MINISTÈRE DE LA TRANSITION ÉNERGÉTIQUE ET DU DÉVELOPPEMENT DURABLE

وزارة الانتقال الطاقي والتنمية المستدامة

Royaume du Maroc
Ministère de l'Economie et des Finances

Royaume du Maroc
Ministère de l'Intérieur

MINISTERE DES EQUIPEMENTS ET DES TRANSPORTS

Royaume du Maroc
Ministère de l'Industrie et du Commerce

المملكة المغربية
وزارة الصناعة والتجارة

# EV ROADMAP I

## FINAL RESULTS AND NEXT STEPS

CGEM

الإتحاد العام لمقاولات المغرب
Confédération Générale des Entreprises du Maroc

4 MAY, 2023

CASABLANCA

EVCONSULT

Netherlands Enterprise Agency

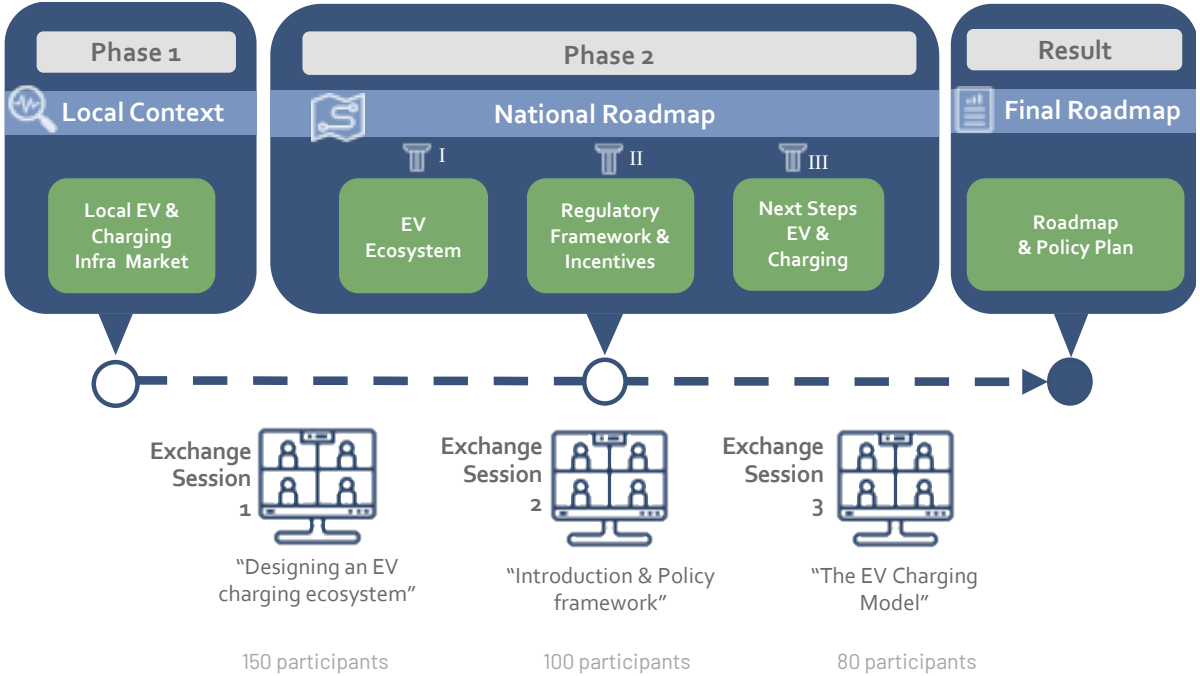
IRESEN
Institut de Recherche en Energie Solaire et en Energies Nouvelles

green energy Park

amee
Agence Marocaine pour l'Efficacité Energétique

المكتب الوطني للكهرباء و الماء الصالح للشرب
Office National de l'Electricité et de l'Eau Potable

# PROJECT OVERVIEW



# PROJECT OVERVIEW

## PHASE I

The goal of the first phase was to develop a **comprehensive overview of the market for electric vehicles and charging infrastructure in Morocco**. Information gathered during this phase served as contextual backing for the roadmap development in phase 2.

## PHASE II

The second phase was focused on developing an internationally benchmarked **EV and charging roadmap for Morocco** based on the aforementioned pillars. Recommendations identified in this phase were used to inform the roadmap and policy plan presented in the final report.

**The final roadmap presents the recommendations formulated in phase 2 and based on contextual information from phase 1 in a roadmap overview until 2035. The recommendations are combined to form a four-year policy plan for 2023-2026.**

# INTERVIEWS

**National Goverment**

- Ministère du Transport et de la Logistique
- Ministère de la transition énergétique et de développement durable
- Ministère de l'économie et des finances
- Ministère de l'industrie et du commerce
- Ministère de l'Intérieur
- Institut Marocain de la Normalisation (IMANOR)

**Private Sector**

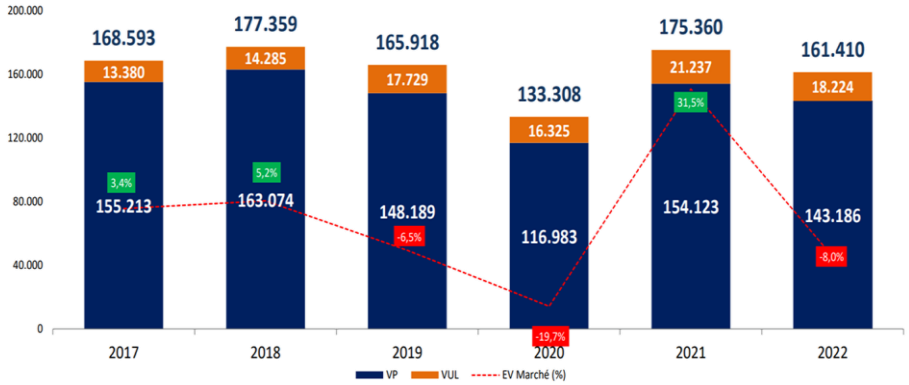
- Emob
- EMVC
- Afrimobility
- Tesla Group
- AIVAM

# 1. LOCAL CONTEXT

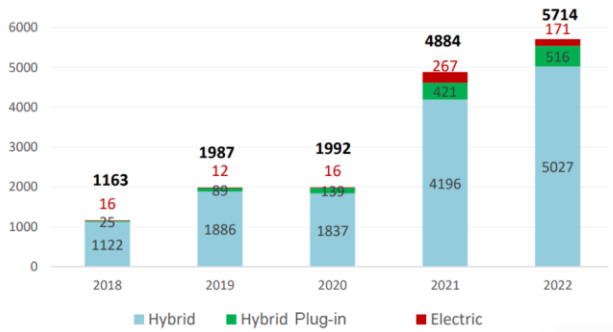
## LOCAL EV AND CHARGING INFRASTRUCTURE MARKET

# CURRENT ELECTRIC MOBILITY

## Development of the Moroccan new car market
[units/year]




## Sales of hybrid and electric vehicles
[units/year]




Source: AIVAM

# CURRENT ELECTRIC MOBILITY

## EV Adoption

More than 500 electric vehicles registered in Morocco, more than 1200 plug-in hybrid vehicles and more than 14000 hydrid vehicles.

## Charging Network

The charging network currently consists of 152 public charging points in operation (large share is located along the highway between Tangier and Agadir) and more than 650 in companies, automotive branch offices, Ministeries...

## Local Manufacturing

The first fabrication chain for EV charging stations in Morocco with the fabrication process in 2023 with a capacity of 3600 terminals annually was established in 2020 in Benguerir.

