

E-mobility Development in the Context of the Egyptian-German Technical Cooperation

Dr.-Ing. Ahmed Elguindy

The future of E-mobility and Urban Planning in Egypt
20th November, 2019



Implemented by



Arab Republic of Egypt
Ministry of Electricity and
Renewable Energy



Egyptian-German Joint Committee
on Renewable Energy, Energy
Efficiency and Environmental
Protection

Overview of the German cooperation

Implementing Organizations (GIZ and KfW)



- GIZ operates in more than 120 countries worldwide
- Proud of our long-lasting partnership in Egypt dating back to 1956
- The priority areas agreed with the Egyptian government are



Renewable energy (RE) and energy efficiency (EnEff)



Water supply and sanitation, irrigation and waste management



Sustainable economic development for employment

The Egyptian-German Joint Committee for Renewable Energy, Energy Efficiency, and Environmental Protection (JCEE)

- On-going cooperation **since 2008** with the Ministry of Electricity and Renewable Energy (MoERE)
- The 4th phase of the project started in June 2019 until 2023 with a total budget of an additional EUR 7,5 million for TC/TA

The operational framework for the reduction of CO₂ intensity in electricity supply is reduced and at a consumer level improved

Renewable Energy (RE) for utility-scale projects

MoERE
Renewable Energy Authority (NREA)
Transmission Company (EETC)

Coordination of the energy efficiency (EnEFF) national strategy

MoERE
EnEff Units (EEUs)
Electricity Regulator (EgyptERA)

Dissemination of EnEff technologies

NREA
Distribution companies (DSOs)
ECO-FEI

RE and EnEff on the distribution level

DSOs
NREA

Sustainable energy and climate protection using RE and EnEff

Environmental Agency (EEAA)
MoERE

Cross-cutting topics including capacity development, policy mechanisms, awareness rising and application of innovative technologies, e.g. smart grids

The current situation since October 2018

	Topic	Description
1	Electric Vehicles (EVs)	<ul style="list-style-type: none">• More used EVs in the market according to 2018 منشور استيراد رقم 37 لسنة• New EVs from US, European and Korean markets• Locally manufactured through Ministry of Military production (MoMP)
2	Charging stations	<ul style="list-style-type: none">• Charging stations by two (2) charging point operators (CPOs) scattered across Egypt, covering shopping malls, highways and condensed residential areas in greater Cairo.• The chargers are primarily AC and located at filling stations owned by the National Petroleum Company (NPCO)
3	Electric buses	<ul style="list-style-type: none">• E-buses manufacturing line through Arab Organization for Industrialization (AOI)• Beyond the pilot and testing phase stage• The market is dominated through Chinese products
4	Policy	<ul style="list-style-type: none">• The governance structure is still in its early phase• International IEC technical standards on the national scope are still missing• Licensing initiated through EgyptERA



Agenda

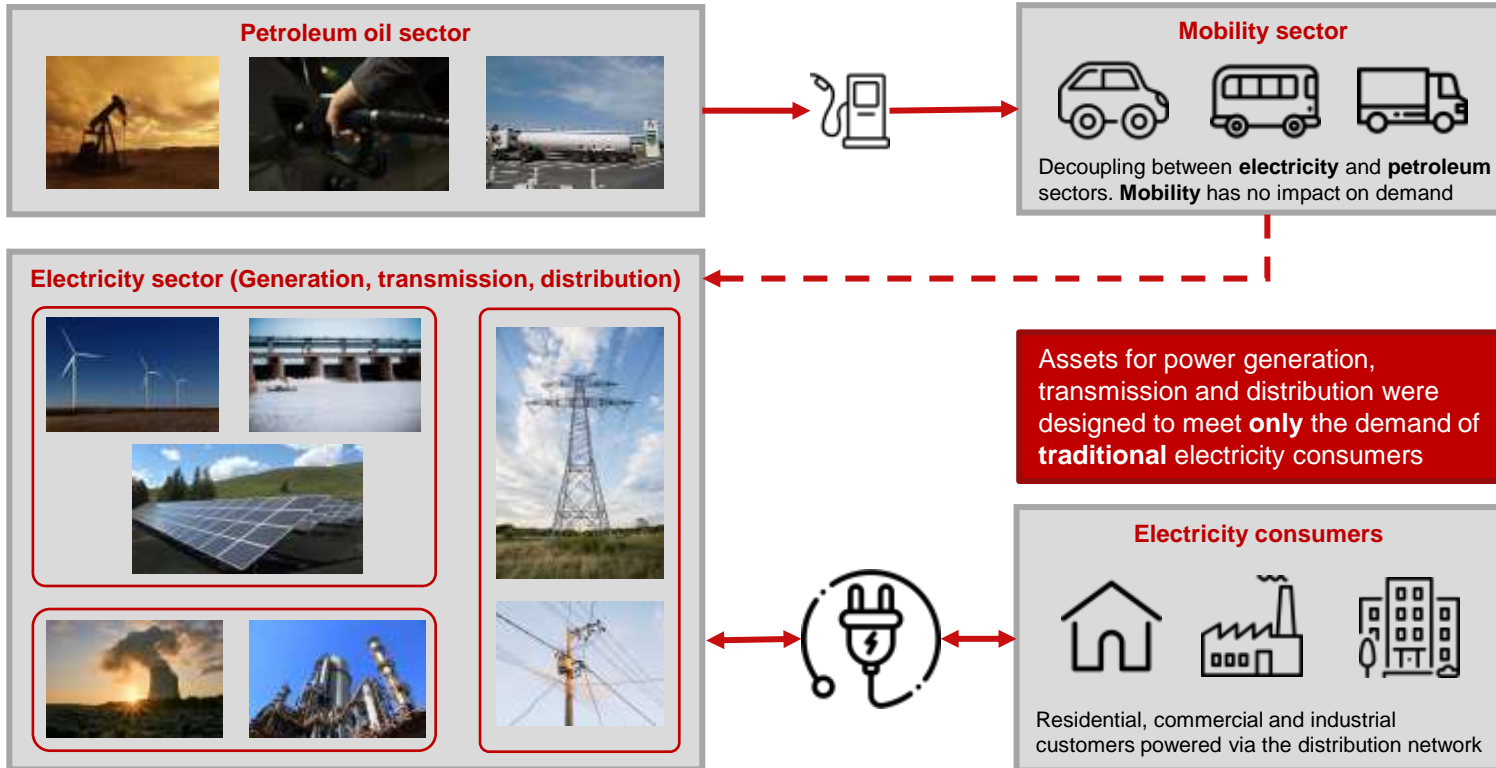
- ❑ Process landscape using the GIZ management tool Capacity WORKS
- ❑ Development of Scenarios of EVs ramp-up in Egypt (up to 2040)
- ❑ Impact of the EV fleet on the Egyptian power system
- ❑ Way forward



