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The Future of Mobility : the role of technology and Integrated Mobility Plans

Dr. Ahmed Mosa

Co-Founder and Managing Director- MASARAT

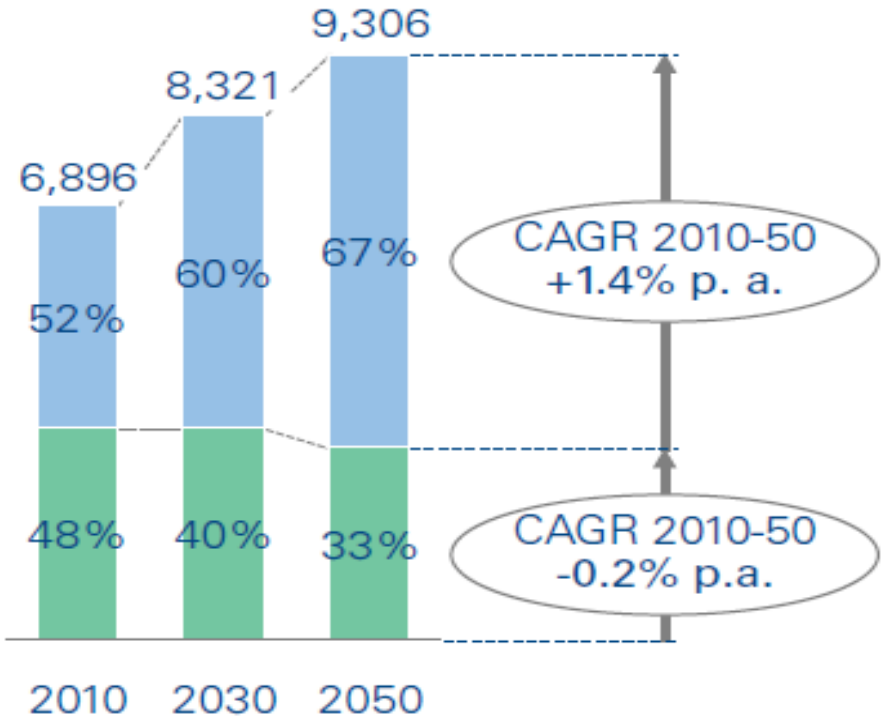
Outline

1. MEGA Trends& Changing Mobility Landscape
2. The New Definition of Urban Mobility
3. The Maturity of Urban Mobility Technologies
4. The New Mobility Ecosystem and Business Models
5. Roadmap for Egypt

Mega Trends

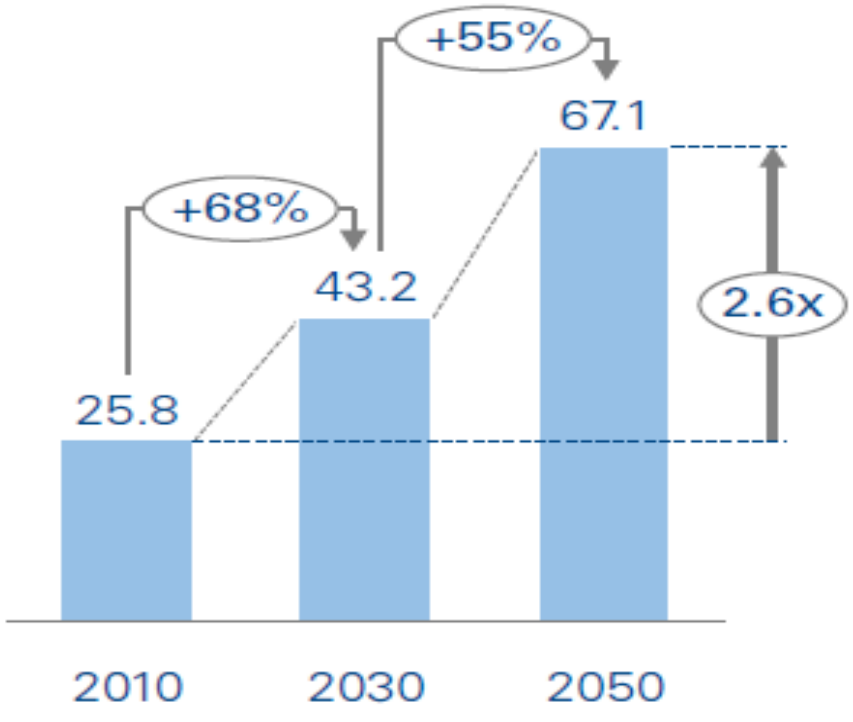
Urbanization and The Changing Mobility Landscape

The world is Becoming Increasingly Urban



Urban and rural population, 2010-2050 [m people; %]

Urban Mobility Demand Explodes

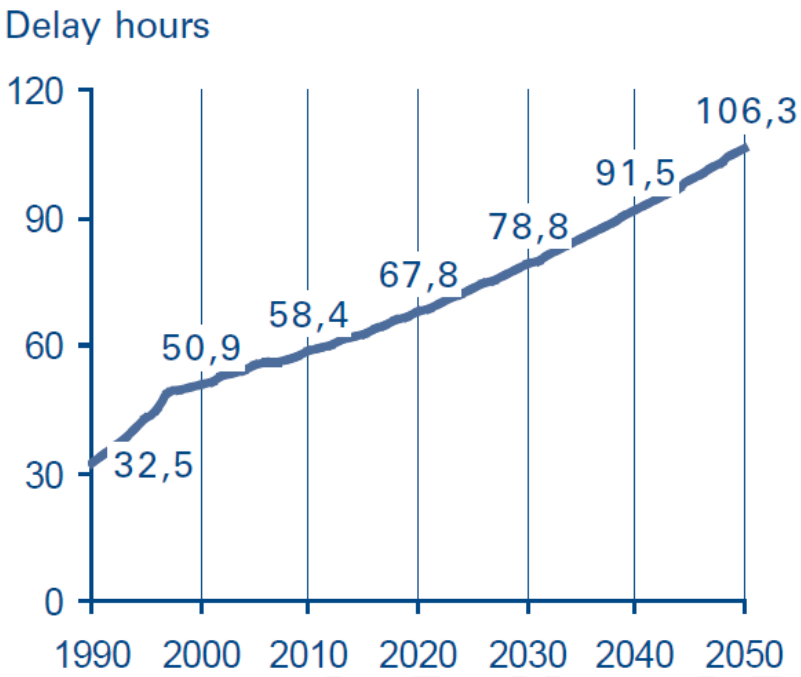


Urban mobility demand, 2010-2050 [trillions pkm p.a.; %]

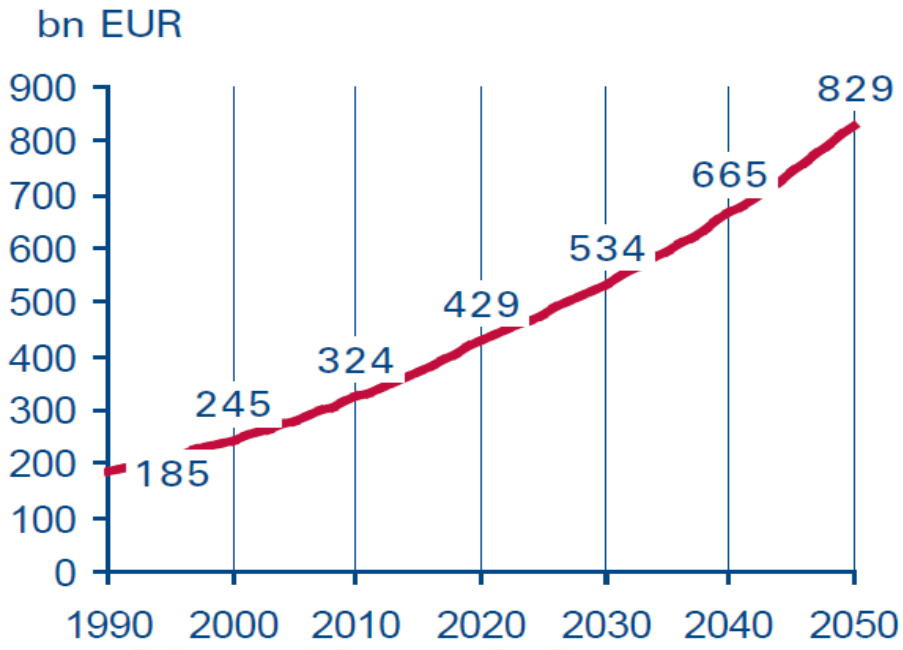
Source UN reports

The Changing Mobility Landscape

Delay hours due to congestions p.a.



