E-Mobility: the Win-Win-Win-Effect for Users, Network Operator and Climate

Prof. Dr. Christian Jänig

Stadtwerke Unna GmbH

Speach for „Green City Energy" 01. July 2010, Pisa

Context

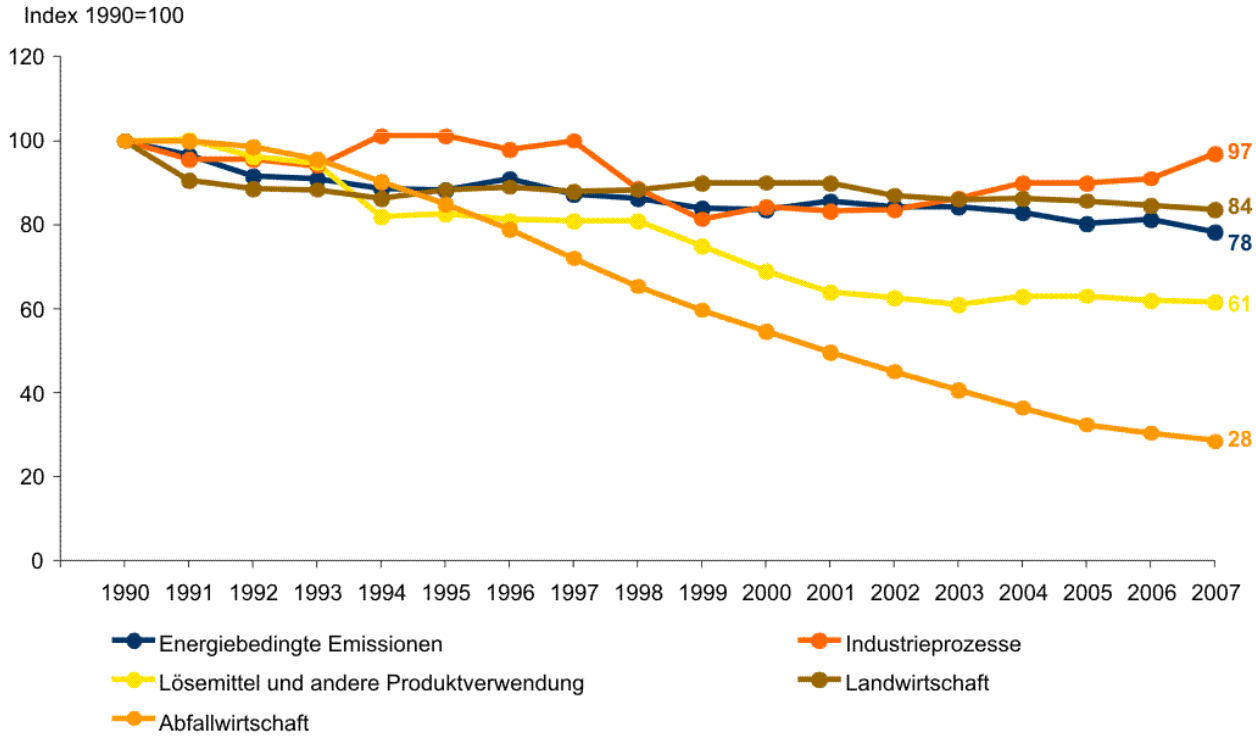
- Those who ignore the climate change, will get eliminated by the climate this century
- The man-made climate change is neither ideology nor utopia, but undeniable reality
- In the last 100 years there was measured an additional temperature increase of 0,8 ° C. Until 2020 this will rise up to 2,4 ° C. If we remain inactive, this ascent will measure in 2050 about 6 ° C and by 2100 about 9 ° C. This temperature increase will have devastating economical, environmental and sociopolitical implications

- The best case scenario shows temperatures, that haven't been measured in the least 100 000 years
- The worst case scenario point temperatures up, which haven't been existent for millions of years. That means, that the temperatures in this current Ice Age are similar to those of the last Interglacial Period (Cretaceous Period about 60 million years ago)
- This facts wont be changed neither by the inglorious conclusions of the Climate Summit in Copenhagen, nor by the current debate on inessential statements of the last IPCC report (melting of Himalayan glaciers)
- The effects of various "tipping points" are still unclear - probably they will be more serious than the current optimistic forecasts

Consequences

- Especially energy companies are responsable for the climate protection.