Icons provided
from **flaticon**

How was the study structured

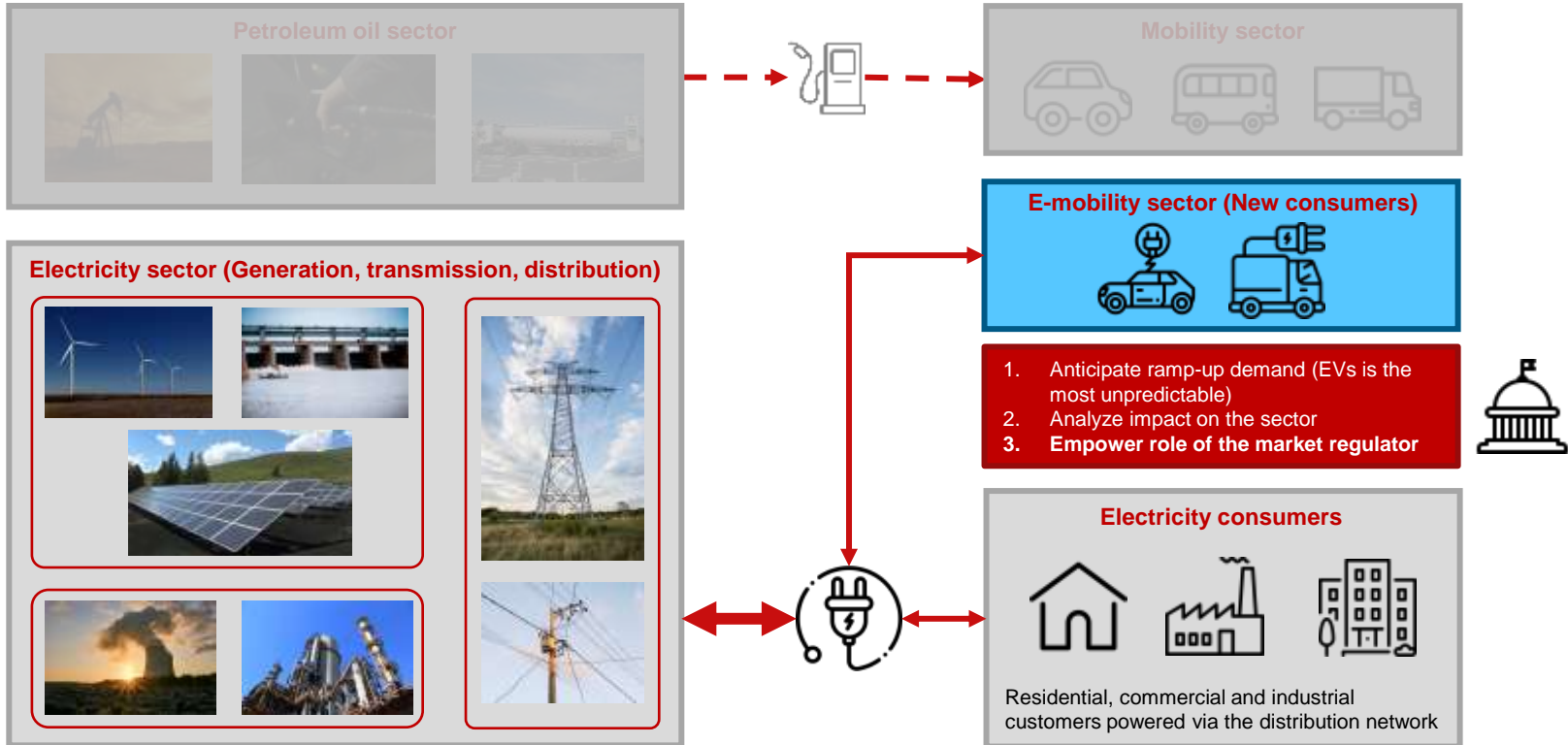
Status quo: energy supply of mobility sector is performed by fuel oil sector



Icons provided from **flaticon**

How was the study structured (cont.)