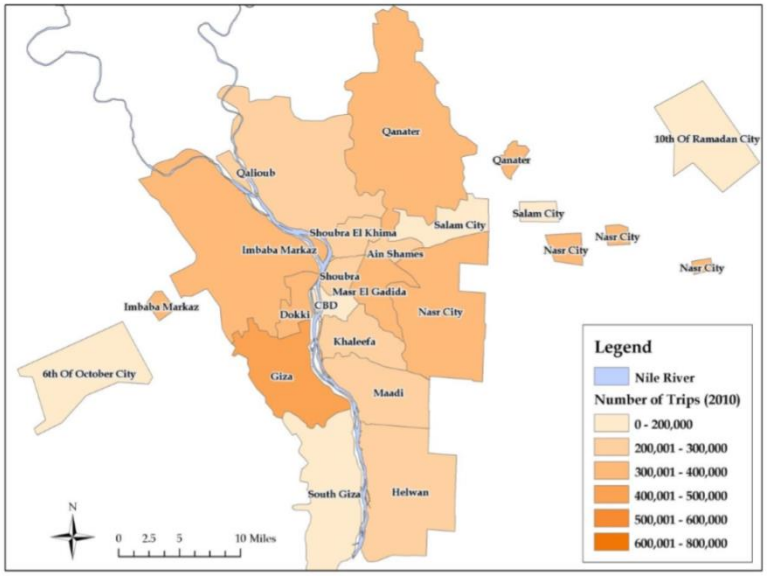
Urban mobility investment need p.a.



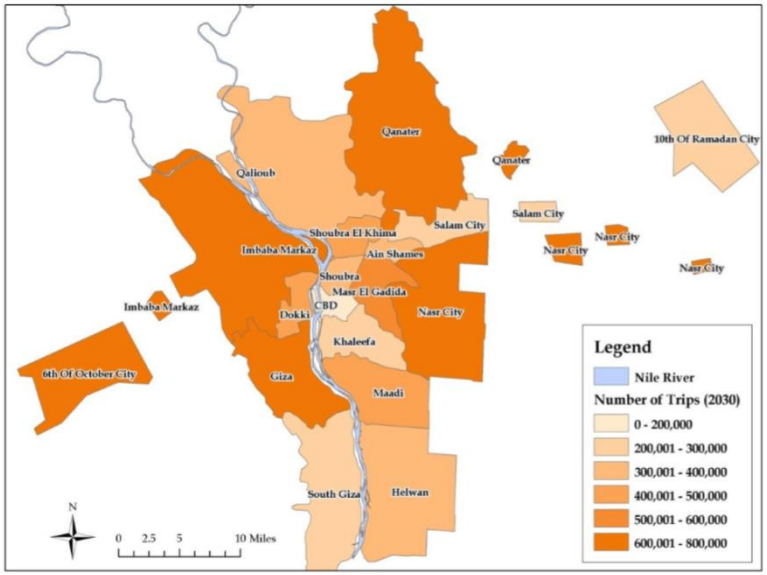
Cairo

	2012	2030	Change
Cairo's population	18.5 mln	25.5 mln	**40%**
GRDP Per Capita	10,724 EGP	27,286 EGP	**145%**
Total Number of Trip Demand (Trips / Day)	21.2 mln	28.5 mln	**34%**
Average Speed (Km/Hr)	9.6	4.3	**-45%**

Number of Trips 2010 generated by TAZ**



Number of Trips 2030 generated by TAZ**



Total Cost of Congestion is Expected to reach 50 Bill. EGP/ Year by 2030

MEGA TRENDS (4)- MEGA CITIES
"City as a Customer"

➢ **Cities, and Not Countries, Will Drive Wealth Creation In the Future**

Cities like Seoul account for 50% of the South Korea's GDP; Budapest (Hungary) and Brussels (Belgium) each for roughly 45%.

What are the Micro Implications?

- High Economic Power
- Hub and Spoke Business Model
- Transit oriented development
- New Mobility Solutions