## Targets

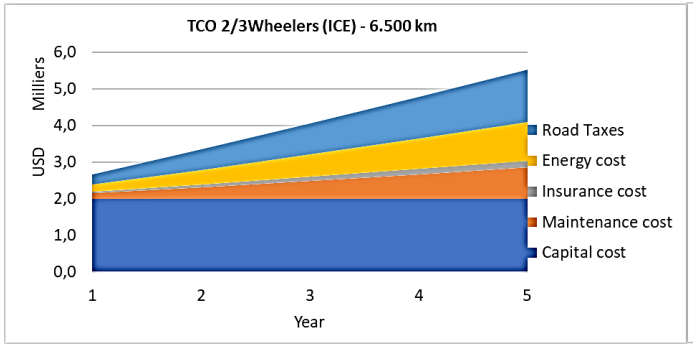
The public administration aims to raise the share of hybrid and electric vehicles in the government fleet to 30% and to reduce fuel consumption by 10% in 2021.

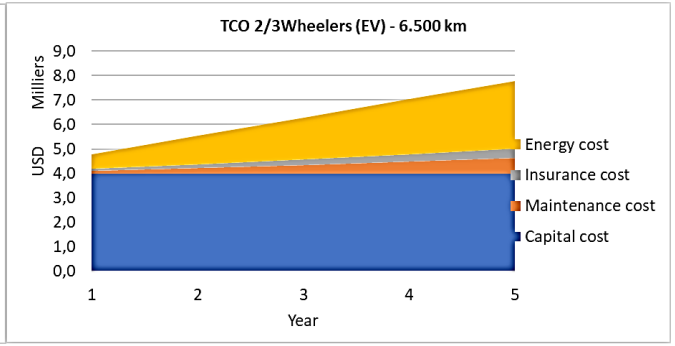
## EV Policy

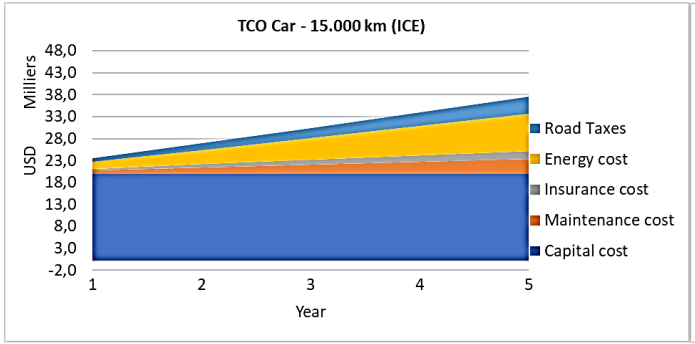
Morocco introduced a VAT tax reduction for importers and distributors of eco-friendly cars. Excise duties have been reduced to 2.5% for hybrid and electric vehicles and hybrid and electric vehicles are exempted from the luxury goods and circulating taxes

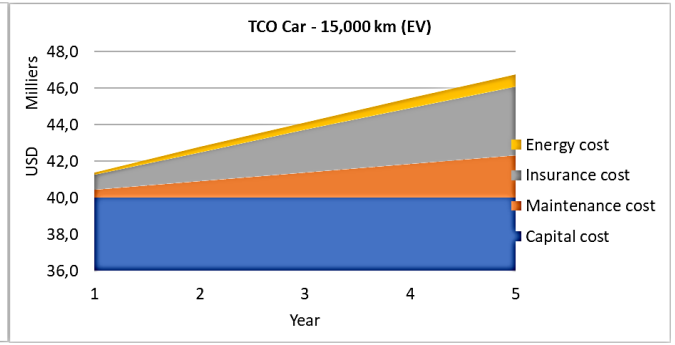
## Emission standards

As of August 2021, vehicles sold in Morocco have to comply with Euro 6 emission standards.



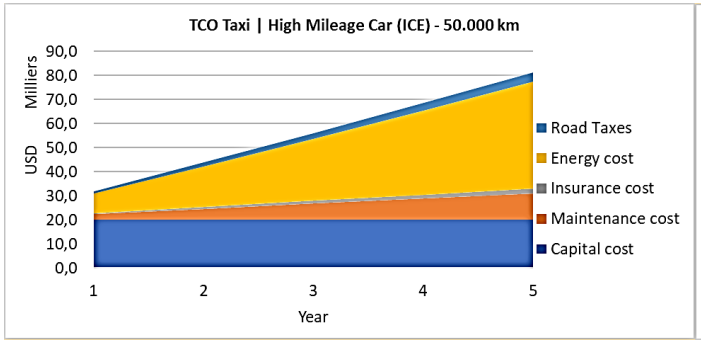



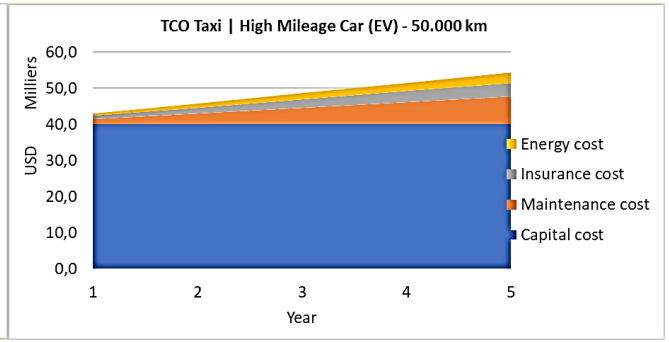



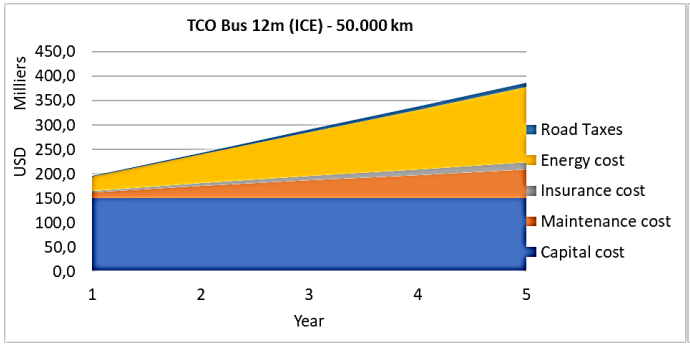



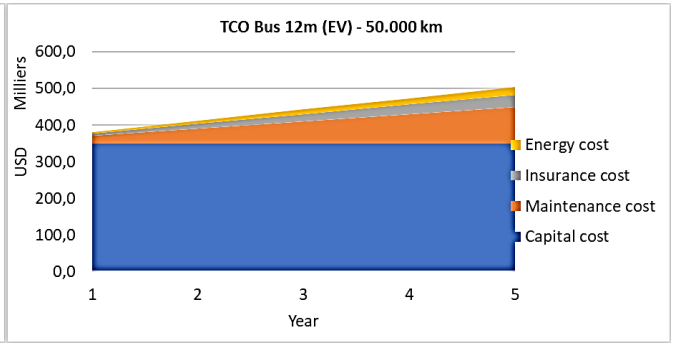

- The main takeaway of this high-level TCO analysis is that for most vehicle types, the TCO of the battery electric vehicle is higher compared to its fossil fuel counterpart.
- 2/3 wheelers are the single vehicle type for which the BEV is the more cost attractive solution.

# TOTAL COST OF OWNERSHIP




- For buses, financial incentives are required to enable and accelerate the adoption of EVs.