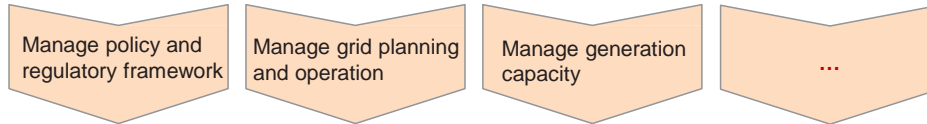
Future: energy supply of mobility sector is performed by electricity sector



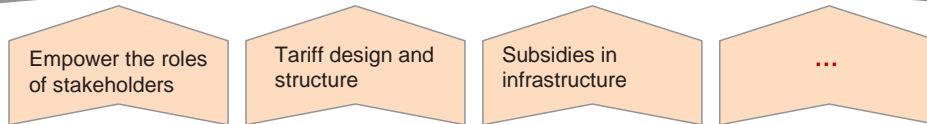
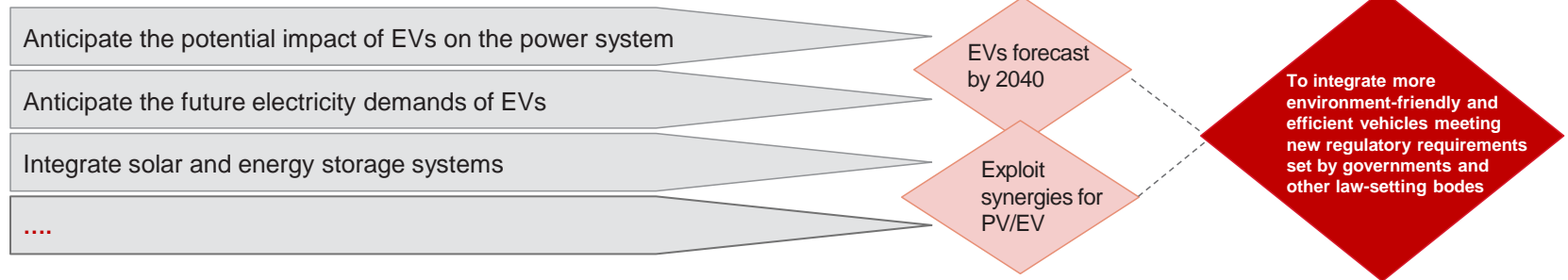
Technical cooperation through Capacity WORKS

Process landscape of E-mobility in Egypt (exemplary landscape)

Steering processes



Core processes



Support processes

The GIZ employs a total of **42 tools** clustered through its **5 success factors**

GIZ/JCEE study

(can be requested by e-mail through ahmed.elguindy@giz.de)

Evaluating the impact of integrating EVs in the Egyptian electricity sector

Dec. 2018 – Jul. 2019

Partner: MoERE
EgyptERA
North Cairo DSO

Consultant: Fichtner GmbH & Co



Strategic orientation of the stakeholders

- International best practice and policy recommendations primarily for EgyptERA
- Guidelines on tariff design structure
- Impact on various policies (incl. climate and transport)

Scenarios development of EVs ramp-up in Egypt (Topic of discussion today)

- Major criteria influencing the electricity demand of EVs
- EV fleet for different segments
- Market Penetration

Grid impact

- Anticipated electricity demand and grid loads by EVs
- Forecast of market share of EVs and its impact on the grid



Population development according to UN forecast figures

Base Scenario:

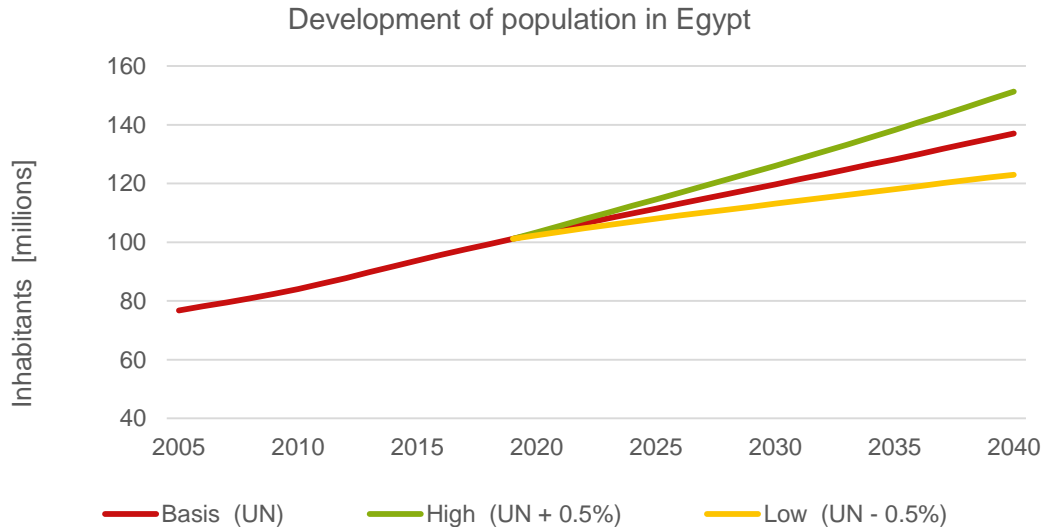
- Population growth forecast for Egypt published by United Nations (UN)
- Population growth rates ranged in between **1.3% and 1.7 %** per year