Emissionstrend der sechs im Kyoto-Protokoll genannten Treibhausgase in Deutschland nach Quellkategorien



Quelle: Umweltbundesamt, Nationale Trendtabellen für die deutsche Berichterstattung atmosphärischer Emissionen seit 1990, Emissionsentwicklung 1990-2007 (Endstand 12.11.2008)

Previous Strategies:

- Energy saving and increase of efficiency for the clients
- Energy saving and increase of efficiency in the own company
- Decentralization of energy system: from big and inefficient power plants to efficient and local renewable and environmental friendly plants
- Primary regulation of local power plans trough „virtual power plans“ on the basis of on-demand energy systems

Climate Protection and Transport

- **Energy induced CO2 emissions in Germany for the year 2007**

Transport compared to other source groups:

• **source group**	**quota in %**	**change to 1990 in %**
• transport	20,1	- 6,6
therefrom road traffic	19,1	- 4,2
• energy sector	51,0	- 7,1
• households	11,4	-33,6
• industries	11,8	-42,3
• commerce, trade, services	4,7	-43,9

Source: Umweltbundesamt, Emissionsberichterstattung der Bundesrepublik Deutschland 2009, CRF-Tabellen 1990-2007, Berichtstabellen nach dem Common Reporting Format für die Emissionsberichterstattung unter der Klimarahmenkonvention der Vereinten Nationen, April 2009 (Stand:12.11.2008); http://www.umweltbundesamt.de/emissionen/publikationen.htm

Fact is That...

...to 96% of the time a car is parked.[1]

...the average road distance driven is 10 km.[2]

...on 80% of the days of year a car is driving less than 40 km.[3]

...50 e-cars are consuming in one year the same like a discount market.[4]

...1 Mio. e-cars will rise the electricity demand in Germany with only 0,3%.[5]

---

[1] W. Kemton, J. Tomic, 2004
[2] bmvit 2007
[3] Mobilität in Deutschland 2005
[4] Gregor Hampel, VAE Distribution Berlin GmbH
[5] Franzjosef Schlafhausen, BMU

Source: The Mobiliy House

Scenario for the Climate Protection (1)

- The optimistically estimations are showing for Germany that until 2020 there will be ca. 2 Mio. e-cars on the roads
- The Federal Association for Renewable Energies e.V. forecasts 278 TWh electricity from renewable energy sources.
- Each e-car, witch is consuming in average 24kWh/100km in city traffic (Source: Autobild from 29.02.2010), can drive ca. 579.000 km/year with clean energy.

Scenario for the Climate Protection (2)

1. **Possible savings by using e-cars with Eco-Electricity Feed-in Volumes:**

Each regular e-car: 9 kg CO_2/ 100 km

That means that for each e-car with 10.000 km/year in local traffic

= 0,9 tones CO_2 per year saved

For 500 e-cars:

= 450 tones CO_2 per year saved

The advantages from the network operator and power storage optimization are not calculated.

Scenario for the Climate Protection (3)

2. Possible economies by using e-cars with Eco-Electricity Feed-in Volumes in the power grid:

- Reduce the high usage of the power grid (by smoothing the power supply) with the effect of an equable operation for the power plants, thereby improving of the efficiency

- The refurbishment of the power grid could be suspended or disabled. The result is a lower CO2 emission for the production of power grid elements and the real construction measures (trough the use of regular cars)