# INTERNATIONAL BENCHMARK

| | The Netherlands | UK | Ireland | US | Egypt |
|---|---|---|---|---|---|
| | 703 000 EV, 70 000 chargers | 660 000 EV 40 496 chargers | 47 000 EV 1900 chargers | 1 700 000 EV 130 000 chargers | ~1000 EV 400 chargers |
| EV Market Overview | **EV-charging infrastructure frontrunner** | **Extensive and pragmatic governmental growth support** | **Centralised electricity market** | **Strong incentives and policy support on federal level** | General plan outlining goals for charging stations in the short-term [2] |
| | **Independent market model, CPO's and DSO's can be separate.** | **Independent and unique e-mobility market model** | Integrated model, charging infrastructure as DSO main activity | Variance in local regulation frameworks | |
| | Incentives and subsidies for R&D&I and competition | Wide variety of active stakeholders | | **Market model highly competitive, yet fragmentation due to bottom-up market** | |
| **Governance of EV policy** | **One coordinating ministry** | **Office for Low Emission Vehicles, a cooperation of multiple ministries** | **Sustainable Energy Authority of Ireland (SEAI)** | **Presidential directives, congress laws (acts), several ministries programs** | **Fully state-owned holding under the Ministry of Electricity and Renewable Energy (MoEE)** |

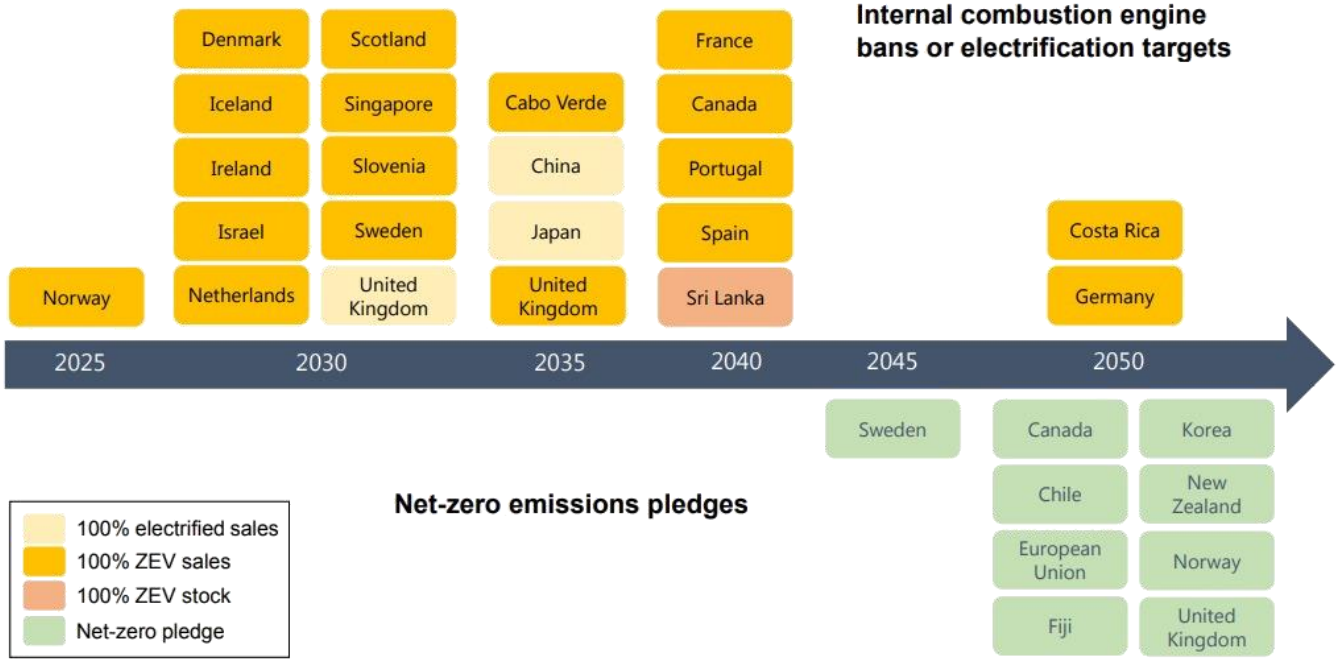
# INTERNATIONAL BENCHMARK

| | The Netherlands | UK | Ireland | US | Egypt |
|---|---|---|---|---|---|
| **Policy - Organisational** | **Green Deals, public-private** | **Public private partnership** | **Cross-sector consortium of private, public and academia** | **Coordination program to foster public-private partnerships, projects, publications and toolsets** | state-owned holding main responsible party for energy sector |
| | **Grid operator organisation** | **Office for low emission vehicles** | **Grid operator launching authority for charging** | | **Authority to develop & introduce energy technologies, e-mobility small part of the agenda**<br><br>**10 companies and consortia had qualified to tender for the management and operation of electric car charging stations** |
| | National knowledge platform charging infrastructure | Framework of EV charging projects with different approaches | Framework of EV charging projects with different approaches | | Third separate entity to regulate energy market |
| | City air quality programs | | | | |

# INTERNATIONAL BENCHMARK

| | The Netherlands | UK | Ireland | US | Egypt |
|---|---|---|---|---|---|
| **Governance and stakeholder roles** | **Grid operator (umbrella organization) installed in the beginning for a short period, then changed to competition** | **Tender by local governments to private parties.** | **Grid operator initially installs (monopoly), with future change to competition** | Charging must comply with local, state, and national regulations | The sector comprises regional generative companies, regional distribution companies and a national transmission company.<br><br>These are governed under a fully state-owned holding |
| | | **grid operator realizes the grid connection** | | Home to several prominent car OEMs | |
| | | | | Grid operators seizing opportunity for extra revenue | |
| **Market model** | **Independent** | **Independent** | Integrated, public | **Independent** | Integrated, PPP |

# EV UPTAKE SCENARIOS – INTERNATIONAL BENCHMARK (1/2)



# EV UPTAKE SCENARIOS

| | Total EV by 2025 | Total EV by 2030 | Total EV by **2035** | EV uptake by **2035** | Share of Ev-uptake by **2035** *** | Saved Emissions (Tons eqCO2/y) * | Charging Infrastructure (No. EVSE)** | | Charging infrastructure estimated cost ** (MAD) |
|---|---|---|---|---|---|---|---|---|---|
| Pessimistic | **3 GWh/year** 1700 | **10 GWh/year** 5700 | **37 GWh/year** **20300** | **7500** | **3%** | **15160** | **2780** | **720 MW** Normal Chargers: 1946 Fast Chargers: 834 | Normal Chargers: 72 mio Fast Chargers: 138 mio |
| Reference | **4,5 GWh/year** 2500 | **84 GWh/year** 46500 | **471 GWh/year** **258500** | **75000** | **30%** | **193047** | **33350** | **2 GW** Normal Chargers: **23450** Fast Chargers: **10050** | Normal Chargers: **868 mio** Fast Chargers: **1,7 Mrd** |
| Optimistic | **6,4 GWh/year** 3500 | **135 GWh/year** 74000 | **775 GWh/year** **425000** | **120000** | **46%** | **317403** | **54500** | **3 GW** Normal Chargers: 38150 Fast Chargers: 16350 | Normal Chargers: 1,4 Mrd Fast Chargers: 2,7 Mrd |

* Assumptions for CO2 emissions calculation:

- Energy consumption per EV is around 0.2 kWh / km.
- The daily journey considered is 25 km / day.
- Emissions of a fuel vehicle: 132 gCO2 / km (Diesel), 120 gCO2 / km (Petrol).
- The national electricity grid renewable share is 52% by 2030 (20% Solar, 20% Wind, 12% Hydro),the power grid's carbon footprint is 288 gCO2 / kWh

- IEA: worldwide average in 2021 is 2.4 kW per EV

** Assumptions for charging infrastructure cost estimation:

- The European Union (AFID) recommends to have minimally 1 charging point per 10 vehicles.
- The share of normal chargers is estimated at 70%, and fast chargers at 30%.
- The cost of normal chargers (22-50kW) is estimated at 10 000/100 000 MAD, the cost of fast chargers (100-200kW) is about 150 000 - 200 000 MAD