High Scenario:

- Population growth rate according to base scenario (UN) + 0.5% (calibration)

or Low Scenario:

- Population growth rate according to base scenario (UN) - 0.5%



Population 2017 standing at **97 million**
Low: 123, basic: 137, and **high: 151 Million** by 2040

Motorization rate in Egypt (2005 – 2015)

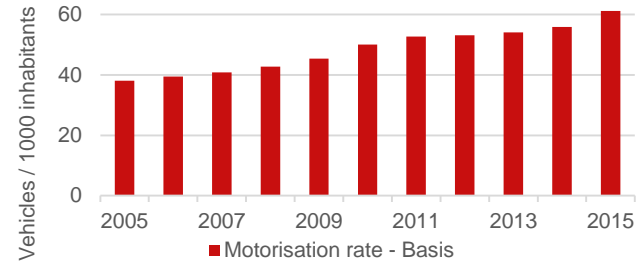
Definition:

The motorization rate (MR) represents the number of vehicle in use per **1000 inhabitants**

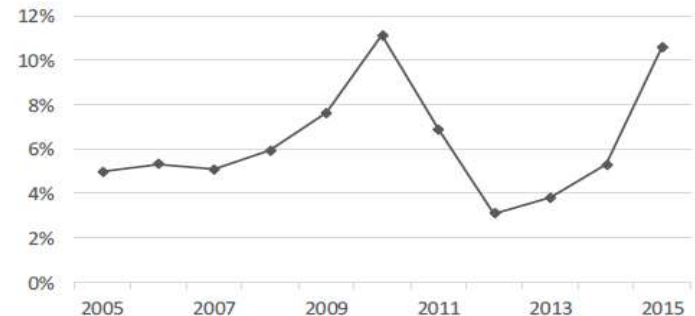
- In the period **2005-2015** the motorization rate in Egypt increased by 60% from 38 to 61 vehicles per 1000 inhabitants
- As the population was also growing considerably during this period, the increase of motorization rate was achieved by an enormous increase of total numbers of vehicles in use from **2.9 to 5.7 million**
- The growth rates are between **3% and 11% per year**

Q. How to forecast the futuristic MR up to 2040?

Development of Motorization Rate in Egypt



Annual increase of vehicles in use in Egypt



Source: International Organization of Motor Vehicle Manufacturers (OICA)

Estimation of the motorization rate by 2040

Approach considering population density

EU, Japan

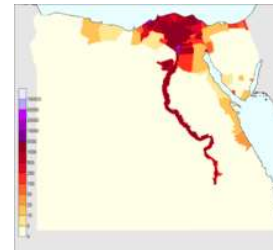
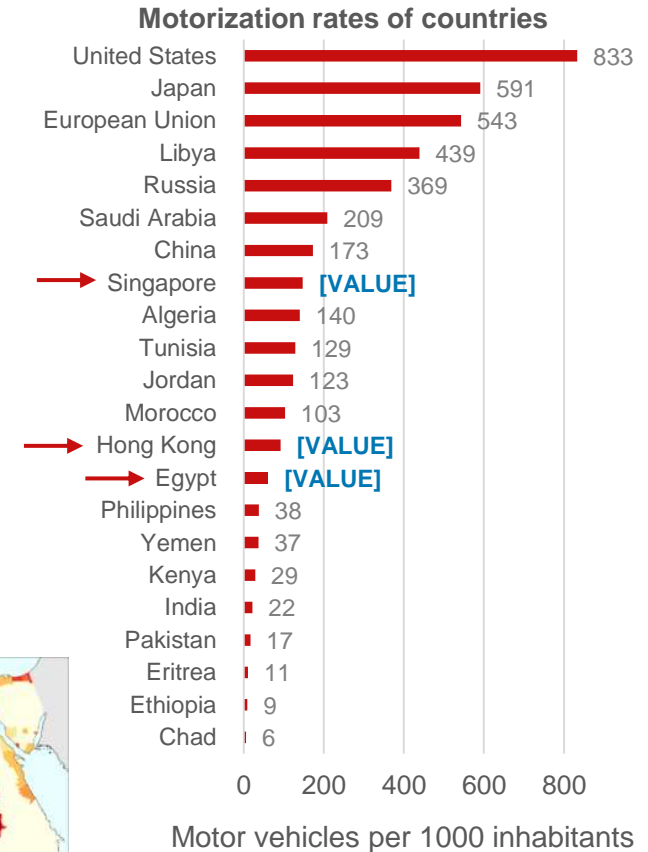
- Population spread across whole country over long distances
- Motor vehicles used to cover larger distance
- High MR level of **543 - 591**

Hong Kong, Singapore

- high population density, population lives in a “small” area
- Smaller distance to be covered during daily routines
- Rather low MR level of **92 and 147**

