Fr	B	C	NY	S	T	Total
2	10	7	0	2	8	29

Example:
One prerequisite for the goal formulated by German Chancellor Angela Merkel and the German government of one million electric vehicles by the year 2020 is an appropriate infrastructure.
In the nationwide funding programmes called „Modellregion Elektromobiliät" („Model Region Electromobility") and „Schaufenster Elektromobilität" („Electromobility Showcase"), the Berlin-Potsdam region alone will receive about €250m in five years.
({Modellregion Elektromobilität Berlin/Potsdam # 21}, {Schaufenster Elektromobilität # 22}). While in recent years it has above all been technical issues that have had to be resolved, what now has to happen is the conceptual and infrastructural integration of electromobility into a comprehensive strategy that embraces the entire mobility sector.

1. Differentiated description of the key field

Electromobility includes the following aspects:
- Vehicle technology
- Battery technology
- Charging infrastructure
- Business models

The aspect of the charging infrastructure can be further subdivided into:
- Charging stations
- Charging points and places
- Electrical power supply
- Accounting systems

Electromobility will only be successful if a suitable charging infrastructure is built. Research shows that, besides the high purchase cost, this has so far been one of the biggest obstacles when it comes to purchasing electric vehicles. Cities have to take care of this need at an early stage with appropriate solutions to fully exploit the economic (e.g. locational and competitive advantages) and environmental potentials (compliance with climate targets, improvement of the urban climate, noise reduction) offered by electromobility.
Attention should be paid to the different charging times and thus standing times from at least 30 minutes (quick charge) to up to 8 hours (normal charge) and the number of charging points. It can be assumed that each vehicle requires its own charging point. These may well have to be primarily built in private places (charging is usually done at home or at the workplace), but charging points are also needed in the public sphere (charging while shopping, charging at one's destination after a long journey, charging of shared cars, making the topic of electromobility visible).
The following measures are therefore key elements of a needs-based infrastructure
The overarching concept
- Integration of the charging infrastructure into superordinate plans in order to counteract an over- or under-supply of charging points (charging station network)
- Development of an overall strategy to be able to make the best possible use of competitive advantages through electromobility and a dense network of charging points
- Involvement of local players such as planners, building owners, companies or energy companies

Public charging infrastructure
- Development a mix of normal and fast charging stations in public spaces with add-ons for the years to come
- Development of intelligent, easy-to-use billing systems
- Designation of parking spaces for public charging points
- Development of appropriate parking fee systems
- Creation of a suitable infrastructure for electric vehicles of public transport companies or city delivery vehicles
- The setting up of mobility hubs –– points of intersection where, for example, one can change from an electric car to a bus

Private charging infrastructure
- Creation of overarching approaches to the charging infrastructure in private spaces (e.g. neighbourhood concepts) with an ideal connection to such in public spaces
- Information from building owners: since each private electric vehicle requires a charging point, one million of these charging options will be needed in Germany by 2020 alone

Creation of incentives to purchase electric vehicles
Cars, light electric vehicles:
- Exemption from the congestion charge (the Netherlands)
- Discounted or free urban parking spaces (e.g. London, Stuttgart)
- Use of the bus lane (e.g. Oslo)
- etc.

E-bikes
- High-speed bicycle lanes (e.g. Copenhagen)
- Secure parking spaces (at interchanges such as at railway stations)
- Free charging
- Etc.

2. Reference to sustainability:

Impact on the following levels: social, ecological, economic, resilience of the urban system

Social impact

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Ecological impact

In the future, electromobility will be a key component of

sustainable mobility systems, since it greatly reduces air and noise pollution in cities. The environmental benefits derived from this will pay off economically in the long run, too.

Economic impact
The operating costs (maintenance, power) of electric vehicles are already lower than for conventionally powered vehicles. Since they are currently still up against high purchasing costs, electric vehicles pay off only when used as part of a fleet (mix of different cars with ideally coordinated use of electric or conventional vehicles depending on journey length).
Getting to grips with electric mobility concepts (technical, infrastructural) requires intensive examination of the superordinate mobility systems and thus offers an ideal starting point for the reinvention of holistic mobility concepts.

Resilience
The gradual replacement of conventional vehicles with electric drive ones provides a stable eco-friendly form of total mobility without having to completely dispense with individual modes of transport. At the same time, our dependence on oil diminishes.