*** Market estimation:

- 260 000 cars by 2035

# E-Bus UPTAKE SCENARIOS

| | Total E-Bus by 2025 | Total E-Bus by 2030 | Total E-Bus by **2035** | E- Bus uptake by **2035** | Share of EV-uptake by **2035** *** | Saved Emissions (Tons eqCO2/y)* | Charging Infrastructure (No. EVSE)** | | Charging infrastructure estimated cost *** (MAD) |
|---|---|---|---|---|---|---|---|---|---|
| Pessimistic | **1,6 GWh/year** 12 | **5 GWh/year** 37 | **16 GWh/year** **119** | **30** | **7,5%** | **880** | **37** | **4 MW** Normal Chargers: 19 Fast Chargers: 19 | Normal Chargers: 1,85 mio Fast Chargers: 3,7 mio |
| Reference | **2 GWh/year** 15 | **20 GWh/year** 145 | **84 GWh/year** **616** | **200** | **50%** | **4600** | **214** | **21 MW** Normal Chargers: **107** Fast Chargers: **107** | Normal Chargers: **10,7 mio** Fast Chargers: **21,4 mio** |
| Optimistic | **2,7 GWh/year** 20 | **38 GWh/year** 280 | **179 GWh/year** **1310** | **400** | **100%** | **9780** | **428** | **43 MW** Normal Chargers: 214 Fast Chargers: 214 | Normal Chargers: 2,14 mio Fast Chargers: 42,8 mio |

* Assumptions for CO2 emissions calculation:

- Energy consumption per E-Bus is around 1,5 kWh / km.
- The daily journey considered is 250 km / day.
- Emissions of a fuel vehicle: 132 gCO2 / km (Diesel), 120 gCO2 / km (Petrol).
- The national electricity grid renewable share is 52% (20% Solar, 20% Wind, 12% Hydro), the power grid's carbon footprint is 288 gCO2 / kWh.

** Assumptions for charging infrastructure cost estimation:

- 3 charging points per 10 vehicles.
- The share of normal chargers is estimated at 50%, and fast chargers at 50%.
- The cost of normal chargers (50kW) is estimated at 100 000 MAD, and the cost of fast chargers (200kW) is about 200 000 MAD

*** Market estimation:

- 400 urban-buses by 2035

# E-Moto UPTAKE SCENARIOS

| | Total E-Moto by 2025 | Total E-Moto by 2030 | Total E-Moto by **2035** | E-Moto uptake by **2035** | Share of EV - uptake by **2035** *** | Saved Emissions (Tons eqCO2/y)* | Charging Infrastructure (No. EVSE)** | Charging infrastructure estimated cost *** (MAD) |
|---|---|---|---|---|---|---|---|---|
| Pessimistic | **1,4 GWh/year** 7500 | **2,5 GWh/year** 13480 | **5,7 GWh/year** **31460** | **7330** | **3,3%** | **23495** | **7 MW** Normal Chargers: 3879 | Normal Chargers: 1 mio |
| Reference | **2 GWh/year** 11000 | **10 GWh/year** 54000 | **30 GWh/year** **164000** | **35000** | **16%** | **122480** | **33 MW** Normal Chargers: **19900** | Normal Chargers: **4,8 mio** |
| Optimistic | **1,4 GWh/year** 12500 | **16,6 GWh/year** 91000 | **80 GWh/year** **438000** | **150000** | **68%** | **327111** | **100 MW** Normal Chargers: 58800 | Normal Chargers: 28 mio |

* Assumptions for CO2 emissions calculation:

- Energy consumption per EV is around 0.02 kWh / km.
- The daily journey considered is 25 km / day.
- Emissions of a fuel vehicle: 132 gCO2 / km (Diesel), 120 gCO2 / km (Petrol).
- The national electricity grid renewable share is 52% (20% Solar, 20% Wind, 12% Hydro), the power grid's carbon footprint is 288 gCO2 / kWh.

** Assumptions for charging infrastructure estimation:

- The European Union (AFID) recommendation for EV was considered for the above calculations
- The cost of chargers is estimated at 250 MAD

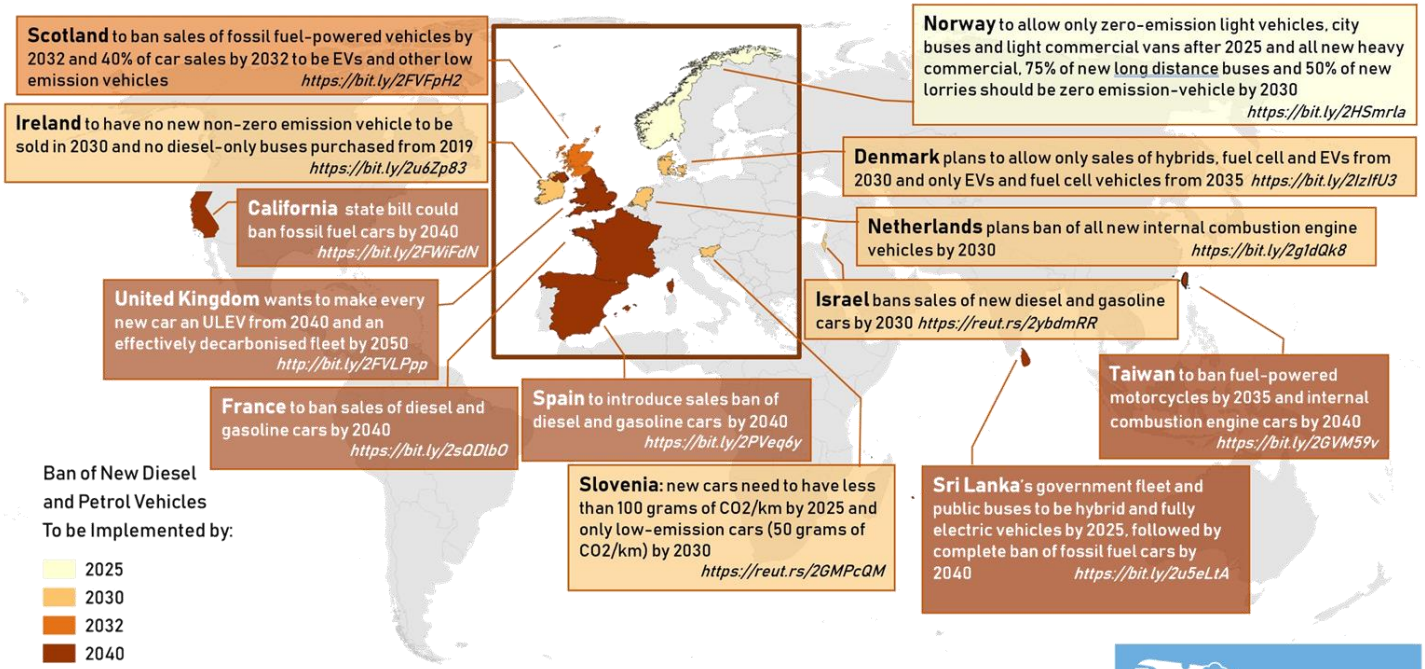
*** Market estimation:

- 220 000 two-wheelers by 2035

# EV UPTAKE SCENARIOS – INTERNATIONAL BENCHMARK (2/2)

CGEM

## Policy initiatives on the phase-out of fossil fuel vehicles




Map was produced by **The Partnership on Sustainable, Low Carbon Transport**.
For more information, please refer to E-Mobility Trends and Targets: https://bit.ly/2FQbX9g

Partnership on Sustainable Low Carbon Transport

# CURRENT ELECTRIC MOBILITY : BARRIERS

Several challenges for upscaling electric mobility in Morocco are addressed in this roadmap:

- The current number of **charging stations** is not able yet to sustain a strong growth of electric vehicles and deters potential EV buyers
- **Awareness** of EV and their benefits among drivers is in general still low
- Electric vehicles are not taken into account yet in **urban planning** and **development**
- The added electricity peak demand on the **power grid (ONEE study ongoing)**
- Missing suitable **insurance offers** for electric vehicles
- **Regulations** of EVs charging services

# CURRENT ELECTRIC MOBILITY : BARRIERS

- **Safety** concerns of EV batteries in local climate
- Lower-income households have a need for a **second-hand market** of EVs in order to replace their existing vehicles
- **Human resources** and infrastructure for training have to be consolidated
- The **support network** and the local production of **spare parts** required for maintenance and repair of EVs are undeveloped yet