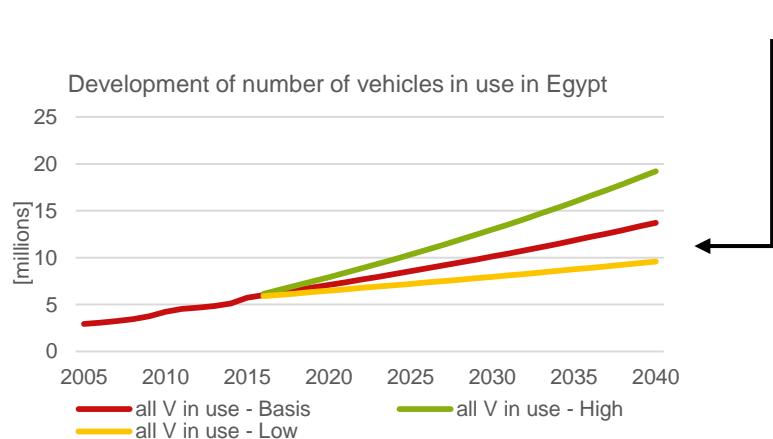
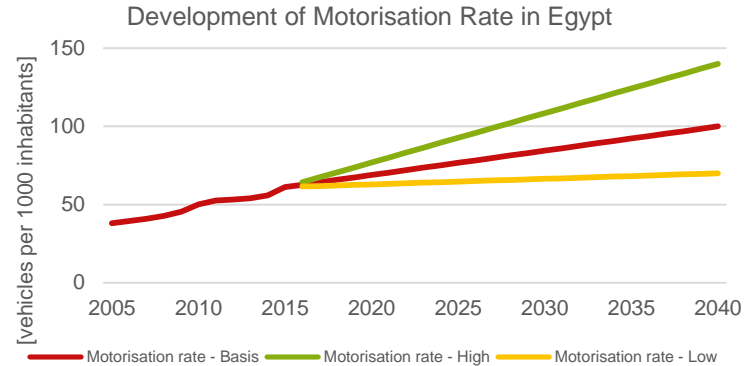
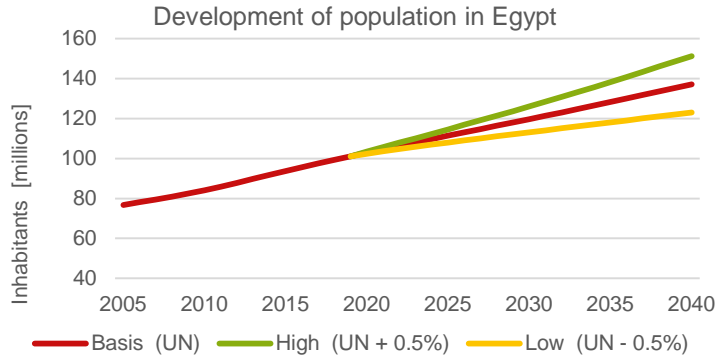
Egypt (Comparable to Hong Kong or Singapore)

- selected motorisation rate levels for Egypt for 2040 to be applied in the model:
 - **100 (basis), 140 (high), or 70 (low)**



Egypt density map
Source: Wikipedia

Forecasting the number of vehicles in use in Egypt by 2040



Low: 9.6 Mio (68%) – 2.72% per year
Base: 13.7 Mio (140%) – 5.6% per year
High: 19.2 Mio (236%) – 9.44% per year

Note: There are various secondary factors (which were not taken into account) incl. the macro- and micro-economics aspects

Decommissioning and sales of vehicles in Egypt by 2040

Factors and assumptions

Assumption for internal combustion engines (ICEs)

- **Lifetime:** 15-20 years (decommissioning of 5% per year), based on an average driving distance of 15,000 km per year in Egypt
- A detailed lifetime will depend on a variety of factors incl. regular maintenance, brand ...etc.

Assumption for (first generation) of electric vehicles

- **Lifetime:** 10-15 years. Lower than ICEs since there no international experience (**yet**) regarding battery lifetime.
- Figures may be increased in future, and affected by customs regulations منشور استيراد رقم 37 لسنة 2018
- Driven by **EV market attractiveness**

EV Market Attractiveness is defined as the degree to which from a **customer perspective** the purchase of an EV instead of a conventional vehicle is a **more attractive option, in both monetary and non-monetary terms.**



Political factors

- Charging infrastructure
- Government monetary subsidies (one-time or post-purchase)
- Non-monetary regulations (parking)



Economical factors

- Purchasing price
- Fuel price
- Maintenance cost
- Battery



Technology factors

- Driving range
- Charging time
- Charging capacity

One of the biggest and strongest catalysts for EV market attractiveness is the presence of **monetary and non-monetary government subsidies.**

Icons provided from **flaticon**

E-mobility expansion intentions / targets of selected countries

Selection of EV-share of new vehicles sales in Egypt in 2040 (Strategic target)