City as a Customer

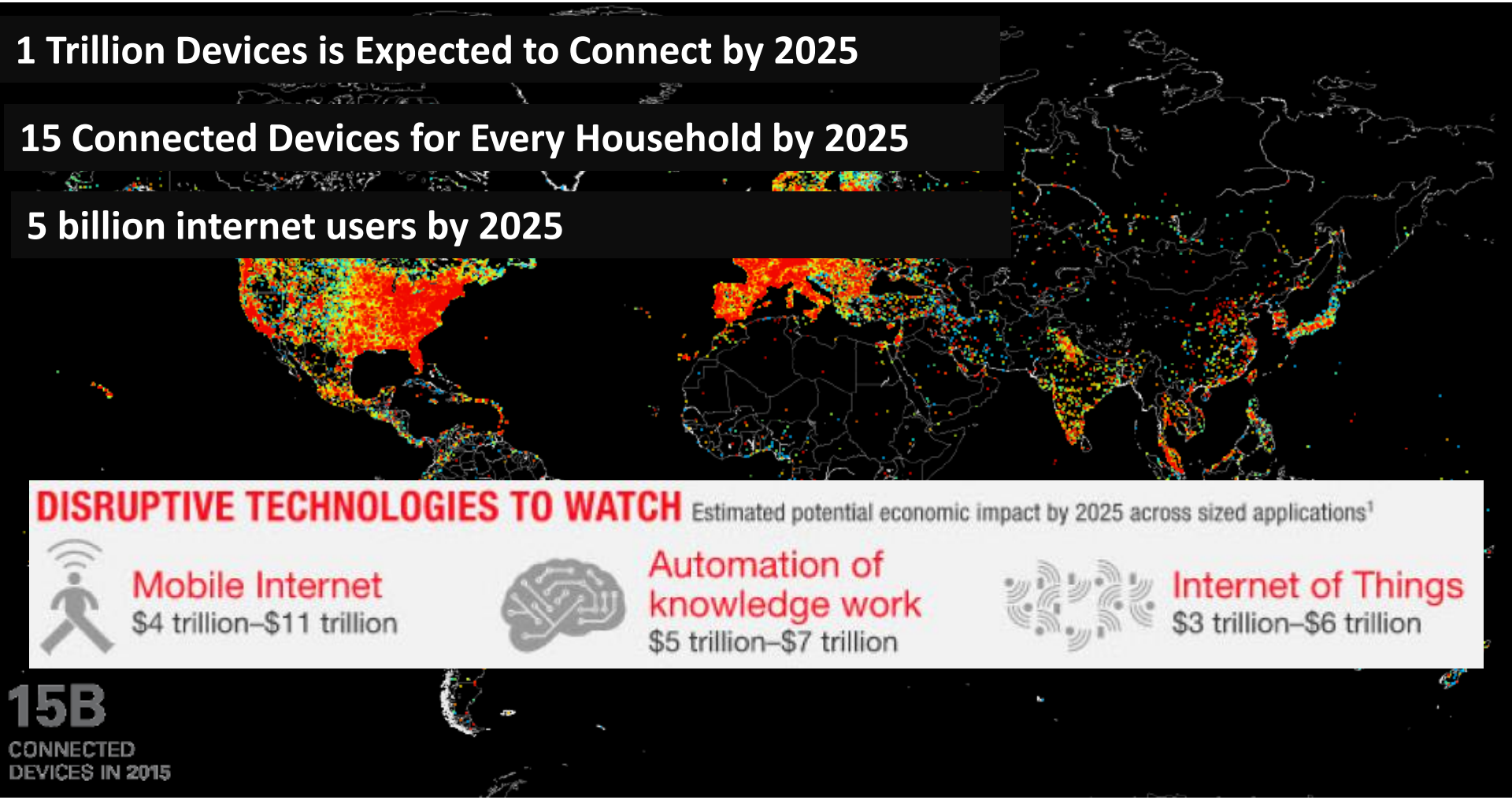
MEGA TREND 2: Connectivity

More People have Access → **To More Information** → **At Lower Cost**

1 Trillion Devices is Expected to Connect by 2025

15 Connected Devices for Every Household by 2025

5 billion internet users by 2025



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Knowledge Gaps

Traditional Approach		Smart Approach
Increased demand met by building more capital-intensive infrastructure	>	Increased demand met by making infrastructure more efficient, not larger
Vehicle-oriented	>	People-oriented Customer-centric
Focus on reacting to congestion	>	Focus on positive business and operational outcomes
Emphasis on “knowing and seeing”	>	Emphasis on “predicting and anticipating in order to avoid”

Pathways for Cities

Newly motorizing cities without much traffic-immune mass transit

Rapidly rising car ownership

Low transport investment

Some cities act early to change mindsets and policies on cars

Chronic traffic saturation

Continued rapid motorization

Low Transport Investment

Traffic-saturated cities

avoid car subsidies and restrain growth of car ownership and/or use

Improve public transport institutions, investment, capacity and quality

TOD

Some increase their efforts to welcome cars

Others react later How Late?

Automobile dependent cities

NEW TRANSIT CITIES

spectrum between the extremes (depending on priority for cars versus alternatives)

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Urban Mobility Redefined

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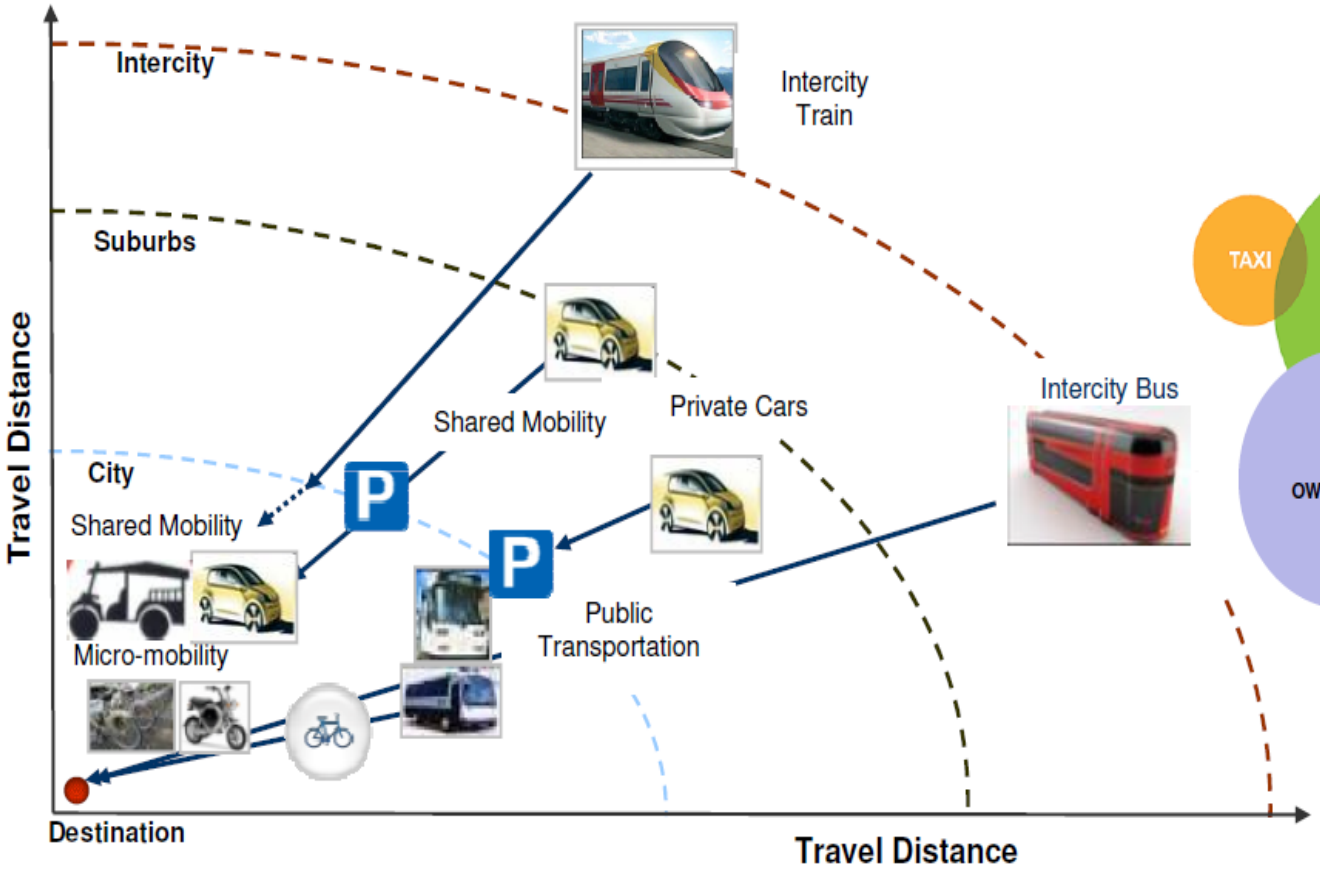
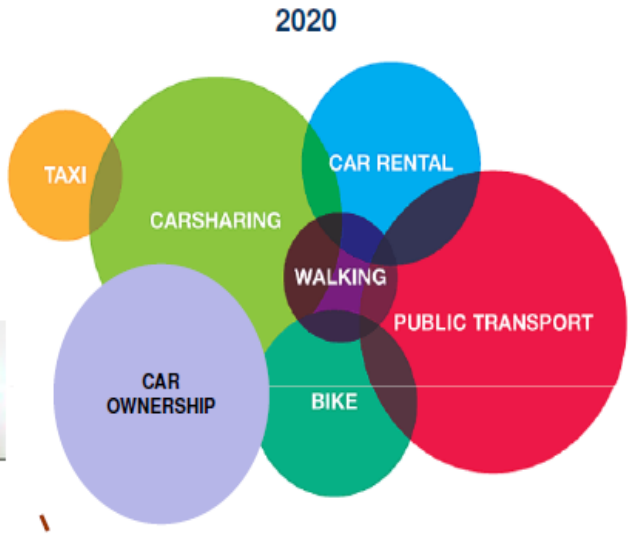
Multimodal is the new Paradigm! Door to Door