# NATIONAL ROADMAP

CGEM

**1. EV ECOSYSTEM AND GOUVERNANCE**

- 1A VALUE CHAIN
- 1B GOUVERNANCE

**2. REGULATORY FRAMEWORK AND INCENTIVES**

- 2A REGULATORY FRAMEWORK
- 2B INCENTIVES

**3. NEXT STEPS FOR EV CHARGING**

- GRID – ONEE study

# EV ECOSYSTEM AND GOVERNANCE

# 1A : GOVERNANCE

- 1A.1 Initiate a public-private National Commission to coordinate the set-up of the EV roadmap (Ministery of Transport and Logistics, Ministery of Interior, Ministery of Economy and Finance, Ministery of Energy Transition and Sustainable Development, Ministery of Industry and Trade, ONEE, CGEM, APIM, Energy Federation, AMEE, IRESEN)
- 1A.2 Establish a public-private partnership between businesses, universities, research institutions and the government. (installed by the government to promote electric mobility developments, to align these with international best practices and to provide policy advise to government)
- 1A.3 Consolidate the national knowledge platform, for collecting and sharing information related to EV and charging infrastructure; Enable strong collaboration with universities and research institutions

# 1A : GOVERNANCE

- 1A.4 Define and implement a hybrid market model for charging infrastructure governance for adopting an independent model
- 1A.5 Formulate a national charging plan in line with the national scenarios, which includes agreements between public and private parties
- 1A.6 Establish a knowledge and innovation center for EV, smart charging and protocols. It guides market parties and governmental agencies on matters related to the connection of charging stations to the grid. (like the center established by ELAAD, the Dutch Grid Operator
- 1A.7 Prepare Professional Certificate in Electric Cars (ex. Delft University edX)

# 1B : VALUE CHAIN

- 1B.1 Manufacturing of EV components and charging hardware; charging services: platform and app, charge card and billing, and energy and grid.
- 1B.2 Build partnerships with foreign partners to develop integrated EV production research through joint working groups and explore joint financing, research, training mechanisms and joint production.
- 1B.3 Continue to invest in triple-helix locations like the Green Energy Park and comparable initiatives in order to foster a close transfer of knowledge between industry, research and government.
- 1B.4 Raise awareness of the economic opportunities that EV and charging can bring in the near future by taking the lead in organizing international summits creating a regional platform for policy makers, industry leaders, research experts and global innovators in the field of EV and charging.
- 1B.5 Require public tenders to mandate that at least 50% of charging infrastructure value is added by local manufacturing or assembly.

# 3. REGULATORY FRAMEWORK AND INCENTIVES

# 2A : REGULATORY FRAMEWORK

- 2A.1 Formalise “charging services” as non-regulated services to provide a clear legal framework on EV charging and the delivery of energy and implement a robust connection and tariff construction based on international best practices.
- 2A.2 Redesign the vehicle registration cost calculation based on tailpipe emissions.
- 2A.3 Formalize the checklist for import, registration and fitness test for new and reconditioned EVs.
- 2A.4 Separate registration of hybrid and fully electric vehicles.

# 2A : REGULATORY FRAMEWORK

- 2A.5 Mandate (national) goals for newly purchased urban buses (e.g. 50% e-bus acquisition in 2030, 100% urban buses electric in 2035).
- 2A.6 Mandate national goals for public procurement procedures for public administration fleet vehicles, e.g. an annually required renewal of 5% of the fleet with electric vehicles from 2024 on.
- 2A.7 Integrate gradually charging stations into the specifications of petrol stations
- 2A.8 Encourage municipalities to launch tenders for charging stations in partnership with the private sector (PPP)

# 2A : REGULATORY FRAMEWORK

- 2A.9 Adapt local electrical installation norms to incorporate safe EV charging installation requirements
- 2A.10 Formalize national charging standards for regular and fast charging, in agreement with the industry, based on European standards, to enable interoperability. Update existing norms. (Appendix H - EV related protocols)
- 2A.11 Implement low-emission zones in medinas (2026), and in cities (2028).
- 2A.12 Implement zero emission zones in medinas (2030), and in cities (2035-2040).

# 2B : INCENTIVES

- 2B.1 Provide financial incentives for zero emission vehicles until at least 2026
- 2B.2 Reduce customs duties for EV spare parts and standalone batteries to the same level as assembled EVs (2,5%)
- **2B.3 Reduce import duties for charge points until local production meets demand**
- **2B.4 Encourage local zero emission public transport buses**
- **2B.5 Provide 'green loans' for zero emission purchase of taxis and commercial fleets.**

# 2B : INCENTIVES

- 2B.6 Reduce the value added tax for EV and charging related goods incl. standalone batteries and spare parts
- 2B.7 Reduce or remove highway tolling fees for electric vehicles
- 2B.8 Provide subsidies to deploy an initial fast charging network
- **2B.9 Allow priority public parking for electric vehicles**
- **2B.10 Simplify the permitting process related to charge point installation**
- **2B.11 Implement a fast track for permits for electric taxis**
- **2B.12 Assign designated “e-taxi stops” on privileged locations in cities and airports**

# 4. NEXT STEPS FOR EV CHARGING

# 3 : NEXT STEPS FOR EV CHARGING

## Minimal Infrastructure

- 3.1 Facilitate a coalition of first-movers to set clear objectives for the share of electric vehicles in their fleets
- 3.2 Map locations with major potential for charging demand and review against electric grid expansion (ONEE study)
- 3.3 Support property developers to incorporate charging infrastructure in large-scale urban renovation or new building projects

# 3 : NEXT STEPS FOR EV CHARGING

## Minimal Infrastructure

- 3.4 Coordinate and prepare initial tenders for public/private EV charging infrastructure in the 6 prioritized cities (with a population over 500.000) and in 15 Second-tier other cities
- 3.5 Integrate gradually charging stations into the specifications of petrol stations
- 3.6 Encourage municipalities to launch tenders for charging stations in partnership with the private sector (PPP)

  - Require local charging station manufacturers as subcontractors of CPOs implementing the tenders
  - Ensure transparent charging pricing
  - Implement a strategic placement strategy
  - Allocate public funding to encourage private investment after this preparation phase

# 3 : NEXT STEPS FOR EV CHARGING

CGEM

| EV chargers for 2025 | | Minimum required number of charging points per petrol stations | Total number of charging points in petrol stations | Total required number of charging points envolving PPP/Municipalities |
|---|---|---|---|---|
| Prioritized cities | Casablanca | 6 | 30 | 35 |
| | Rabat | 3 | 15 (each city) | 20 ( each city) |
| | Agadir | | | |
| | Marrakech | | | |
| | Tanger | | | |
| | Fès | | | 15 |
| Second-tier cities | Meknès | 2 | 8 (each city) | 8 (each city) |
| | Mohammedia | | | |
| | Oujda | | | |
| | Kénitra | | | |
| | Eljadida | | | |
| | Tétouan | | | |
| | Salé | | | |
| | Safi | | | |
| | Settat | | | |
| | Errachia | | | |
| | Béni-Mellal | | | |
| | Nador | | | |
| | Larache | 1 (each city) | 4 (each city) | 5 |
| | Laayoune | | | 6 |
| | Taza | | | 5 |
| **Charging infrastructure** | | | Min 1x EV chargers at 22 kW<br>Min 1x EV chargers at 50 kW | EV chargers at 11kW/22 kW |
| **Total number of charging points in cities** | | | **108** | **242** |
| **Total required number of charging points in Highways** | | | **100** | |
| **Total of chargers** | | | **450** | (27 MW) (35 mio. MAD) |