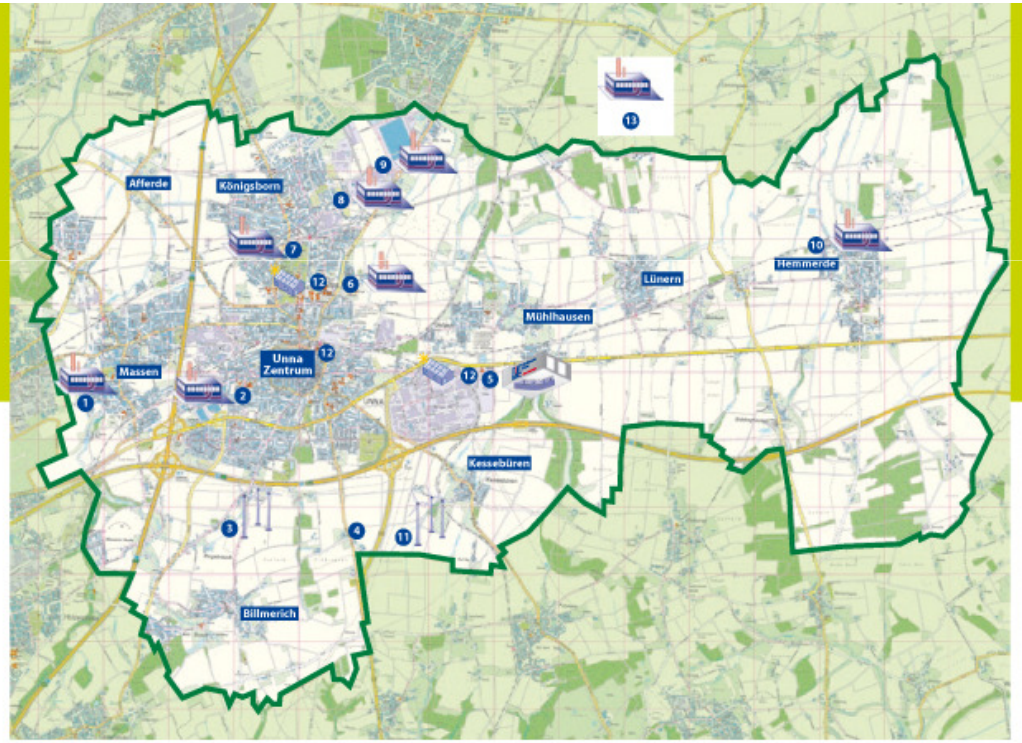
Inducement for E-Mobility

- Climate protection
- The use of the amount of Eco-Electricity Feed-in Volumes
- Accumulator
- Smart Grids

Benefits for the Grid

Photovoltaik-Anlage Schulzentrum Königsborn

Windkraftwerke auf dem Ostenberg



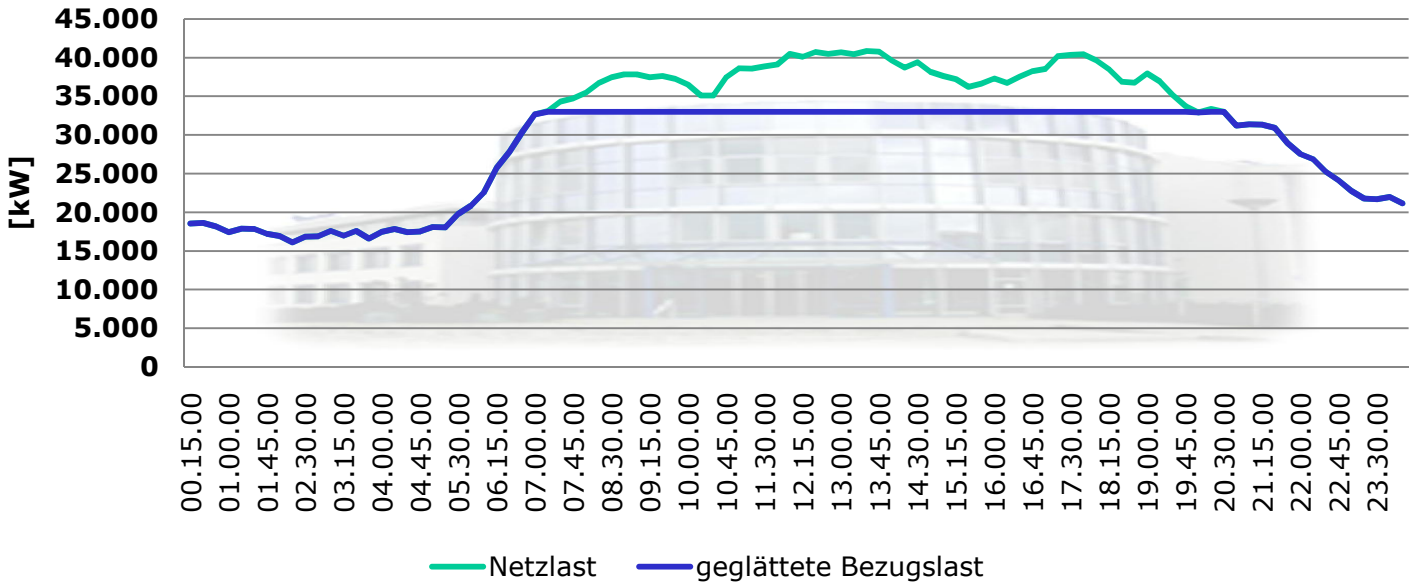
Blockheizkraftwerk 1 in der Gartenvorstadt