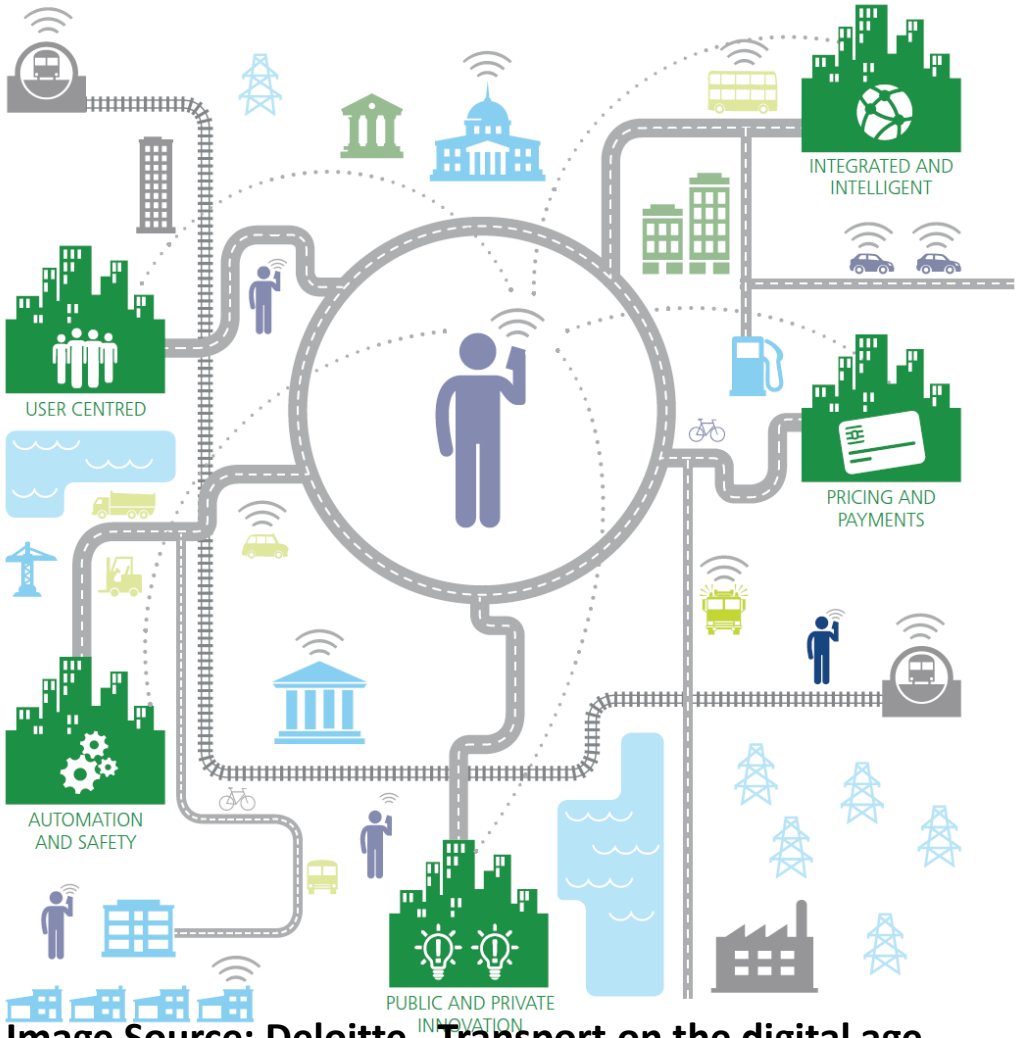




Urban Mobility Redefined

User Centered

Integrated & Intelligent



Automation & Safety

Pricing and payments

Image Source: Deloitte , Transport on the digital age

City as a Customer

Seamless "Multi-modal mobility" without ownership

- ("mobility aggregators"), integration with public transport
- Service access over mobile and stationary channels, integration of various interfaces/value added services

New vehicle concepts

- Zero emission
- Quasi-autonomous driving
- Communication with road infrastructure/other vehicles

Low-price mobility":

- Low-priced mobility enabling further movement than walking/biking distance
- Inferior to 4-wheeler speed, size, driving distance, safety and comfort
- Low-cost energy (fuels or electricity)

The Maturity of Urban Mobility Technologies

Adaptive signal control

Bicycle sharing system

Automobile sharing

Autonomous self-driving vehicle

V2V and V2I technologies

Speed Map Panel

Smart vehicles

The New Mobility Ecosystem and Business Models

Mobility Integrators—Stakeholders making it possible

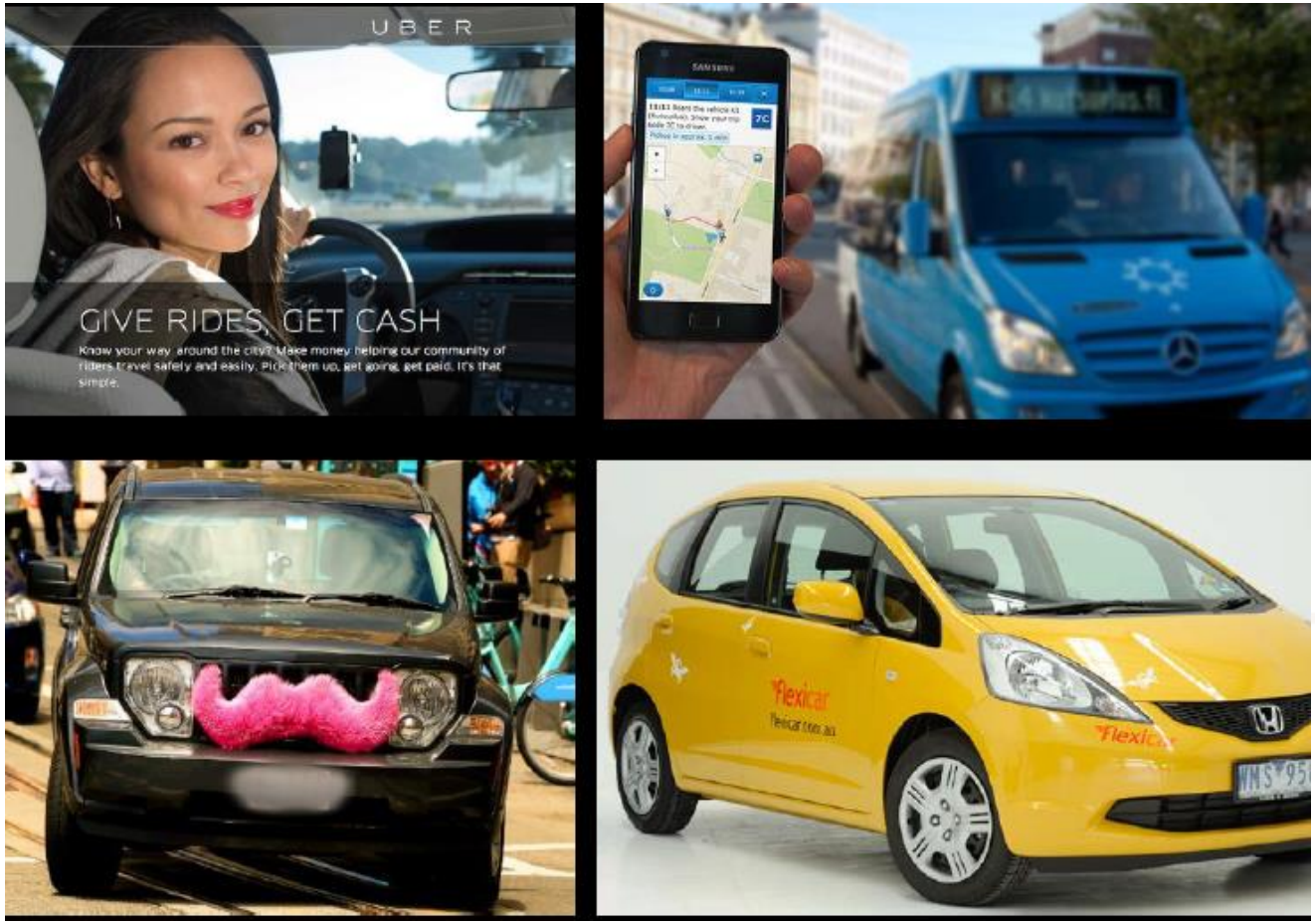
The Concept of a Dynamic Transport Solution Integrating Different Modes Under a Single Entity to make Personal Transportation Easy and Simple

MIs will start exploiting the Web 2.0 and Mobile 2.0 Internet service to offer mobility-based applications (apps) on smart phones.