# 3 : NEXT STEPS FOR EV CHARGING

| EV chargers for 2030 | | National distribution in petrol station | Total required number of charging points envolving PPP/Municipalities |
|---|---|---|---|
| Prioritized cities | Casablanca | Afriquia:**543**<br>Vivo:**348**<br>Total:**310**<br>Petrom:**212**<br>Ziz:**216**<br>Winxo:**203**<br>Ola:**185**<br>Autres:**82** | **250** |
| | Rabat | | **150 (each city)** |
| | Agadir | | |
| | Marrakech | | |
| | Tanger | | |
| | Fès | | |
| Second-tier cities | Meknès | | **125 (each city)** |
| | Mohammedia | | |
| | Oujda | | |
| | Kénitra | | |
| | Eljadida | | |
| | Tétouan | | |
| | Salé | | |
| | Safi | | |
| | Settat | | |
| | Errachia | | |
| | Béni-Mellal | | |
| | Nador | | |
| | Larache | | |
| | Laayoune | | **110 (each city)** |
| | Taza | | |
| | Dakhla | | |
| **Charging infrastructure** | | MIN 2x EV charging points per petrol station :<br>1 EV charger 50 kW & 1 EV charger 100/200 kW | 11, 22 kW EV chargers and 50 kW EV chargers |
| **Total number of charging points in cities** | | **4198** | **2955** |
| **Total of chargers** | | **7150** (840 MW) (655 mio. MAD) | |

# 3 : NEXT STEPS FOR EV CHARGING

## Minimal Infrastructure

- 3.7 Select 100 locations **fast charging locations** along national highways and around city edges
  - Ensure at least one fast charging location for each 100 kilometers of main expressway and at main highway hubs (i.e. interchanges)
  - Determine best-suited locations in cooperation with relevant stakeholders;
  - License commercial parties to install and operate fast charging infrastructure along highways

3.8 Stimulate solar power charging solutions by networking between the solar power sector and emerging EV charging sector

# 3 : NEXT STEPS FOR EV CHARGING

## Awareness Campaign

- 3.9 Launch an EV communications strategy focused on the positive impact of EVs in cooperation with taxi and fleet companies
- 3.10 Provide a free "Total Cost of Ownership" online tool for fleet owners and taxis
  - Take away uncertainty by giving insight into the cost factors of EVs and charging infrastructure and stimulate a view on total cost of ownership rather than purchase cost
- 3.11 Establish an EV training program for emergency services and maintenance
- 3.12 Consolidate the knowledge sharing platform and networking events for fleet owners
  - Include a central information hub with data on EV and charging in the knowledge platform

# 3 : NEXT STEPS FOR EV CHARGING

## Smart charging strategy

- 3.13 Prepare a phased smart charging strategy;
  - Include pilot projects that also include innovative solutions like vehicle-to-grid (V2G)
  - Plan for the rollout of smart meters (a precondition for smart EV grid integration)
- 3.14 Develop a National Battery Plan to support local manufacturing, maintenance, second-life applications and battery recycling
- 3.15 Launch a Battery Competence Center to bundle knowledge and strengthen the competitive position of Morocco

# ROADMAP AND POLICY PLAN

Overview of all recommendations in a roadmap and a four-year policy plan.

# PHASE I : LAUNCH PHASE

- This **first stage covers the period 2023 to 2026** and aims to shape the electric mobility market as well as to **put in place the appropriate governance: a national commission (public-private)** and should be structured into different executive committees whose mission is to guide and support the competent bodies in the deployment of actions in the different phases at the level of each of the axes and to **support the elaboration of the regulatory and normative framework**. Thus, the **objective of achieving a public minimal charging infrastructure (450 chargers: gasoline stations and communes)** is to be considered by 2025.
- In addition, this period will see the **advent of local manufacturers of electric vehicles and their spare parts as well as producers of charging solutions**, **thus allowing the Kingdom to position itself on an important part of the value chain.** This local integration will thus make it possible **to strengthen the national charging infrastructure on major roads and major Moroccan cities (6 priorities cities and than 15 other cities)**. In terms of governance, a hybrid market model will be put in place, where several **key partners will be solicited for the installation of public charging infrastructures**. Thus, through the first actions carried out by government institutions, these pioneering actions will serve as a basis for a rise in power during the second phase.
- A **gradual transition of public transport means – taxis and buses – should also be taken into consideration**.

# PHASE II : RAMP UP PHASE

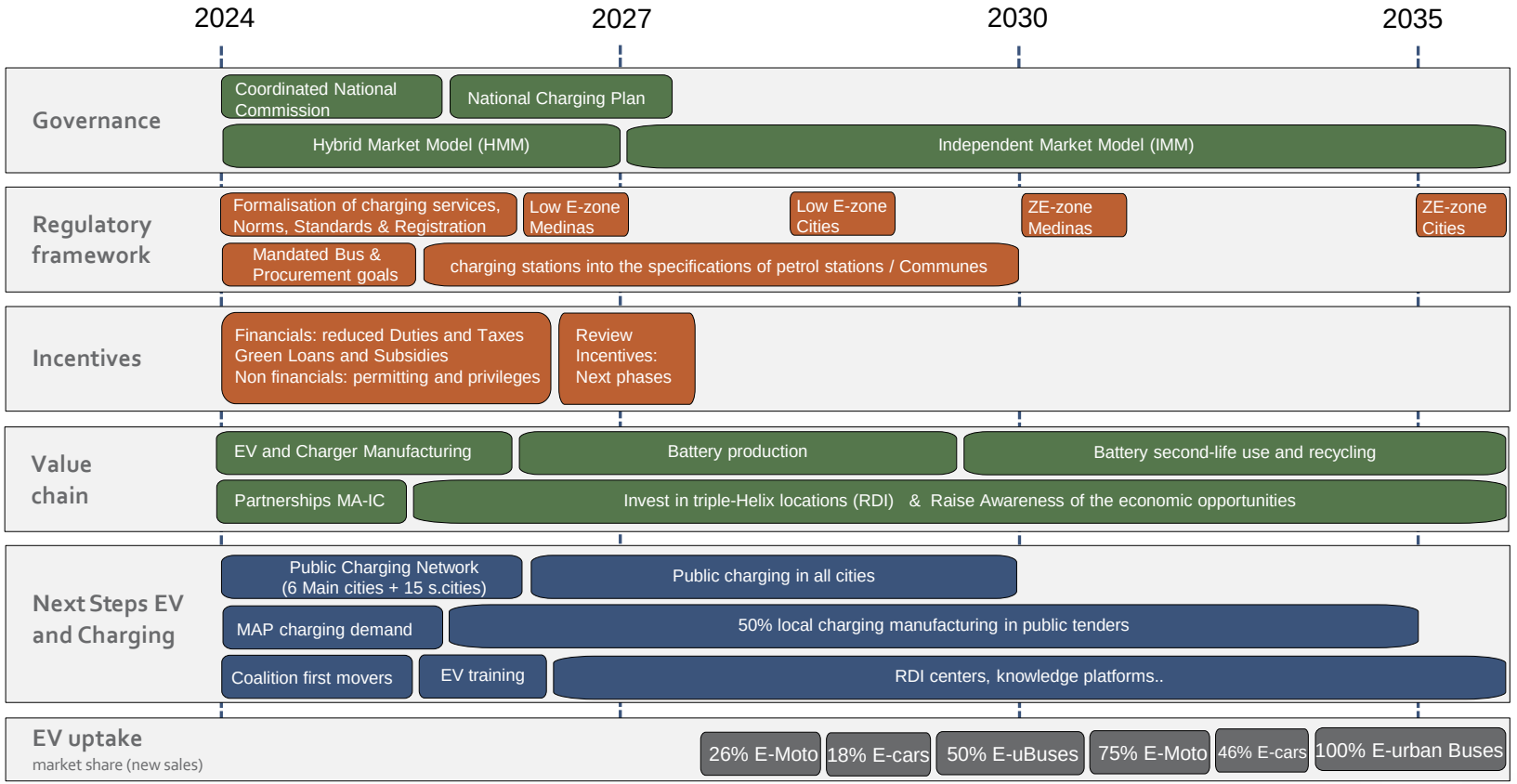
- This phase will span the period **2027 to 2030 and will capitalize on the achievements of the previous phase**. Furthermore, a reassessment of the incentive measures will be necessary in order to meet the specific needs of this stage. **Urban buses and taxis could reach a 50% market share in 2030, followed by two- and three-wheeled vehicles which could reach 26% in 2030 and cars 18% market share.**
- The **deployment of public charging infrastructure** will have to be in line with the **evolution of the fleet of electric vehicles**: **nationally distributed public charging infrastructure including normal and fast chargers (7150 chargers)**.
- In addition, an **action plan will be defined for the supervision and analysis of the data collected**, while **organizing workshops to raise awareness**, share and promotion of the electric mobility market in order to inform stakeholders in the public and private sectors.