Gas- und Dampfturbinenkraftwerk in Hamm-Uentrop

- Connection to local power generation
- Accumulator for the Eco-Electricity Feed-in Volumes

Implications and Chances for Network Operations (1)

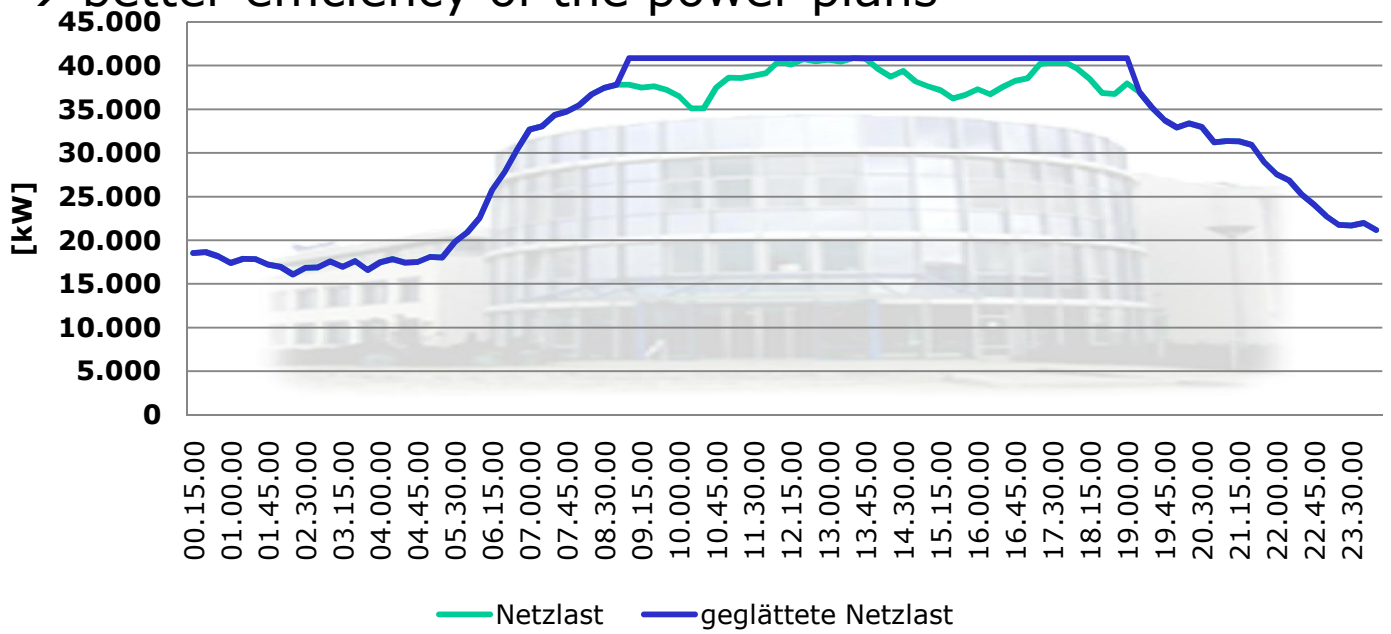
- The Eco-Electricity Feed-in Volumes can be temporarily stored in car batteries and used to improve the reference load (by lowering the high moments of grid utilization and smoothing the reference load)



Implications and Chances for Network Operations (2)

- In case that the Eco-Electricity Feed-in Volumes have a low level or the electricity purchases is short, the system load can become smoother trough the centrally optimization from the charging times of the car batteries

  → better efficiency of the power plans



Implications and Chances for Network Operations (3)

- The installed power of each car is ca. 3 kW
- That means that the optimization potential of 500 cars is 1,5 MW
- Conditions for using the optimization potential:
    - The use of smart-meters
    - A high forecasting level for energy feeds and loadings
    - The use of optimization software (like "virtual power plant")
    - cascading the supply points – in case of a high number of charging stations and user

Implications and Chances for Network Operations (4)

- The optimizing possibilities are conditioned by the acceptance of the e-mobility-users. Possibility of costumers intervention in the charging process:
  - Acceptance trough the possibility of the user to choose, if the optimization trough the network operator is desired or not. This possibility occurs in each charging process.
  - The possibility to chose doesn't have to be only YES/NO. E.g. determination of a minimal charging level for the next trip.
  - Dependent on these possibilities there can be offered special prices for costumers

→ use of Smart-Meter

Advantages for the Users

- E-Mobile for short distances or as a second car (less than 50 km to work or less than 2 h)