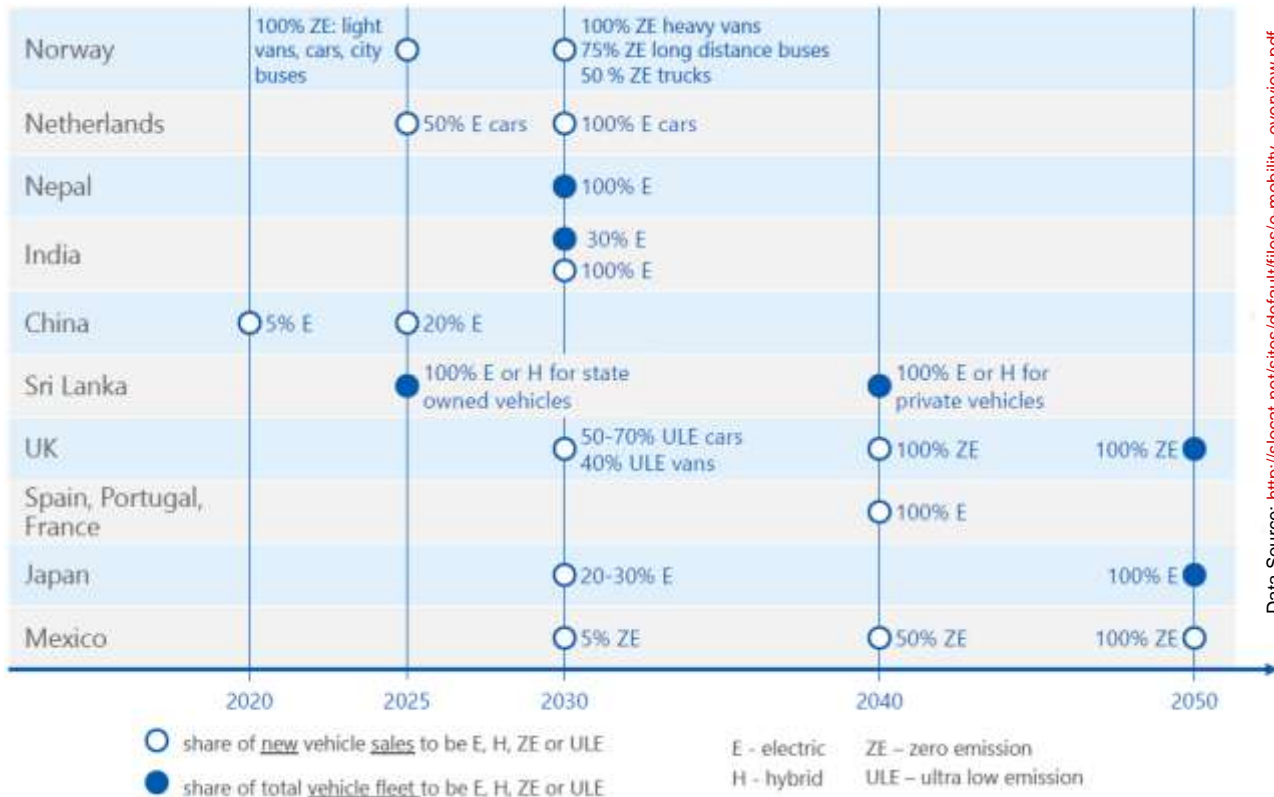
Countries worldwide have set targets for an absolute number or overall share of electric vehicles by a certain year.

(Still missing in Egypt in SDS2030 or ISES2035).

In the developed model (exponential growth expected)

- **Starting year (2019): 0%**
- **End-year (2040):**
 - basis scenario 45%
 - high scenario 75%
 - low scenario 25%

The figures are rather conservative



Data Source: http://slocat.net/sites/default/files/e-mobility_overview.pdf

Share of EVs by 2040

Putting all the pieces together

The total number of EVs in Egypt is expected to be in the range of **1.2 to 3.6 million** vehicles in 2040.

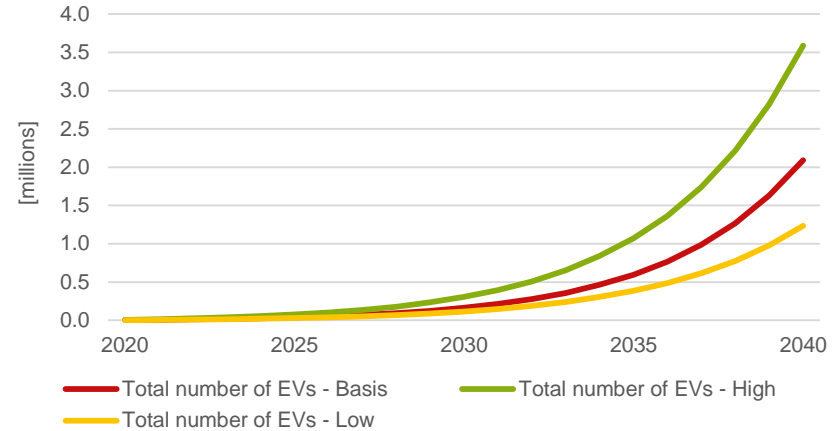
- **Low:** 9%, **Basic:** 15%, and **High:** 26% of total vehicles

The model provides rather indicative figures and cannot be considered as a complete model