# PHASE II : RAMP UP PHASE

- The **local production of batteries should be considered as a crucial element of the value chain in Morocco**. Indeed, automotive industrialists such as Renault, Stellantis and Tesla have announced a drop in the cost of lithium-ion batteries by 2030 of up to $80/kWh compared to $150/kWh currently. This will allow a **better positioning of Moroccan industrialists on the battery value chain, while promoting local materials**.
- On the other hand, a **circular economy approach should be considered through the recycling of batteries used in renewable energy projects**. Furthermore, and following the necessary **regulatory and organizational changes, an independent market may emerge**. In terms of regulations, a **phased approach for low and zero emission zones will require the implementation of 0-emission vehicles in urban areas**.

# PHASE III : MATURITY PHASE

- The two **previous phases will lead to the "maturity" phase** which will begin from 2031 to 2035, during which the **ecosystem will be set up and where the support and coordination of public authorities may be reduced**.
- **Up to 100 % of the market share of urban Bus fleets, up to 46% electric cars and 75% two-wheelers by 2035.**
- The **public charging infrastructure will integrate more than 30000 chargers and will be deployed in all Moroccan cities.**
- **Previous efforts will have made it possible to use and recycle batteries**. Indeed, considering all the links of the New Development Model, an unprecedented boom of decentralized renewable systems is expected, particularly in industrial applications, which will give batteries a second life.
- It is also essential to **continuously assess the impact of policy measures**, in order to be in sync with the evolution of prices and technology**. Incentives may eventually be removed as electric vehicles** will in most cases have reached price parity with fossil fuel vehicles




# ROADMAP TIMELINE

# 5. APPENDICES
# UPTAKE SCENARIOS
# CHARGER COST - ENERGY

# APPENDIX I/ EV UPTAKE SCENARIOS

| R | | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total EV /year | | 1500 | 2500 | 4500 | 8500 | 15500 | 26500 | 41500 | 61500 | 87000 | 119000 | 156000 | 258500 | 333500 |
| EV uptake /year | | 1000 | 2000 | 4000 | 7000 | 11000 | 15000 | 20000 | 25500 | 32000 | 37000 | 46000 | 75000 | |
| Chargers | | | 450 | | | | | 6150 | | | | | 33350 | |
| Charging Infrastructure | Normal Chargers | | 315 | | | | | 4305 | | | | | 23345 | |
| | Fast Chargers | | 135 | | | | | 1845 | | | | | 10005 | |
| Charging infrastructrure estimated cost ••• (,-MAD) | Normal Chargers | | 9450000 | | | | | 129150000 | | | | | 700350000 | |
| | Fast Chargers | | 27000000 | | | | | 369000000 | | | | | 2001000000 | |

| P | | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total EV /year | | 1500 | 1700 | 2100 | 2700 | 3500 | 4500 | 5700 | 7200 | 9200 | 11800 | 15300 | 20300 | 27800 |
| EV uptake /year | | 200 | 400 | 600 | 800 | 1000 | 1200 | 1500 | 2000 | 2600 | 3500 | 5000 | 7500 | |
| Chargers | | | 210 | | | | | 720 | | | | | 2780 | |
| Charging Infrastructure | Normal Chargers | | 147 | | | | | 504 | | | | | 1946 | |
| | Fast Chargers | | 63 | | | | | 216 | | | | | 834 | |
| Charging infrastructrure estimated cost ••• (,-MAD) | Normal Chargers | | 4410000 | | | | | 15120000 | | | | | 58380000 | |
| | Fast Chargers | | 12600000 | | | | | 43200000 | | | | | 166800000 | |

| O | | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total EV /year | | 1500 | 3500 | 7000 | 13000 | 24000 | 44000 | 74000 | 114000 | 169000 | 233000 | 324000 | 425000 | 545000 |
| EV uptake /year | | 2000 | 3500 | 6000 | 11000 | 20000 | 30000 | 40000 | 55000 | 70000 | 85000 | 101000 | 120000 | |
| Chargers | | | 700 | | | | | 11400 | | | | | 54500 | |
| Charging Infrastructure | Normal Chargers | | 490 | | | | | 7980 | | | | | 38150 | |
| | Fast Chargers | | 210 | | | | | 3420 | | | | | 16350 | |
| Charging infrastructrure estimated cost ••• (,-MAD) | Normal Chargers | | 14700000 | | | | | 233400000 | | | | | 1144500000 | |
| | Fast Chargers | | 42000000 | | | | | 684000000 | | | | | 3270000000 | |

# APPENDIX II/ E-Bus UPTAKE SCENARIOS

| R | | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total EBUS /year | | 10 | 15 | 25 | 40 | 65 | 100 | **145** | 205 | 280 | 365 | 456 | 616 | 816 |
| EBUS uptake /year | | 5 | 10 | 15 | 25 | 35 | 45 | 60 | 75 | 85 | 91 | 160 | 200 | |
| Chargers | | 2 | 4 | 8 | 14 | 16 | 24 | 35 | 50 | 69 | 32,5 | 124 | 164 | 214 |
| Charging Infrastructure | **Normal Chargers** | 1 | 2 | 4 | 7 | 8 | 12 | 17,5 | 25 | 34,5 | 46,25 | 62 | 82 | 107 |
| | **Fast Chargers** | 1 | 2 | 4 | 7 | 8 | 12 | 17,5 | 25 | 34,5 | 46,25 | 62 | 82 | 107 |
| Charging infrastructrure estimated cost *** (,-MAD) | **Normal Chargers** | 100000 | 200000 | 400000 | 700000 | 800000 | 1200000 | 1750000 | 2500000 | 3450000 | 4625000 | 6200000 | 8200000 | 10700000 |
| | **Fast Chargers** | 200000 | 400000 | 800000 | 1400000 | 1600000 | 2400000 | 3500000 | 5000000 | 6900000 | 3250000 | 12400000 | 16400000 | 21400000 |
| **P** | | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| Total EBUS /year | | 10 | 12 | 15 | 19 | 24 | 30 | 37 | 46 | 58 | 73 | 94 | 119 | 149 |
| EBUS uptake /year | | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 12 | 15 | 21 | 25 | 30 | |
| Chargers | | 1 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 15 | 18 | 24 | 30 | 37 |
| Charging Infrastructure | **Normal Chargers** | 0,5 | 1,5 | 2 | 2,5 | 3 | 4 | 5 | 6 | 7,5 | 9 | 12 | 15 | 18,5 |
| | **Fast Chargers** | 0,5 | 1,5 | 2 | 2,5 | 3 | 4 | 5 | 6 | 7,5 | 9 | 12 | 15 | 18,5 |
| Charging infrastructrure estimated cost *** (,-MAD) | **Normal Chargers** | 50000 | 150000 | 200000 | 250000 | 300000 | 400000 | 500000 | 600000 | 750000 | 900000 | 1200000 | 1500000 | 1850000 |
| | **Fast Chargers** | 100000 | 300000 | 400000 | 500000 | 600000 | 800000 | 1000000 | 1200000 | 1500000 | 1800000 | 2400000 | 3000000 | 3700000 |
| **O** | | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** |
| Total EBUS /year | | 10 | 20 | 40 | 70 | 120 | 190 | **280** | 400 | 550 | 740 | 990 | 1310 | 1710 |
| EBUS uptake /year | | 10 | 20 | 30 | 50 | 70 | 90 | 120 | 150 | 190 | 250 | 320 | 400 | |
| Chargers | | 4 | 8 | 16 | 28 | 36 | 48 | 70 | 100 | 138 | 185 | 248 | 328 | 428 |
| Charging Infrastructure | **Normal Chargers** | 2 | 4 | 8 | 14 | 18 | 24 | 35 | 50 | 69 | 32,5 | 124 | 164 | 214 |
| | **Fast Chargers** | 2 | 4 | 8 | 14 | 18 | 24 | 35 | 50 | 69 | 32,5 | 124 | 164 | 214 |
| Charging infrastructrure estimated cost *** (,-MAD) | **Normal Chargers** | 200000 | 400000 | 800000 | 1400000 | 1800000 | 2400000 | 3500000 | 5000000 | 6300000 | 3250000 | 12400000 | 16400000 | 21400000 |
| | **Fast Chargers** | 400000 | 800000 | 1600000 | 2800000 | 3600000 | 4800000 | 7000000 | 10000000 | 13800000 | 18500000 | 24800000 | 32800000 | 42800000 |