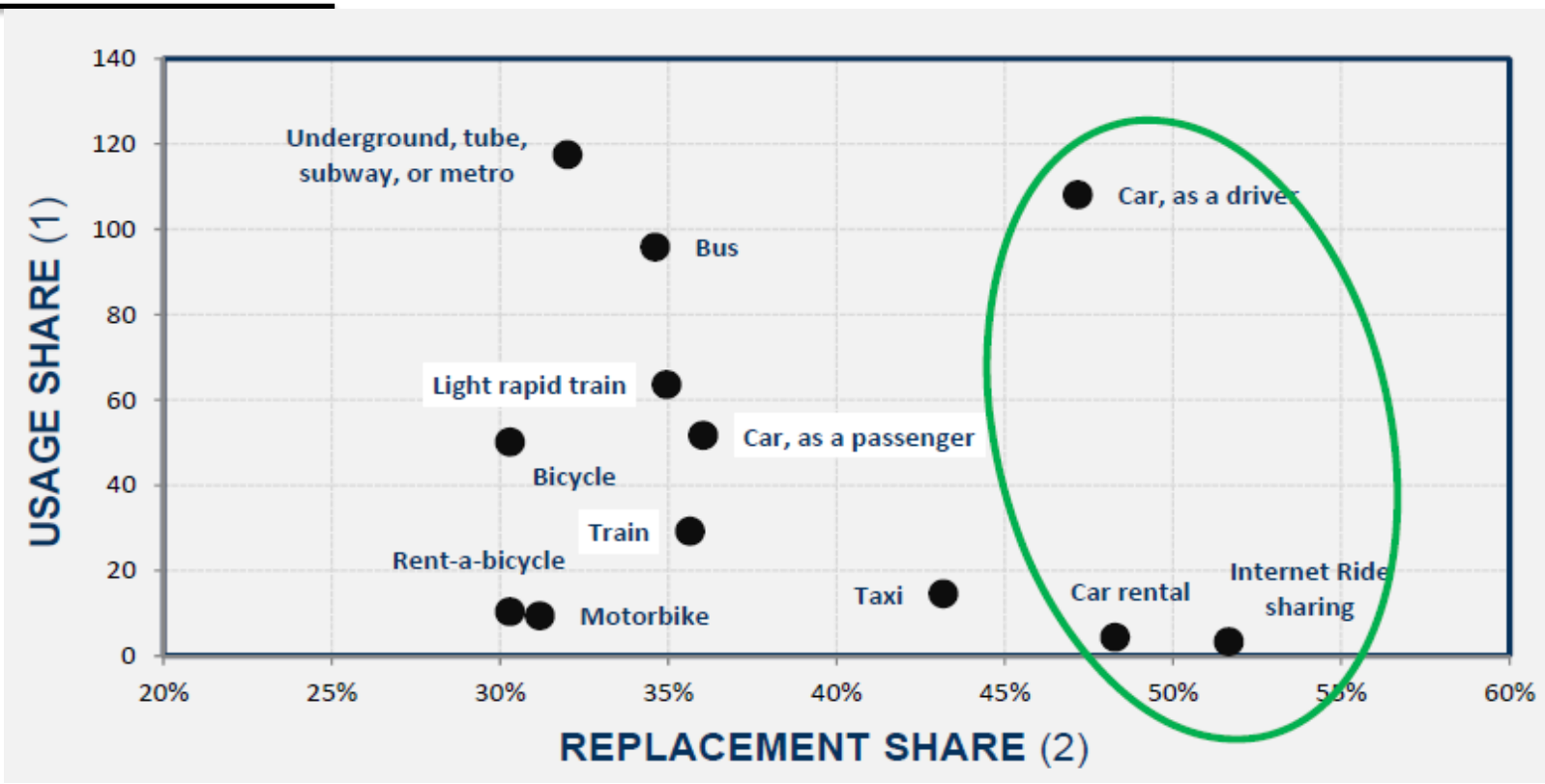
New Business Models

What if …?

Consumers replace traditional car ownership models with on-demand access to the vehicles they want?



Substitution Effects of Shared Mobility



- Between **9 to 13 vehicles removed**, including postponed purchase
- **27 - 43% VMT/VKT** reduction per year, considering vehicles sold and purchases postponed
- Net CO2 reduction of ~**27%**
- 34% - 41% reduction of **GHG** emissions per year for one household