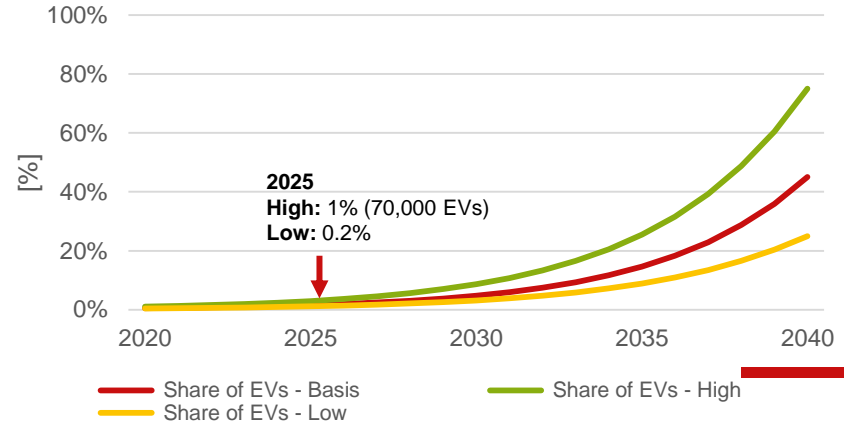
- Secondary factors are still missing
 - **Macro-economics**, incl. consumer price index, inflation rates, interest rates ...etc.
 - **Micro-economics**, incl. product pricing, product related promotion
 - EV market attractiveness (slide 16)

While the figure seem conservative, they make sense put in perspective with other countries, e.g. China 20% EV share of new sales by 2025 (previous slide)

Development of total number of EVs in Egypt



Development of share of EVs of new vehicle sales in Egypt



What else was covered in the GIZ study

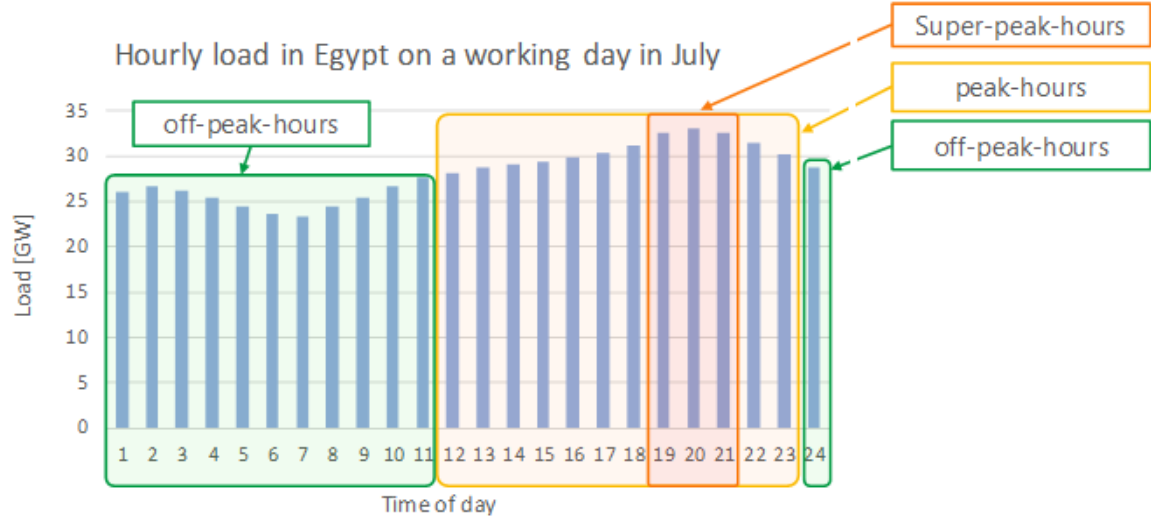
Design of the tariff structure by the Egyptian electricity regulator (EgyptERA)

Tariffs used to promote the ramp-up of e-mobility, e.g.:

- Free charging & parking or **“Pay for the service and not for the energy”** (previous model). Covers public parking space with charging infrastructure
- Reduced tariff for EV users with dedicated meter (residential)
- Time-of-use tariff (residential/public)

A **time-of-use tariff** system could be applied in Egypt

- to avoid charging in super-peak-hours and
- encourage charging in off-peak-hours



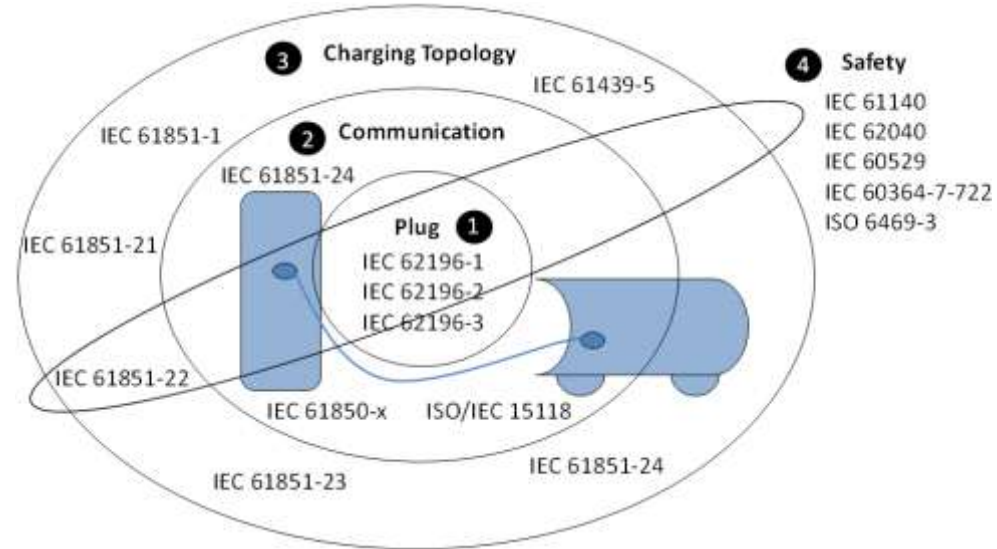
What else was covered in the GIZ study (cont.)