# APPENDIX III/ E-Moto UPTAKE SCENARIOS

| R | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO /year | 6000 | 11000 | 17000 | 24000 | 32000 | 42000 | 54000 | 69000 | 87000 | 109000 | 134000 | 164000 | 199000 |
| eMOTO uptake /year | 5000 | 6000 | 7000 | 8000 | 10000 | 12000 | 15000 | 18000 | 22000 | 25000 | 30000 | 35000 | 40000 |
| **Chargers** | 1100 | 1700 | 2400 | 3200 | 4200 | 5400 | 6300 | 8700 | 10900 | 13400 | 16400 | 19900 | 0 |

| P | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO /year | 6000 | 7500 | 8330 | 9330 | 10430 | 11820 | 13480 | 15480 | 18140 | 21470 | 25800 | 31460 | 38790 |
| eMOTO uptake /year | 1500 | 830 | 1000 | 1160 | 1330 | 1660 | 2000 | 2660 | 3330 | 4330 | 5660 | 7330 | |
| **Chargers** | 750 | 833 | 933 | 1043 | 1182 | 1348 | 1548 | 1814 | 2147 | 2580 | 3146 | 3879 | 0 |

| O | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO | 6000 | 12000 | 20000 | 30000 | 44000 | 63000 | 91000 | 131000 | 183000 | 248000 | 328000 | 438000 | 588000 |
| eMOTO uptake /year | 6000 | 8000 | 10000 | 14000 | 19000 | 28000 | 40000 | 52000 | 65000 | 80000 | 110000 | 150000 | |
| **Chargers** | 1200 | 2000 | 3000 | 4400 | 6300 | 9100 | 13100 | 18300 | 24800 | 32800 | 43800 | 58800 | 0 |

# APPENDIX III/ E-Moto UPTAKE SCENARIOS

| R | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO /year | 6000 | 11000 | 17000 | 24000 | 32000 | 42000 | 54000 | 69000 | 87000 | 109000 | 134000 | 164000 | 199000 |
| eMOTO uptake /year | 5000 | 6000 | 7000 | 8000 | 10000 | 12000 | 15000 | 18000 | 22000 | 25000 | 30000 | 35000 | 40000 |
| **Chargers** | 1100 | 1700 | 2400 | 3200 | 4200 | 5400 | 6900 | 8700 | 10900 | 13400 | 16400 | 19900 | 0 |

| P | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO /year | 6000 | 7500 | 8330 | 9330 | 10430 | 11820 | 13480 | 15480 | 18140 | 21470 | 25800 | 31460 | 38730 |
| eMOTO uptake /year | 1500 | 830 | 1000 | 1160 | 1330 | 1660 | 2000 | 2660 | 3330 | 4330 | 5660 | 7330 | |
| **Chargers** | 750 | 833 | 933 | 1043 | 1182 | 1348 | 1548 | 1814 | 2147 | 2580 | 3146 | 3879 | 0 |

| O | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total eMOTO | 6000 | 12000 | 20000 | 30000 | 44000 | 63000 | 91000 | 131000 | 183000 | 248000 | 328000 | 438000 | 588000 |
| eMOTO uptake /year | 6000 | 8000 | 10000 | 14000 | 19000 | 28000 | 40000 | 52000 | 65000 | 80000 | 110000 | 150000 | |
| **Chargers** | 1200 | 2000 | 3000 | 4400 | 6300 | 9100 | 13100 | 18300 | 24800 | 32800 | 43800 | 58800 | 0 |

# APPENDIX / CHARGERS COST – INSTALLED POWER

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2035** | | | | | | | | | | | | |
| **Scénario référence** | | | | | Nr | MAD | | Somme totale [MAD] | | besoin energetique | | besoin energétique total |
| | Chargeur normal | | prix [MAD] | | 23450 | | | | | | | |
| | 22kW | 70% | 10000 | | 16415 | 164150000 | | 867650000 | | 361130 | 712880 | |
| | 50kW | 30% | 100000 | | 7035 | 703500000 | | | | 351750 | | |
| | | | | | | 0 | | | | | | 2019380 **2 GW** |
| | Chargeur rapide | | | | 10050 | 0 | | | | | | |
| | 100kW | 70% | 150000 | | 7035 | 1055250000 | | 1658250000 | | 703500 | 1306500 | |
| | 200kW | 30% | 200000 | | 3015 | 603000000 | | | | 603000 | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Scénario pessimiste** | | | | | | | | | | | | |
| | | | | | Nr | MAD | | Somme totale [MAD] | | besoin energetique | | besoin energétique total |
| | Chargeur normal | | prix [MAD] | | 1946 | | | | | | | |
| | 22kW | 70% | 10000 | | 1362,2 | 13622000 | | 72002000 | | 29968,4 | 59158,4 | |
| | 50kW | 30% | 100000 | | 583,8 | 58380000 | | | | 29190 | | |
| | | | | | | 0 | | | | | | 720538,4 **720 MW** |
| | Chargeur rapide | | | | 834 | 0 | | | | | | |
| | 100kW | 70% | 150000 | | 583,8 | 87570000 | | 137610000 | | 58380 | 661380 | |
| | 200kW | 30% | 200000 | | 250,2 | 50040000 | | | | 603000 | | |
| | | | | | | | | | | | | |
| **Scénario optimiste** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | Nr | MAD | | Somme totale [MAD] | | besoin energetique | | besoin energétique total |
| | Chargeur normal | | prix [MAD] | | 38150 | | | | | | | |
| | 22kW | 70% | 10000 | | 26705 | 267050000 | | 1411550000 | | 587510 | 1159760 | |
| | 50kW | 30% | 100000 | | 11445 | 1144500000 | | | | 572250 | | |
| | | | | | | 0 | | | | | | 2907260 **3GW** |
| | Chargeur rapide | | | | 16350 | 0 | | | | | | |
| | 100kW | 70% | 150000 | | 11445 | 1716750000 | | 2697750000 | | 1144500 | 1747500 | |
| | 200kW | 30% | 200000 | | 4905 | 981000000 | | | | 603000 | | |

MINISTÈRE DE LA TRANSITION ÉNERGÉTIQUE ET DU DÉVELOPPEMENT DURABLE

وزارة الانتقال الطاقي والتنمية المستدامة

Royaume du Maroc
Ministère de l'Economie et des Finances

Royaume du Maroc
Ministère de l'Intérieur

وزارة التجهيز والماء
MINISTÈRE DE L'ÉQUIPEMENT ET DE L'EAU

Royaume du Maroc
Ministère de l'Industrie et du Commerce

المملكة المغربية
وزارة الصناعة والتجارة

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الإتحاد العام لمقاولات المغرب

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# Commission Economie Verte

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Office National de l'Electricité et de l'Eau Potable