Electric Vehicles Market Overview, Technology Roadmap and Infrastructure Trends

Today's powertrain portfolio

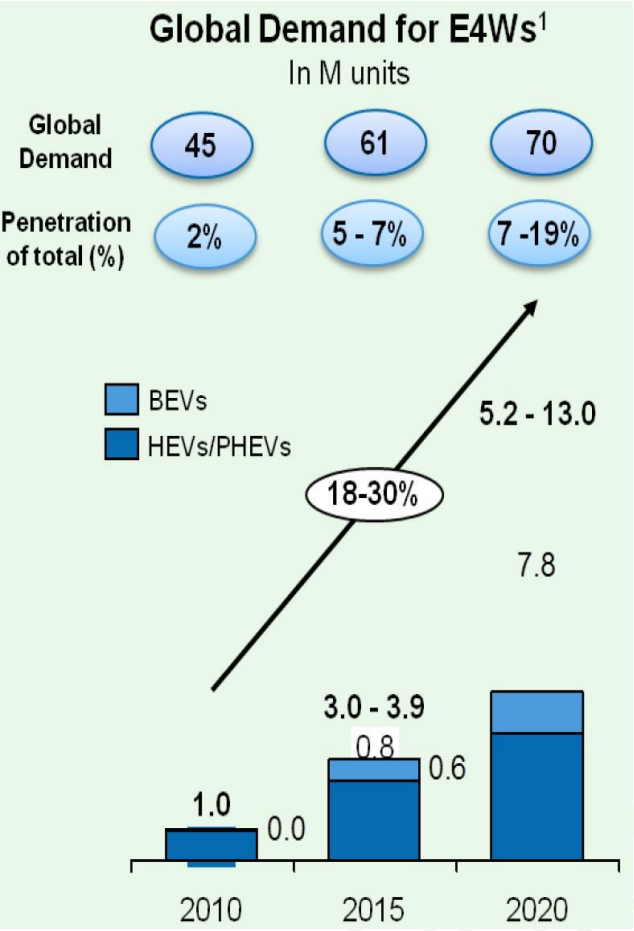
From one technology…

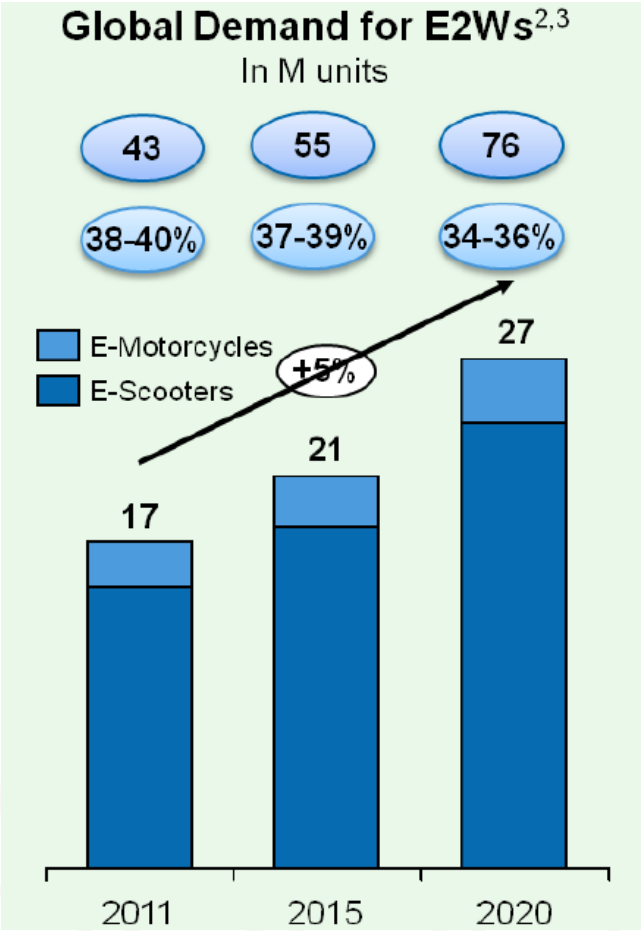
Internal combustion engine

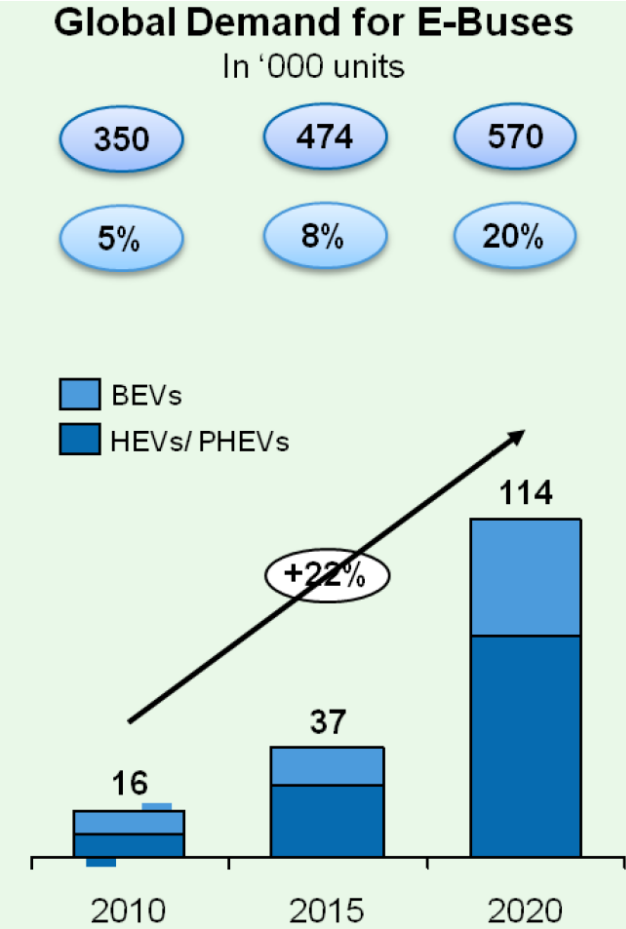
… To a portfolio of powertrains			Propulsion		Energy generation/source		
			ICE	E-motor	ICE[1]	Plug-in[2]	Fuel Cell[3]
ICE  *Volkswagen Golf*	Internal Combustion Engine	Driving with conventional combustion engine only	✓		✓		
HEV  *Toyota Prius*	Hybrid Electric Vehicle	Driving with combustion engine and/or e-motor	✓	✓	✓		
PHEV  *Mitsubishi Outlander PHEV*	Plug-in Hybrid Electric Vehicle	Driving with combustion engine and/ or e-motor, plug-in to recharge battery	✓[4]		✓	✓	
REEV  *BMW i3 with range extender*	Range Extended Electric Vehicle	Driving with e-motor only, ICE & plug in (or fuel cell) used to recharge battery		✓	✓	✓	✓ *Currently in pilots*
BEV  *Nissan LEAF*	Battery Electric Vehicle	Driving with e-motor only and storing energy in battery		✓		✓	
FCEV  *Hyundai ix35 fuel cell*	Fuel Cell Electric Vehicle	Driving with e-motor only and storing energy in hydrogen		✓			✓

✓ Primary Secondary

Global Demand for xEV







Source : Global Engine &Transmission Forecast, Deutsche Bank - Electric Cars Plugged

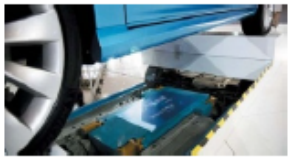
XEV AUTONOMY

Performance

Low → High

	Autonomy			Infrastructure investment
	Distance	Time to recharge	Storage weight	
Internal Combustion Engine	600 km ●	5 min ●	45 kg ●	Already existing ●
Plug-in hybrids	600 km (20 to 60 km electric) ◕	2-3 hours ◑	50 to 90 kg ◕	Already existing ◕
Electric vehicle	60 to 250 km electric ○	4-8 hours ◔	90 to 250 kg ◔	To be developed ◔
Fuel Cell Vehicle	600 km ●	5 min ●	90 to 100 kg ◑	To be developed ○

Charging infrastructure

	Energy source				
	GASOLINE/DIESEL	HYDROGEN	BATTERY		
					
	Fueling gasoline or diesel at a petrol station	**Fueling hydrogen at a hydrogen refueling station**	**"Wired" charging using a plug**	**Battery swapping**	**Induction charging**
Description	Conventional gasoline or diesel refueling	Hydrogen refueling (similar to natural gas refueling)	Plugging in to a charging station using a cable and plug	Replacing a battery for a fully charged one at a special swapping station	Battery in the car is charged by wireless induction charging
Time needed[1]	5 min	5 min	4-8 hrs (slow) 20-30 min (fast)	5 min	~2-8 hrs[2]
Suitable for which power-trains	▪ ICE ▪ HEV ▪ PHEV ▪ REEV (gasoline)	▪ FCEV ▪ REEV (hydrogen)	▪ PHEV ▪ BEV suitable for plug-in charging	▪ Special BEVs suitable for battery swapping	▪ Special BEVs suitable for induction charging
Example car	▪ All ICEs	▪ Hyundai ix35 (FCEV)	▪ Renault Zoe (BEV)	▪ Special model of Renault Fluence	▪ N/A (few pilot cars)
Current availability in Europe	Widely available: ~131,000 stations	Very limited: ~80 stations	Limited availability: >20,000 (slow) >1,000 (fast)	Very limited ~50 stations	Not available (few pilots in progress)