Producer	Typ	power [kW]	Consumption test [kWh/100km]	Range test [km]
Smart	Fortwo electric drive	30	26,5	92,5
Mitsubishi	i-MiEV	47	21,2	76,4
(Source: Autobild Nr. 8, 26.02.2010)				

- Less expensive than in the past years
- But: relatively high investment costs for the e-cars

Political Measures

- The principal motivation of the state is to reduce the CO2-Emissions from 130 g/km by gasoline/diesel to 95 g/km by e-cars

Direct state subsidies:

- USA……7.500 $
- China.....6.700 $
- UK……..5.000 $
- France……..5.000 $
- Spain……6.000 $

Business Model for Companies of Energy Supply

a) private charging stations in cooperation with supply contracts

b) public charging stations

c) smart grid companies

d) roaming companies

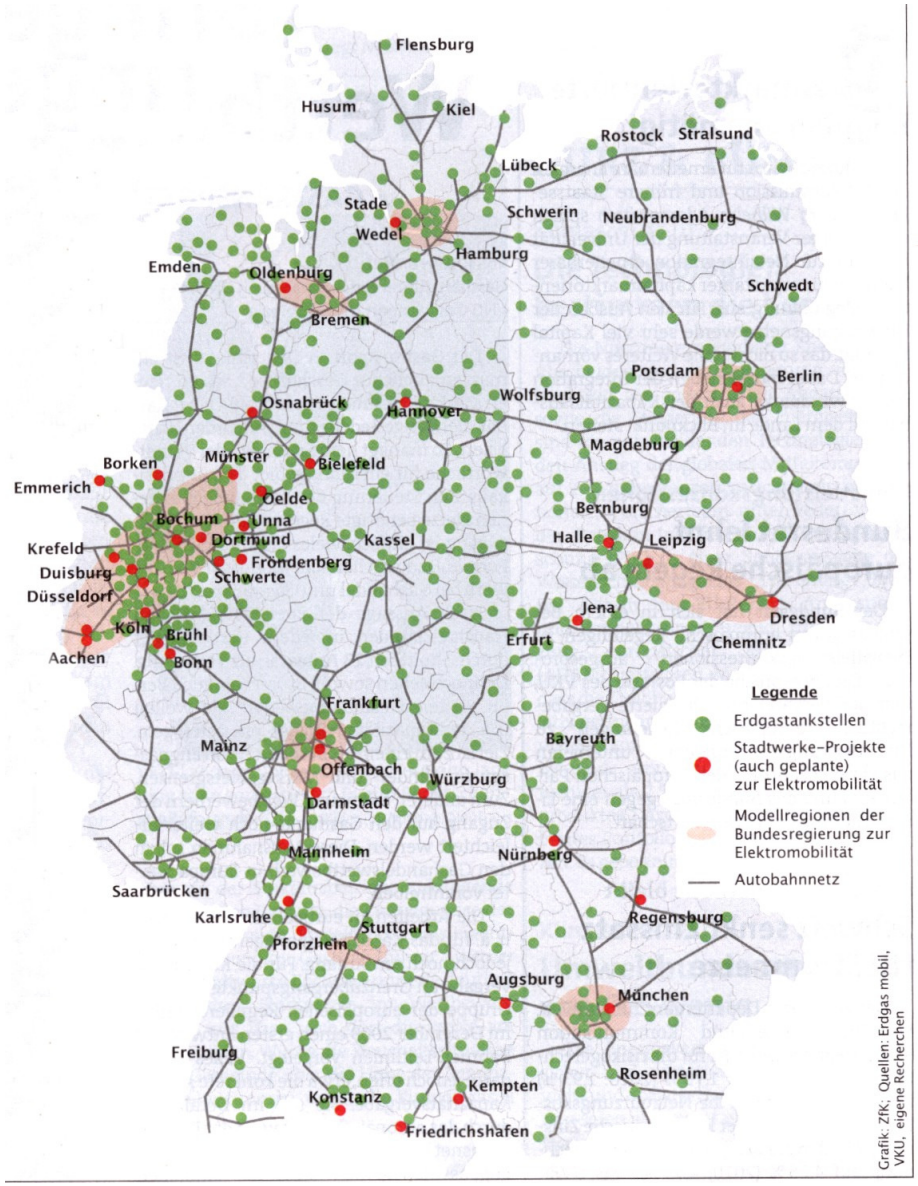
e) smart metering

Further Advantages for the Companies

- Opportune planning of the charging stations and of the infrastructure:
- private charging box < 300 €
- public charging station: electricity price > 24 ct/kWh

- One e-car is using 2.500 kWh/a for a mileage of 12.000 km, in Germany represents this ca. 2,5 TWh for 1.000 MW base load supply.

