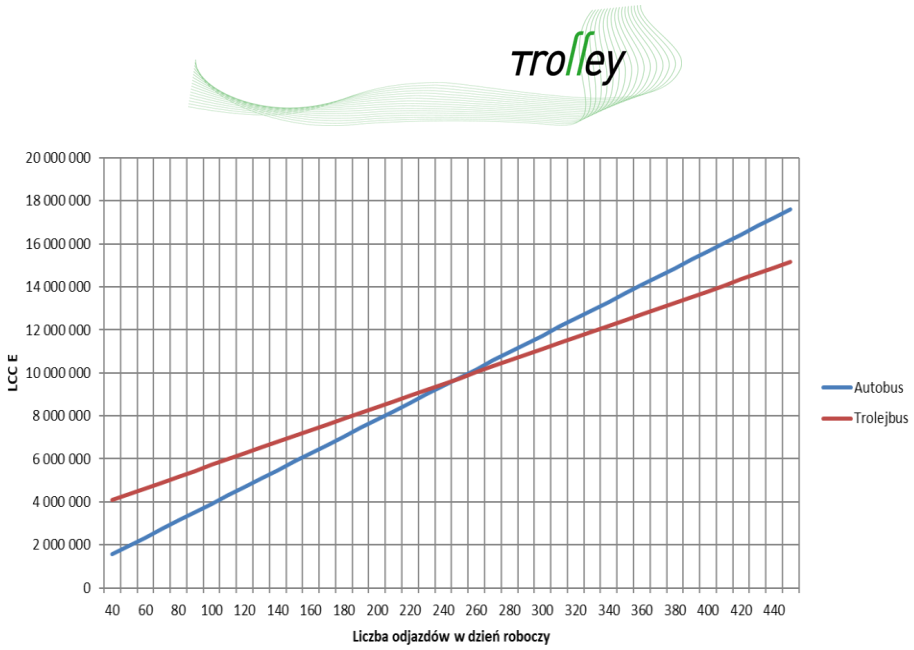

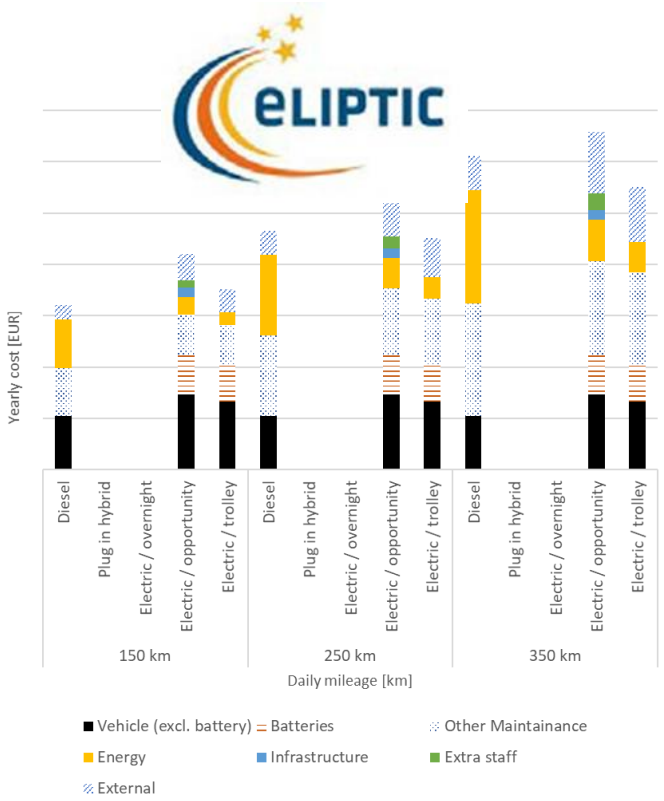

- Main structure similar to the model in ELIPTIC;
- Stronger focus on the environmental impact;
- Sensitivity analysis (i.e. in case of substantial increase of electricity costs);
- Focus on particular lines, inlcuding „lack of local emissions" issue;
- Supporting scenarios of electromobility development.

Summary

- Hybridization of trolleybus fleet is ongoing process;
- Positive experience since May 2015 (shorter distances);
- Next trolleybus lines to be reconfigured, with higher share of route without catenary;
- Many tests (within EU projects) helped to make adequate decisions.

Thank you!
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