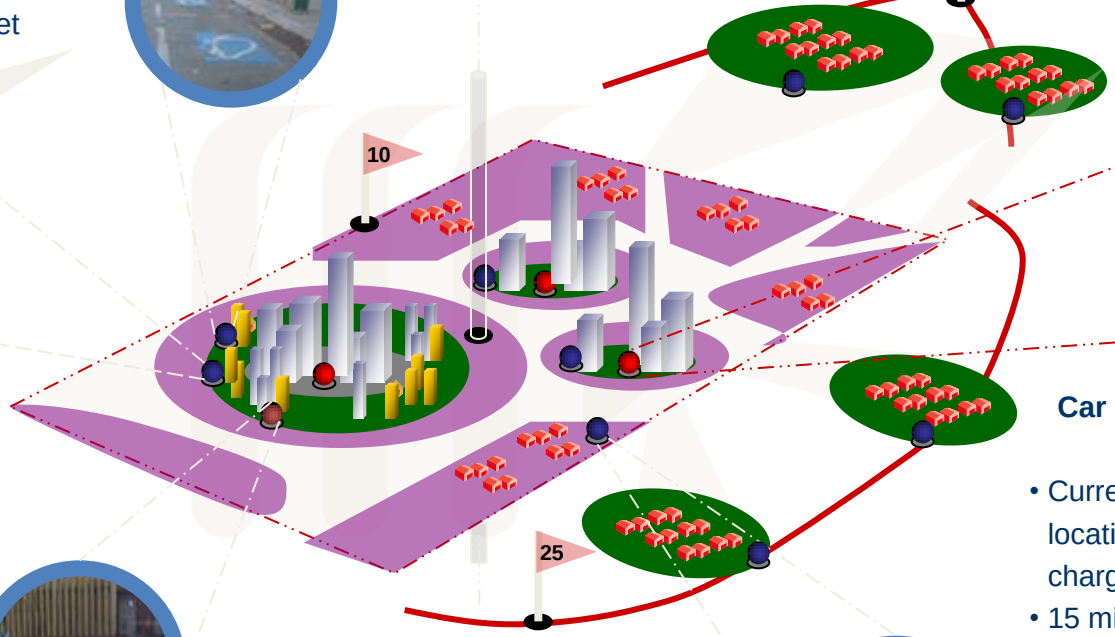
1 Time need for full refueling or recharge. For fast-charging of battery, time to reach 80% of battery capacity is commonly used
2 Since induction charging is still in pilot stage, common duration and power level are not yet established; power levels of 22 kW have been achieved

Source: Europia, Fuel Cell Today, Public sources, MASARAT

Charging Infrastructure: Present Development

Pub. & Pvt. Parking Place

- Special EV parking space
- Free charging from charging outlet



Car Dealers, Public Building

- Current strategic locations for fast charging
- 15 min. charge to yield 60 miles range

Commercial Facilities

- E.g., Dept. Stores, hotels, malls
- Special parking lot for EV next to handicap provision
- Free charge (1-2 hrs) using AC outlet

Home

- Normal charging by nigh time discounted electricity
- Special charging plug at home

- **Improved range extension will see charging points extend beyond city limits to urban and sub-urban areas with emphasis on both normal and fast charging stations**

Electric Vehicle Technology Roadmap

Electric Vehicle Market: Technology and Product Roadmap for Electric Vehicles

performance

- Driving Distance/charge-up to 100 kms → Up to 200 kms → 300 + kms
- Charge Time – 6 to 8 hrs → < 1 hour → < 15 minutes
- Battery Capacity – up to 16kWh → Up to 50 kWh → 75 kWh +
- Motor Power- Up to 70 kW → 70 kW – 250 kW

Infrastructure

- Slow charging - onboard
- Fast charging – mostly off board
- Battery Swapping

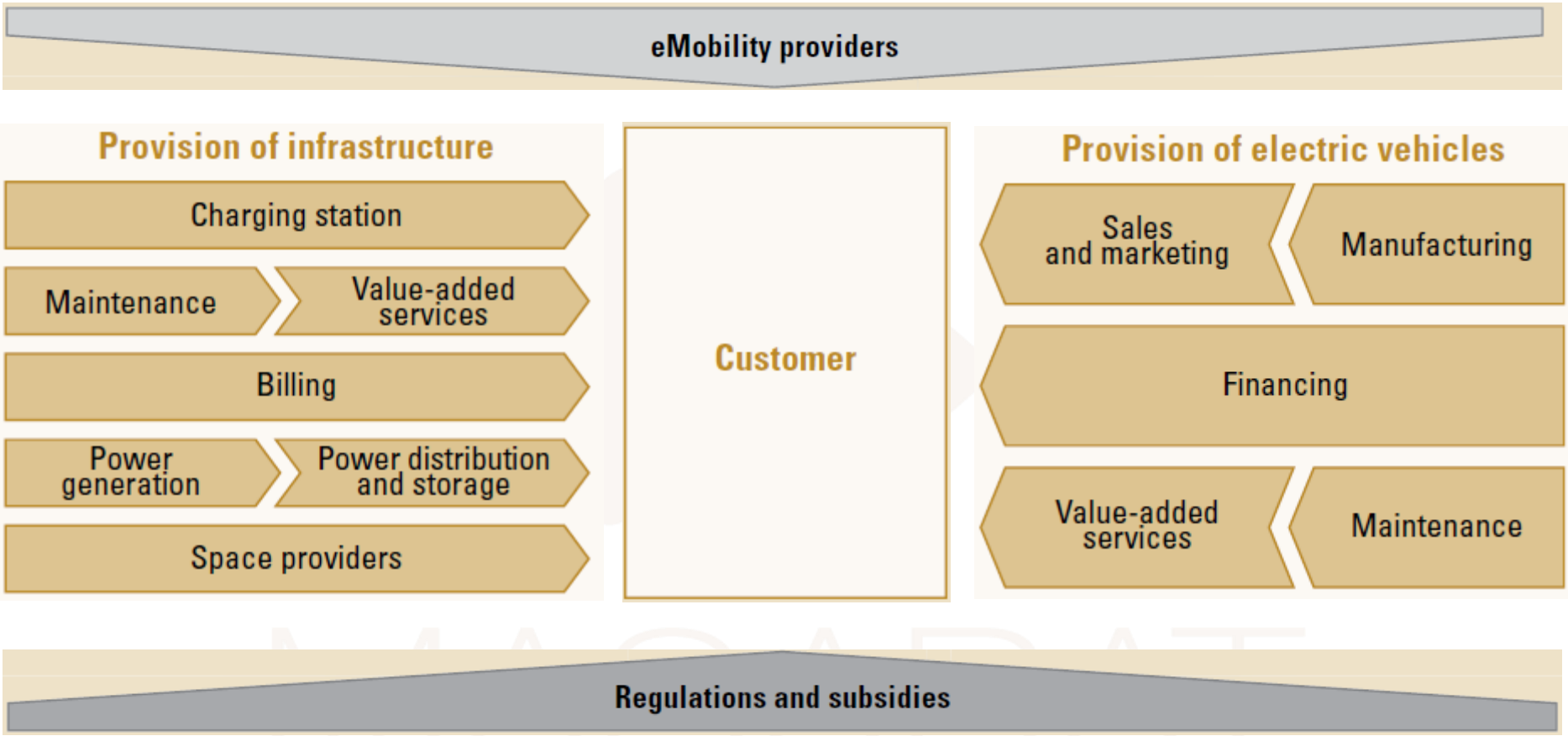
Market for Extended-Range Electric Vehicles: Technology Roadmap for Plug in Hybrid Electric Vehicles

ELECTRIC RANGE	Up to 70 kms	Up to 160 kms
BATTERY CAPACITY	7kWh – 15kWh	16kWh – 25kWh
MOTOR POWER	50kW – 70kW	70kW – 140kW
CHARGING TIME	2 – 6 hrs	15 mins – 2 hrs