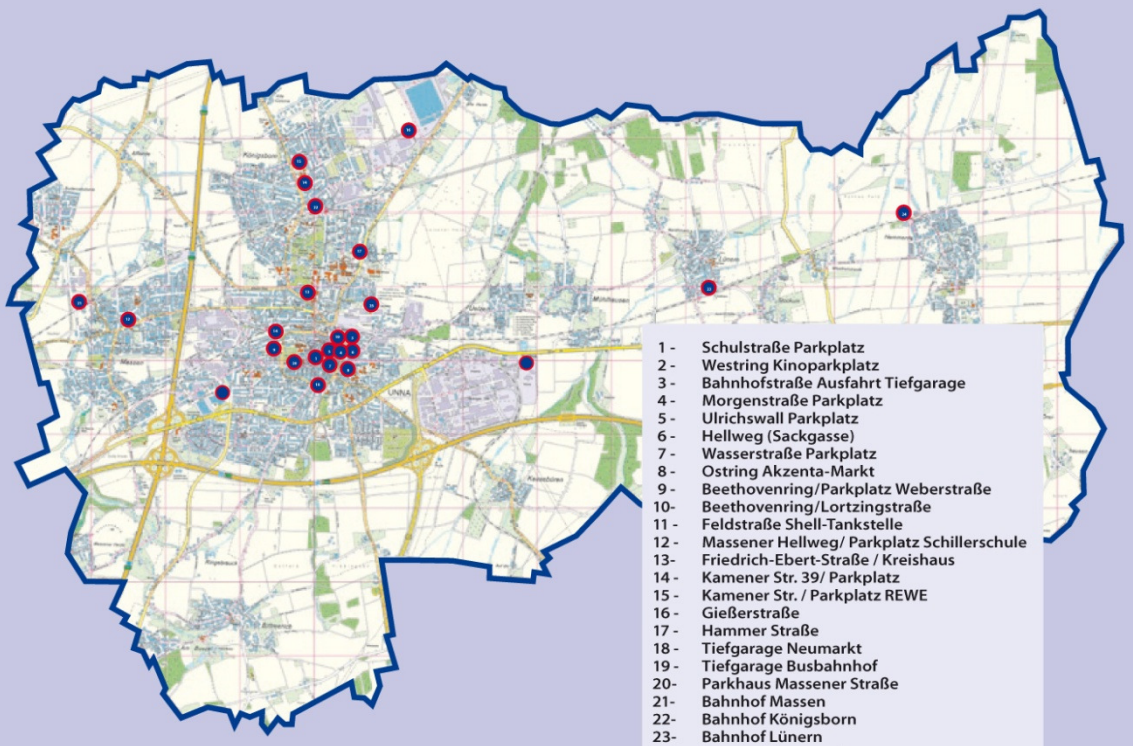
- The use of car batteries as storage for costumers and production (for private charging stations, electricity price < 16 ct/kWh, power storage to 1 GW)


Flensburg
Husum
Kiel
Rostock
Stralsund
Lübeck
Stade
Schwerin
Neubrandenburg
Wedel
Hamburg
Emden
Oldenburg
Schwedt
Bremen
Potsdam
Berlin
Osnabrück
Wolfsburg
Hannover
Magdeburg
Borken
Münster
Bielefeld
Emmerich
Oelde
Bernburg
Bochum
Unna
Halle
Leipzig
Dortmund
Kassel
Krefeld
Frondenberg
Duisburg
Schwerte
Düsseldorf
Jena
Dresden
Köln
Brühl
Erfurt
Chemnitz
Aachen
Bonn
Frankfurt
Bayreuth
Mainz
Offenbach
Würzburg
Darmstadt
Mannheim
Nürnberg
Saarbrücken
Karlsruhe
Regensburg
Stuttgart
Pforzheim
Augsburg
München
Freiburg
Rosenheim
Kempten
Konstanz
Friedrichshafen
Legende
Erdgastankstellen
Stadtwerke-Projekte (auch geplante) zur Elektromobilität
Modellregionen der Bundesregierung zur Elektromobilität
Autobahnnetz
Grafik: ZfK; Quellen: Erdgas mobil, VKU, eigene Recherchen

Stadtwerke Unna
Unsere Energie.

