Technological Viability Evaluation

Results from the SWOT Analysis

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Agenda

- Study Objectives and Scope
- SWOT Analysis Methodology
- Cluster 4 Results
- Cross-Cluster Analysis Results
- Recommendations and Outlook

The SWOT analysis: lessons learned from the use cases' experiences

Objective: Assessment of the viability of the technological concepts behind the **feasibility studies** with an analysis focus on technical and operational topics

	Scoping and Methodology	Information Collection and Analysis	Result Validation and Recommendations
Activities	• Refine **scope** • Define methodological **framework** • Establish **first contact** with feasibility studies	• Gather information through **project documents, questionnaire and bilateral interviews** • Develop of a comprehensive **SWOT analysis** • Discuss and validate results	• **Validate** and **consolidate** final results (use case and cross use case) • Draft and finalize **report** • Ensure overall **alignment**
Results	• Final scope and methodology • Final questionnaire • Draft technology overview and SWOT analysis	• Revised SWOT analysis • Draft recommendations • 1st results dialogue industry partners and experts	Final report • SWOT analysis and recommendations • Transferability to EU level

In-depth SWOT questionnaires and interviews are the basis of our analysis

Use case clustering

Cluster 1

Electricity from **existing public transport grids** to power **electric bus charging points**

- A.2 (London)
- A.3 (Brussels)
- A.8 (Gdynia)

Cluster 2

Equip trolleybuses with an additional traction battery (**hybrid rolleybus**)

- A.9 (Gdynia)
- A.10 (Ebers-walde)
- A.11 (Szeged)

Cluster 3

Braking energy **recuperation and storage**

- B.1 (Bremen)
- B.2 (Brussels)
- B.3 (Gdynia)

Cluster 4

Electricity from existing public transport grids to power **multimodal charging hubs**

- C.2 (London)
- C.3 (Barcelona)
- C.4 (Leipzig)
- C.6 (Szeged)

SWOT Evaluation

The results from the expert questionnaires and the bilateral interviews are analyzed in four categories

- **Technology**
- **Operation**
- **Financial**
- **Society and Environment**

from which the respective

Strengths, Weaknesses, Opportunities and Threats from each case and cluster are derived

Analysis and recommendations

The **analysis** examines the collected findings to determine the **advantages** and **disadvantages** of the technological concepts regarding their **technical and operational viability**, as well as the influence of the **surrounding system** (e.g. funding, regulations, stakeholders) on their successful set-up and operation

Recommendations to improve the viability of the concepts are drawn from the SWOT evaluation by **case** and by **cluster**, but also from **cross-case** and **cross-cluster** analyses

Cluster 4 – Use existing public transport grid to push urban charging opportunities

	C.2 – London	C.3 – Barcelona	C.4 – Leipzig	C.6 – Szeged
Objective	Investigate the feasibility to use **metro infrastructure to supply electric vehicle charging points**	Investigate the feasibility to use the **metro infrastructure** to **supply electric vehicles charging points in parking places**	Investigate the **legal barriers and judicial background** in relation to the **multipurpose use from the tram network** to third parties	Investigate the feasibility to use **the trolleybus infrastructure to supply electric vehicle charging points**
Use Case Activities	• **Feasibility study** and **demonstrator** • Charging points **at own facilities** and **public spaces** • Connection to the **AC metro power supply grid**	• **Feasibility study** • Charging **points in off- and on-street parking places** • **Double connection** to **metro substations** or **stations** and to **public distribution grid**	• Feasibility study: **Legal assessment** with a focus on regulations and possible commercial application • **Consequences** of the concept on **energy subsidies** and tax reductions	• **Feasibility study** and **demonstrator** • Charging points **at own facilities** and in **public spaces** • Connection to the **DC trolleybus power grid**
City	• **Large** city (8.6 m) • **Public** transport oriented (1.31) • **Mature** city (€67,500)	• **Large** city (4.7 m) • **Public** transport oriented (1.54) • **Mature** city (€27,600)	• **Medium** city (545,000) • **Private** transport oriented (0.45) • **Mature** city (€30,100)	• **Small** city (172,000) • **Public** transport oriented (1.65) • **Emerging** city (€7,800)

Cluster 4: Technology is ready, but integral concept still needs further integration and validation

Technology | Operation | Financial | Society and Environment

Technological readiness	• Individual technological **components are mostly market available** • **Integration** in final set-up still requires the development of the **validation of standards and interfaces** • **DC grids** face challenges in gauged metering and AC conversion steps
Comparison to alternative grid	• The public transport grid has a **higher reliability** than the public distribution grid • Availability is site-specific, but **comparable or superior** to the public grid • **Output capacity** per connection point may be higher (site-specific) than public grid outlets
Interaction with PT grid	• **No negative effects** on the public transport grid perceived or expected • **Second priority:** PT operation may limit energy supply at operational peaks and specific locations • PT grid's **voltage and current spikes** may negatively impact or hinder the concept's viability • Potential negative effects may be **mitigated** by smart energy demand control and storage systems