Risk if ignored:
The integration of electric vehicles will hardly be enforceable without a customised charging infrastructure, as well as appropriate business and accounting models. Progress in reducing greenhouse gases and noise pollution will thus be unattainable.

3. Relevance to industrial sectors?

Mobility:	High
Energy:	High
Production & logistics:	Medium
Security:	Low
ICT:	Medium
Water infrastructure:	Low
Buildings:	Medium
Governance:	Medium

Brief description of the high level of importance:
Adapting the infrastructure to electromobility exerts a great impact primarily on the mobility and the energy sector.

Mobility
Urban mobility can be designed at a consistently high and flexible level through the use of electrically driven individual (private cars and car sharing) and public vehicles; pollutant and noise emissions can likewise be reduced.

Energy
With regard to the power supply, the challenges lie in
- the provision of large amounts of energy (from sustainably produced electricity) at „peak charging times“ and
- maintaining network stability (electric vehicles are „large consumers“, and mains supply systems in private underground car parks, for example, are currently not designed to cope with them),
and there is great potential
- with respect to vehicle batteries as electricity storage devices which, during their standing time, can feed energy back into the grid during peak hours (e.g. noon)

Buildings
A private charging infrastructure places new demands on parking and energy concepts in buildings. The layout and allocation of parking spaces as well as the ownership of the charging infrastructure have to be clarified. A corresponding (expandable) energy concept, where vehicles act both as large consumers as well as storage facilities (of, for example, green electricity produced in-house) has to be developed for the buildings of the future.

ICT
ICT plays an important role in the development of intelligent charging technology and the control and monitoring of charging operations.

Governance
Governance through the development of concepts and the creation of control mechanisms play a great role in the fundamental change of mobility systems. Legal requirements will change.

4. Impact:

Positive
- Rebuilding the infrastructure makes integration of electromobility possible
- Electromobility facilitates the achievement of environmental goals

Negative
- In part (construction of fast charging stations or induction loops) large investments are required
- Informing and forming the political objectives of stakeholders difficult

5. Implementation measures:

- Learning from what has gone on before: until now, there has been no holistic approach to rebuilding the entire infrastructure to suit the requirements of electric mobility, only individual pilot projects which mainly deal with the construction of charging stations. Measures for holistic implementation must be derived from the experience gained from individual projects.
- Information: education and training for municipal employees, local businesses, building owners, citizens
- Holistic concepts: inclusion of electromobility in the ove-

rall urban mobility system, in neighbourhood concepts in development plans
- Requirements and if need be changes to regulations

6. Actors: Who can shape things? With whom?

Municipalities:
- Promote and coordinate the expansion of the infrastructure by political, legal and structural instruments.
- Cooperate with economic and social actors
- Communicate and promote electromobility as a locational factor

Citizens:
- Contribute demands and concrete ideas to the planning processes

Energy suppliers:
- Design the development of the charging infrastructure and so create new areas of business

Enterprises:
- General: make use of the CO2 and cost savings potential of electromobility by having an ideal mix of vehicles in their fleets. Cooperate with the city with the development and provision of charging points.
- From the mobility sector: develop new business ideas, help to shape the infrastructure

7. Prerequisites:

Such infrastructure solutions only make initial sense in urban, densely populated areas where many people can benefit directly from them. Along with the structural change, cultural change and support of the idea in the population are key prerequisites.

8. Obstacles/barriers:

- Changing existing infrastructure is not always easy
- Lack of financial resources
- Lack of support among the general population
- Lack of knowledge among relevant stakeholders
- Resistance of energy suppliers and conventional automakers.

9. Indicators:

- How many electric vehicles are registered?
- How many charging stations there are in total?
- How many of them are fast-charging stations?
- How many designated parking spaces for electric vehicles are there?
- Is there a booking system for the charging infrastructure?

10. Special features/remarks:

Despite the great ecological and economic potential of electric vehicles, many cities are still reacting in a very restrained way when it comes to concepts to develop an appropriate infrastructure. The reason for this is the large feeling of uncertainty. Yet while the number of private purchases is still stagnating, the increasing proportion of electric vehicles in car sharing schemes, in public and corporate fleets show that cities have to react now and not only when the vehicle numbers (thanks to lower costs; more and more manufacturers are launching ever cheaper models onto the market) rise too quickly.