STANDORTPLANUNG E-TANKSTELLEN

Stadtwerke Unna
Unsere Energie.

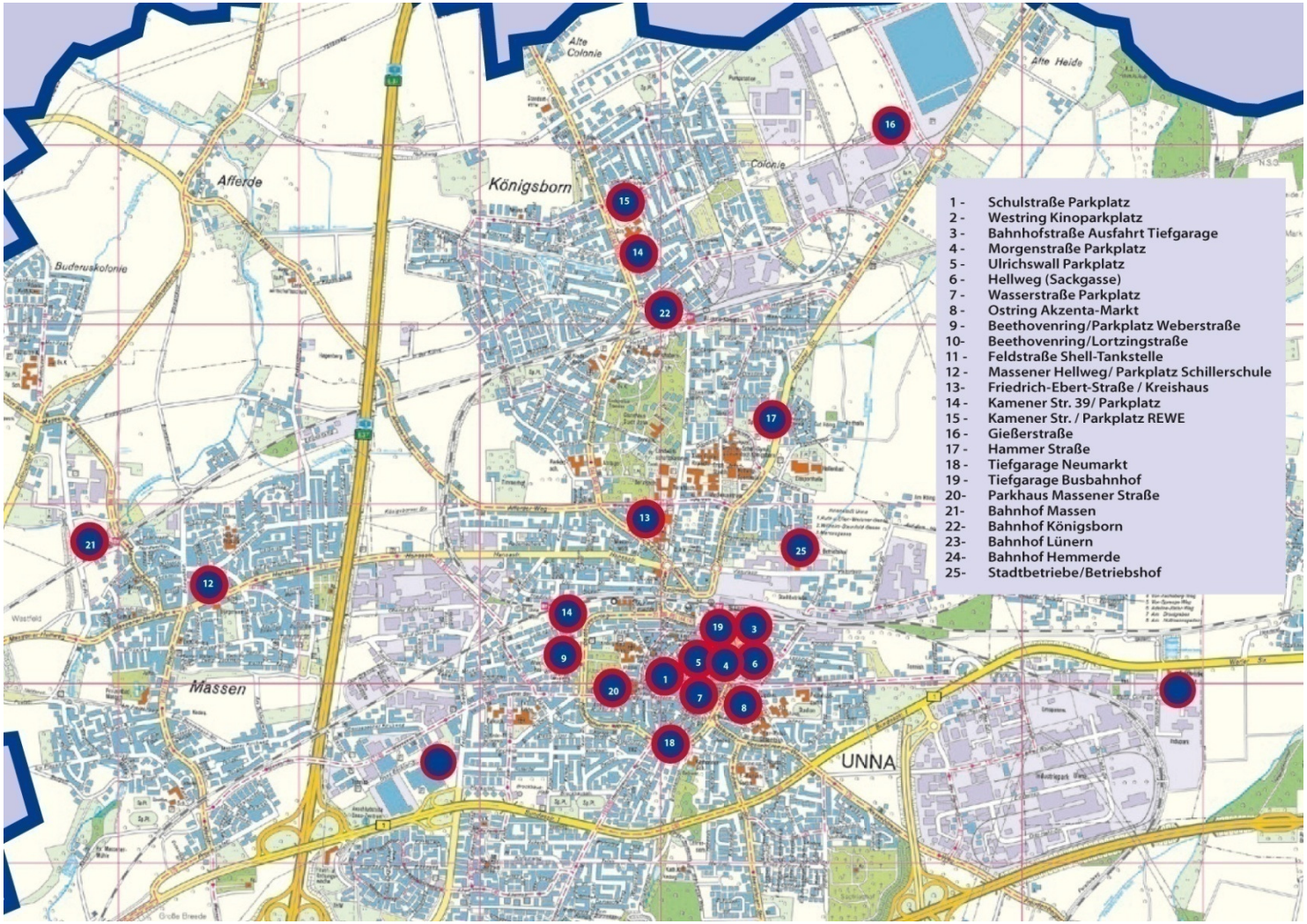


Erste Standorte

- **Zentrum**
- **Bahnhöfe**
  - Unna
  - Königsborn
  - Massen
  - Lünern
  - Hemmerde
- **Tiefgaragen**
  - Bahnhof
  - Neumarkt
- **Große Parkplätze**
- **Gewerbegebiete**
  - Indupark Süd
  - B1/Stadtwerke
  - Indupark-Nord
  - Stadtbetriebe