Cluster 4: Implementation effort strongly depends on location and grid characteristics

Technology | **Operation** | Financial | Society and Environment

Implementation and management	• In comparison with the public grid, implementation effort is **similar or higher, depending on the location** • Main occupational roles are **only partially available** within the organizations • Maintenance effort will **assumedly increase** to service the new equipment
Operational integration	• Complementary power demand schedules make **overnight charging** especially attractive • Daytime and operating peak times relegate the concept to a **second priority** in the grid
Synergies	• Public transport grid may be **more efficiently used** by taking advantage of spare capacity • Public transport operators may benefit from an **increased coverage** through **park and ride** offers

Cluster 4: Unclear lifecycle cost jeopardizes financial viability and availability of funding

Technology | Operation | **Financial** | Society and Environment

Fulfillment of Investment Criteria

- The technology concept **mainly fulfills** the individual use cases' investment criteria (exc. Leipzig)
- **Lifecycle costs are still unclear** and vary among use cases:
  - **CAPEX** is usually **comparable or higher** than a connection to the public grid
  - **OPEX is still unclear** due to regulatory framework uncertainties

Availability of Funding

- Funding for the implementation of the concept is **only partially or not available** (main funding sources: EU, municipal, national) due to:
  - **Lifecycle cost** uncertainty
  - **Third party** use regulations

Cluster 4: Legal regulations for energy and grid management constitute a substantial barrier

Technology	Operation	Financial	**Society and Environment**

Impact on City, Society and Environment	• Implementation of the concept **pushes the adoption of electric vehicles** by providing an infrastructure basis • Concept indirectly **contributes to a reduction of local transport-related emissions** • Contributes to **increase the acceptance** of electric mobility
Attitude and Influence of External Stakeholders	• **Local politics and authorities**, as main stakeholders with **high influence** over implementation, **actively support** the concept • Individual national or regional **initiatives support the goals** of the technology (Live6 in Barcelona, ULEZ in London, Hungarian electromobility program)
Regulatory and Political Framework	• Technology concept is **well aligned with the cities' goals** for **environmentally friendly transport** and the **electrification of mobility** • **Legal framework is unfavorable** in terms of the current limits for the **distribution of energy** from a privileged grid to **third parties**

The potential of the Cluster 4 technology concept is currently limited by regulatory issues and funding uncertainty

Common Strengths	• PT grid is **competitive or superior** (availability, reliability, efficiency) to the public grid • PT grid capacity may allow **more outlets per connection point** than public grid • Complementary demand patterns are attractive for **overnight charging**
Common Weak-nesses	• Multimodal charging is still **second priority during peak** PT operation • Concept still presents **technical challenges** (DC metering, voltage/current peaks, technical validation) • **Specialized personnel** for operation and maintenance only partly available
Common Oppor-tunities	• Implementing **complementary technologies** for **power management and storage** • **Strong public and political support** due to its alignment with cities' electromobility goals • Promotes the **acceptance of e-mobility** in cities
Common Threats	• **Unfavorable legal framework** for the distribution of power to third parties • **Electric fleets** (both private and municipal) in some cities are still small • **Funding** is not, or only partly available

Strategic actions

- **Invest** in power management and storage systems to develop integral solutions
- **Develop** complementary charging schedules to take full advantage of the concept's potential
- **(De)regulate** the energy market to allow for more flexibility in the distribution to third parties
- **Combine** with other strategies and technologies (energy recuperation, etc.)
- **Promote** the concept's enabling potential for the rapid electrification of fleets to leverage support

Use cases share important advantages and disadvantages across all technology clusters

	+	−
Technology	• Direct access to robust and reliable grid • Potential for implementation and scalability • Complementary to current operation	• Grids not yet ready for full electrification • Development of individual components still necessary
Operation	• In-house expertise and capabilities in operation and maintenance • Lower maintenance effort (C 1 and C 2) • Higher operation efficiency (C 1, C 2 and C 4)	• Schedule and layout adjustments required • Technical know-how still to be acquired (C 4)
Finance	• Funding partially available • Lifecycle business cases tend to be positive	• Cost of technology • External funding and subsidies usually required
Society and Environment	• Overwhelming support for most concepts • Superior local environmental performance • Motor for future electrification of mobility	• Regulations still pose a barrier for implementation

Public transport electrification requires strategic actions for further growth

Invest	Develop and Improve	Regulate	Promote	Combine
• Complementary technology • Grid capacity upgrades • Pilot implementations	• Technological components • Smart scheduling and operation models • Power interfaces	• Grid management and third-party distribution • Stronger environmental regulations • Incentives and funding for new technology	• Environmental benefits of electric vs. diesel mobility • Transferability potential at national and European level	• Storage media solutions • Integral charging strategies • Lessons learned from **ELIPTIC** and beyond

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