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From CIVITAS ELIPTIC to EFFICIENCE: the Electrifying Results of Gdynia Trolleybus Network

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GDYNIA PUBLIC TRANSPORT FACTS OVERVIEW

- One of the three cities (together with **Gdansk and Sopot**) forming 1 million inhabitants **Tricity agglomeration** on the Baltic Sea coast in the north of Poland
- **250.000** inhabitants
- Length of public roads: ca. **400 km**
- Length of public transport routes: ca. **250 km**
- Motorization rate: **500 cars/ 1000 inhabitants**
- Transport modes market share: **56%/43%** individual transport and public transport; ca. **1%** covered by cycling

TROLLEYBUS TRANSPORT:

- **13** day trolleybus lines, **1** night line
- **103** trolleybuses (**85** trolleys in daily operation)
- **90 km** of trolleybus traction mileage of **over 5 milion** vehicle km a year
- **411** employees, incl. **260** drivers only **3** trolleybus cities in Poland (Gdynia, Lublin, Tychy) – 15 in the past

ELECTRIC vs DIESEL PT MARKET SHARE

Trolleybus transport covers ca. **30%** of the whole public transport in Gdynia and neighbouring Sopot.

OUTPUTS OF CIVITAS DYN@MO & ELIPTIC – TASK 1:

Regular off traction courses by trolley battery hybrids – an innovative measure introduced by first CIVITAS DYN@MO and then ELIPTIC project

Line 21 – a line extended by **2 km** to a Gdynia landmark street Skwer Kościuszki

- runs from May 2015 - DYN@MO

Line 29 – a line extended by **4 km** odcinek to Fikakowo densely populated housing estate

- runs from December 2016 - ELIPTIC

Automatic lowering and raising of current collectors due to special devices – docking stations placed on the overhead grid

Origins of trolley battery hybrids in Gdynia

- In 2008 - PKT's preparation to the fleet modernization co-financed by EU funds

  Basic requirement – auxiliary drive allowing for autonomous operation in trolleybuses

Diesel drive

- long distatance
- flexibility
- popular solution

Battery

- promising technology
- zero emission
- easy maintenance („all electric")

Decision makers

OUTPUTS OF CIVITAS DYN@MO & ELIPTIC – TASK 2:

Energy efficiency strategy and solutions introduced within CIVITAS DYN@MO & ELIPTIC PROJECTS, which opened perspectives to new projects including EFFICIENCE (INTERREG CE)

Optimised braking energy recovery in the trolleybus network due to:

►installation of an energy storage device - **a supercapacitor** on the substation (DYN@MO)

►implementation of a **dual power supply system** (i.e. bidirectional power supply) in two spots of Gdynia trolleybus network (ELIPTIC). Dual power supply software links 2 pairs of substations and optimizes the energy flow between them. Due to balancing voltage drops it increases energy recuperation.

Wielkopolska Substation - location of a supercapacitor energy bank introduced within CIVITAS DYN@MO project