8

EMAS
GEPRÜFTES UMWELTMANAGEMENT
D-118-00002
ISO 14001


Alte Colonie
Alte Heide
Afferde
Königsborn
Colonie
Buderuskolonie
Massen
UNNA
1 - Schulstraße Parkplatz
2 - Westring Kinoparkplatz
3 - Bahnhofstraße Ausfahrt Tiefgarage
4 - Morgenstraße Parkplatz
5 - Ulrichswall Parkplatz
6 - Hellweg (Sackgasse)
7 - Wasserstraße Parkplatz
8 - Ostring Akzenta-Markt
9 - Beethovenring/Parkplatz Weberstraße
10- Beethovenring/Lortzingstraße
11 - Feldstraße Shell-Tankstelle
12 - Massener Hellweg/ Parkplatz Schillerschule
13- Friedrich-Ebert-Straße / Kreishaus
14 - Kamener Str. 39/ Parkplatz
15 - Kamener Str. / Parkplatz REWE
16 - Gießerstraße
17 - Hammer Straße
18 - Tiefgarage Neumarkt
19 - Tiefgarage Busbahnhof
20- Parkhaus Massener Straße
21- Bahnhof Massen
22- Bahnhof Königsborn
23- Bahnhof Lünern
24- Bahnhof Hemmerde
25- Stadtbetriebe/Betriebshof

➔ Complete a service agreement with the local authority

„Local agreement for the construction and functioning of e-mobility plans"

◇ Integrated local concept for e-mobility charging stations

- improving the local air quality
- reducing the CO2 emissions
- reducing the noise level

◇ Commissioning the operators trough the commune

◇ The map with the charging stations in the local area is part of the agreement

- The local authority is creating the conditions for the traffic road regulations
- The local authority is giving a special permission for the operator
- The right of using the streets with follow-up cost regulation
- Obligation to construct and put into service the stations
- The propriety limits are representing the link to the network operator
- The operator has the obligation for documentation (location, technical data etc.)

- The operator is obligated to make sure that the interested clients have an easy access to the stations and are not discriminated

- Obligation of connecting all installed power plains – even those from private lands – to the local distribution network

- Validity period: 20 years

E-mobility Trends

- The price for crude oil is 150$ pro Barrel – the consequence is that the regular car will be to expensive for many users
- To have „his/her own car" is not part of the image anymore
- Smog limits and city tolls are reducing the individual traffic
- Services like taxi or car sharing are replacing the individual traffic
- The car manufacturers are transforming into mobility providers

Actual Restrictions

- no standards for the Information and Communication Systems
- missing norms for plugs and power sockets systems
- no saleable serial e-cars
- global economy crisis
- the users expectance are still to high
- the plug-in-vehicle needs a international roaming for charging

Summary

➔ E-mobility is only than **ecological**, if the used energy is produced from **renewable** energy sources. If not…

- ◇ …the used oil will be only replaced trough coal or nuclear energy.
- ◇ …the operating time of the big central power plants will be extended.
- ◇ …the change of paradigm from central to decentralist (renewable) energy systems will be counteracted.

➔ Since ca. 87 % from the global Lithium resources are exported only by China, it accrues a monopoly dependence for batteries and accumulators.

➔ The energy and performance of the batteries is sufficient, but not the price, the safety and reliability.

- ➔ Factors like price, distance and size car are determining costumers to buy a second or third car; this trend is showing a potential market for 1-2 million cars.
- ➔ The dependence from energy imports (oil, coal etc.) can be reduced through the strict use of renewable energy.
- ➔ It is necessary to reduce the investment risks trough an agreement of a services contract with the local authority.
- ➔ An extensive construction of the charging infrastructure in public and private locations
- ➔ The infrastructure has to be improved by smart grids and smart metering

- ➔ Connect the e-mobility to the smart-grid and the load management trough the “virtual power plant”
- ➔ Allocate the cost from new supply investments to the grid fees of the distribution system operator
- ➔ The costs for the investments in the public charging stations have to be covered by the mobility provider
- ➔ The private owner is supporting all capital investment for private power plants (clients power plants) and the costs for connect or improve the network
- ➔ To guarantee the owners of e-cars a provider independent use of the charging stations (§§ 19, 20 GWB), it needs to develop roaming models similar to those from the branch of telecommunication

Thank You for Your Attention!

Drei Gründe, nichts zu tun

Zeichnung: Gerhard Mester