Licensing and standardization by EgyptERA

The allocation of licenses can be applied to control the EV market. There are different types of licensing:

- License to limit access of CPOs on the grid
- License as quality control (e.g. traders on stock exchange)

- **(Technical) requirements,**
 - construction (by building authority)
 - electrical connection, safety ...etc.
 - Terms and conditions for end customers
 - Charging standards



Source: German National Platform for E-Mobility, 2010)

What else was covered in the GIZ study (cont.)

Grid Impact analysis for regions owned by North Cairo DSO

- Stress test (geographic heat map) with different penetration levels

➤ The models were developed with DigSILENT PowerFactory

- The stress tests considered 5% penetration and 25% penetrations (possible in 15-20 years)



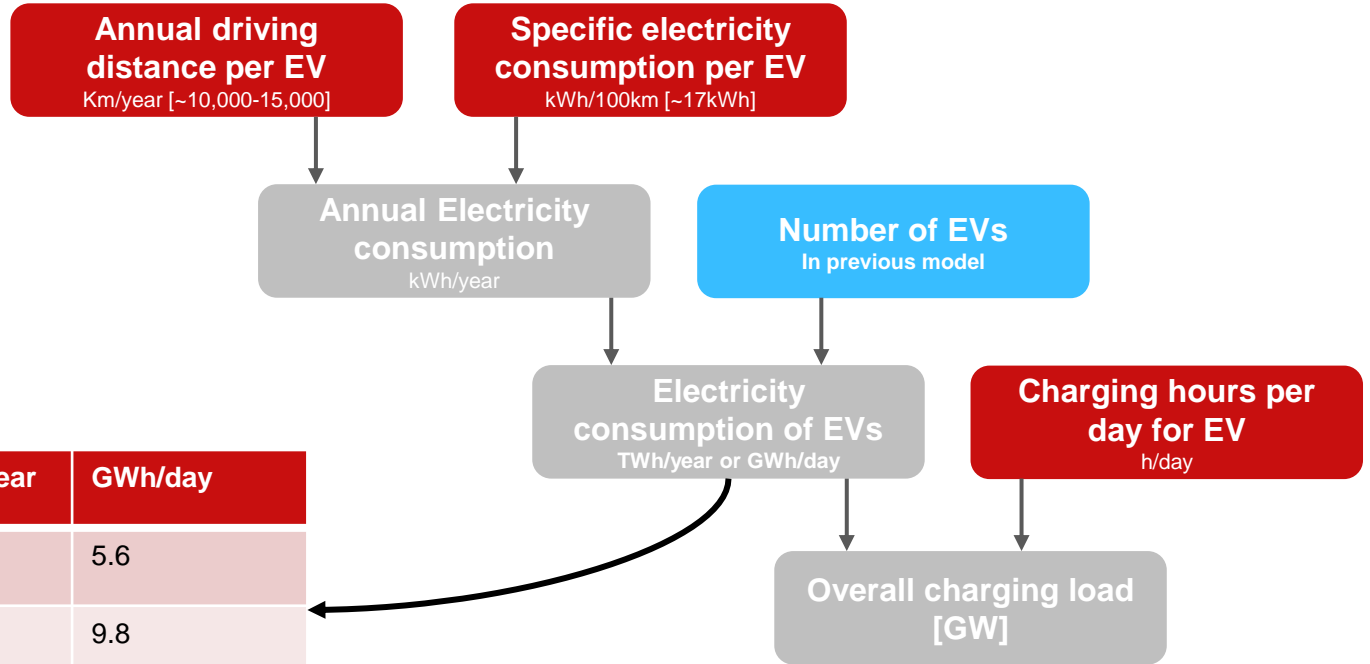
5% EV penetration



25% EV penetration

What else was covered in the GIZ study (cont.)

Determination of future electricity demand of EVs for power system planning



Scenario	EVs in 2040	TWh/year	GWh/day
Low	1.2 Mio	2.04	5.6
Basic	2.1 Mio	3.57	9.8
High	3.6 Mio	6.12	16.8 (energy needed 2040)

Closing remarks and way forward (same as 2018)

Creation of business models

1

Owning the value chain and understanding requirements of the Egyptian market

Cooperation to define the stakeholders map (actors' ecosystem)

2

Collaboration between the private and the public sector and international cooperating agencies

Education, awareness and capacity building

3

Consumers and stakeholders

Define drivers and strategy

4

EV Market Attractiveness with regards to political factors

Stay in Touch



Prof. Dr.-Ing. Ahmed Elguindy

Energy Advisor
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ)

Assistant Professor
German University in Cairo (GUC)

E ahmed.elguindy@giz.de
ahmed.essam-elguindy@guc.edu.eg

M +20 120 764 7494
+49 179 168 3721

I www.giz.de/egypt



<http://jcee-eg.net/>



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