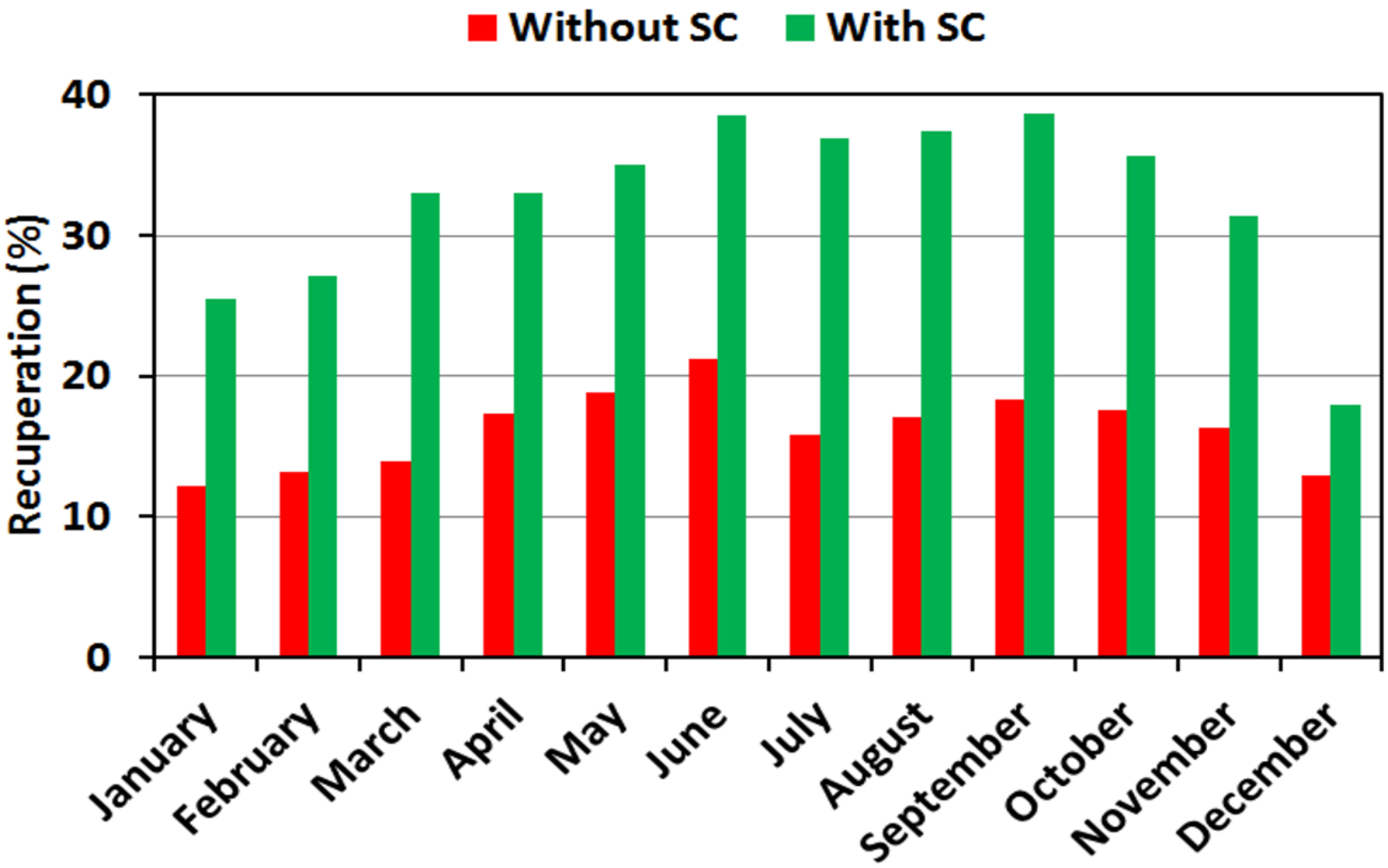
One of the trolleybus network substations (Wielkopolska) is equipped with braking energy supercapacitor – a storage device which saves ca. **12%** of energy on this network section.

This substation was predisposed for supercapacitor installation due to the hilly terrain of the power supply area – there are more occurrences of trolleybuses braking and giving recuperative energy back to the traction network.

HOW SUPERCAP OPERATES?

Supercapacitor 'catches' this energy and stores it for later use by other trolleybuses.

Results – recuperation of energy in 2015 in vehicles before and after SC installation



Lessons learned and main barriers:

- Extensions of trolleybus lines as well as replacement of diesel buses by trolley battery hybrids have proved successful and thanks to CIVITAS projects will be continued
- A ready-to-use solution to be replicated by other cities
- Bilateral supply system and supercaps on substations bring positive energy management and savings results
  - reduction of electric energy consumption by the trolley grid

Main barriers:

- Convincing decision makers and main stakeholders to the implementation of innovative measures
- Competition from diesel bus companies (there are several PT operators in Gdynia which compete with each other for vehicle km)

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ZPORR Zintegrowany Program Operacyjny Rozwoju Regionalnego

Pomorskie w Unii – Urząd Marszałkowski Województwa Pomorskiego

Program Regionalny – Narodowa Strategia Spójności

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Intelligent Energy Europe – For a sustainable future

Central Europe – European Union European Regional Development Fund

Trolley – Promoting electric public transport

Interreg Central Europe – European Union European Regional Development Fund

EfficienCE

■ training programmes in safe eco-driving

■ published handbook on conversion of a diesel bus into a trolleybus

Innovative solutions:

■ off grid courses by battery trolley hybrids

■ dual power supply

Innovative solutions:

■ new technology battery trolleys

■ supercaps on substations

■ study on areas predisposed for supercap installation

CiViTAS – Cleaner and better transport in cities – DYN@MO

The CIVITAS initiative is co-financed by the European Union

eLIPTIC – electrification of public transport in cities

PLANS FOR THE NEAR FUTURE AS A CONTINUATION OF CIVITAS PROJECTS:

- implementation of **EFFICIENCE project** (funded from INTERREG CENTRAL EUROPE Programme) - installation of energy converter which will feed unused braking energy back to the depot; project start April 19)
- **photovoltaic power plant** on the roof of the depot **(5000 m2, 500 kW, 5% of solar power in the traction network)**
- **further line extensions** (thanks to sucessful CIVITAS projects deployment there are already **4 extended trolleybus lines** and **2 lines** on which trolley hybrids have replaced diesel buses)
- 6 in-motion charged e-buses with LTO batteries to arrive in Gdynia in 2020; they will replace diesel buses and run 50% offgrid

Thank you for your attention

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