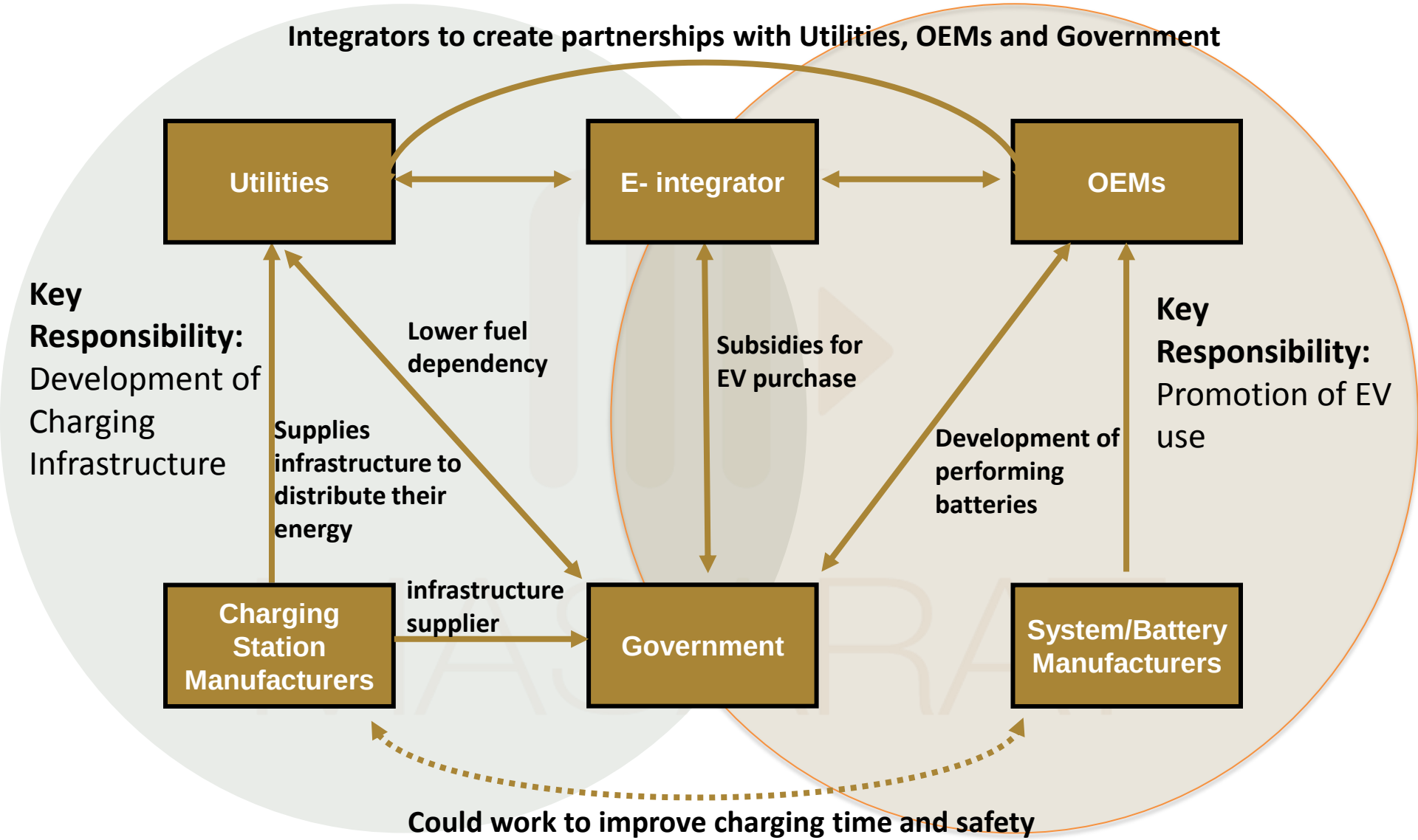
2005 2010 2015 2020

eMobility Business Model
Key Industry Stakeholders and Key Opportunities

Traditional E-Mobility Ecosystem



The New Ecosystem



New Business Models

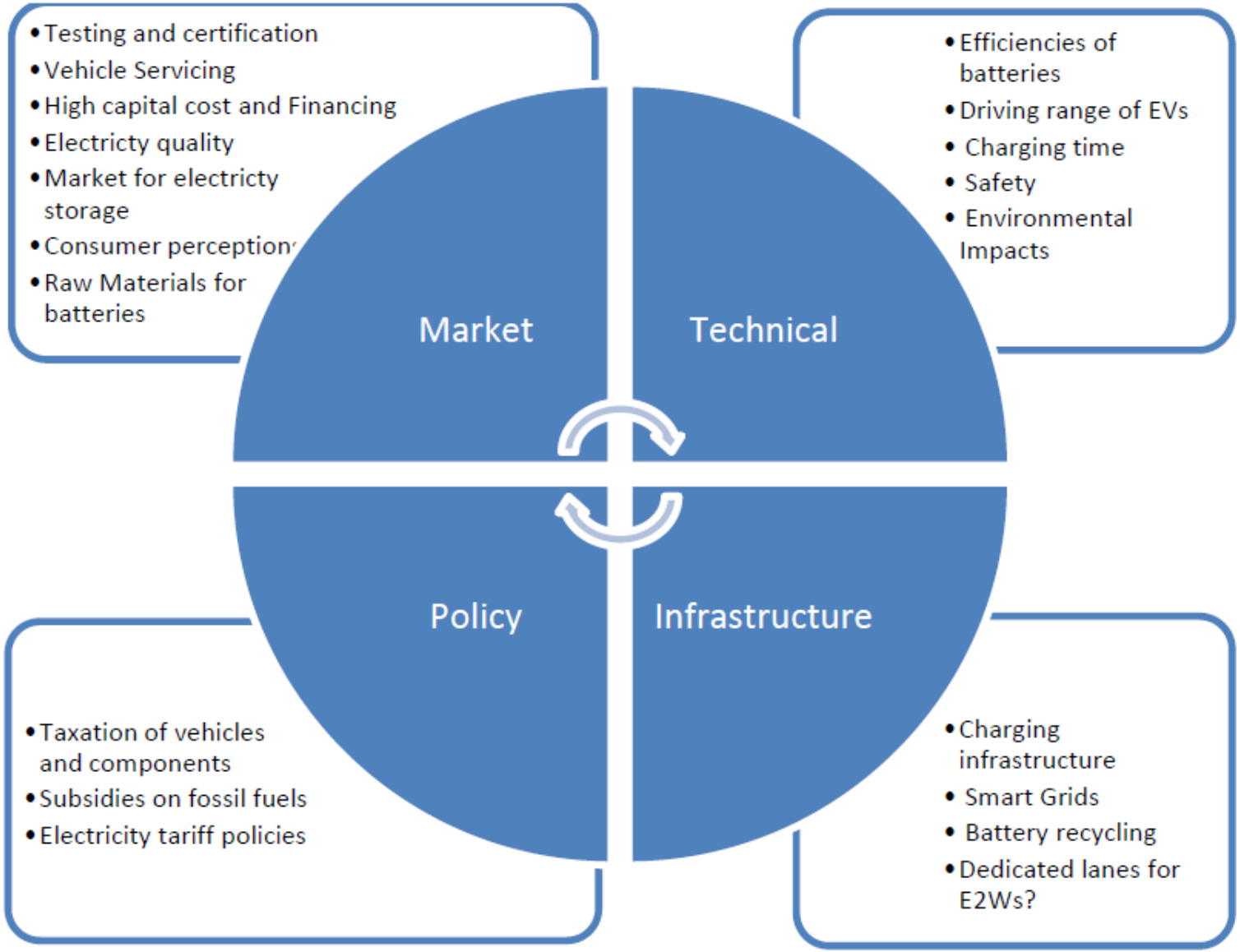
	Business Model 1	Business Model 2	Business Model 3	Business Model 4
TYPE	Energy Package	Maintenance Package	Part Subsidy	Full Subsidy
COVER	Partial battery lease + Electricity	Energy Package+ Insurance+ Maintenance	Maintenance Package+ Discount	Maintenance Package+ 100% Discount
ENERGY	Monthly Bill	Flat: Maximum XX kms/month	Flat: xxx kms/year (25,000 km/year)	Flat: xxx kms/year (i.e. 50,000 km Year)
CONTRACT	NA	NA	XX Years (i.e. 4 years)	XX Years (i.e. 7 years)
SUBSIDY	NA	NA	50% car price	Free car
MONTHLY LEASE	Monthly	Monthly	Annual	Annual

Other Possible Leasing models

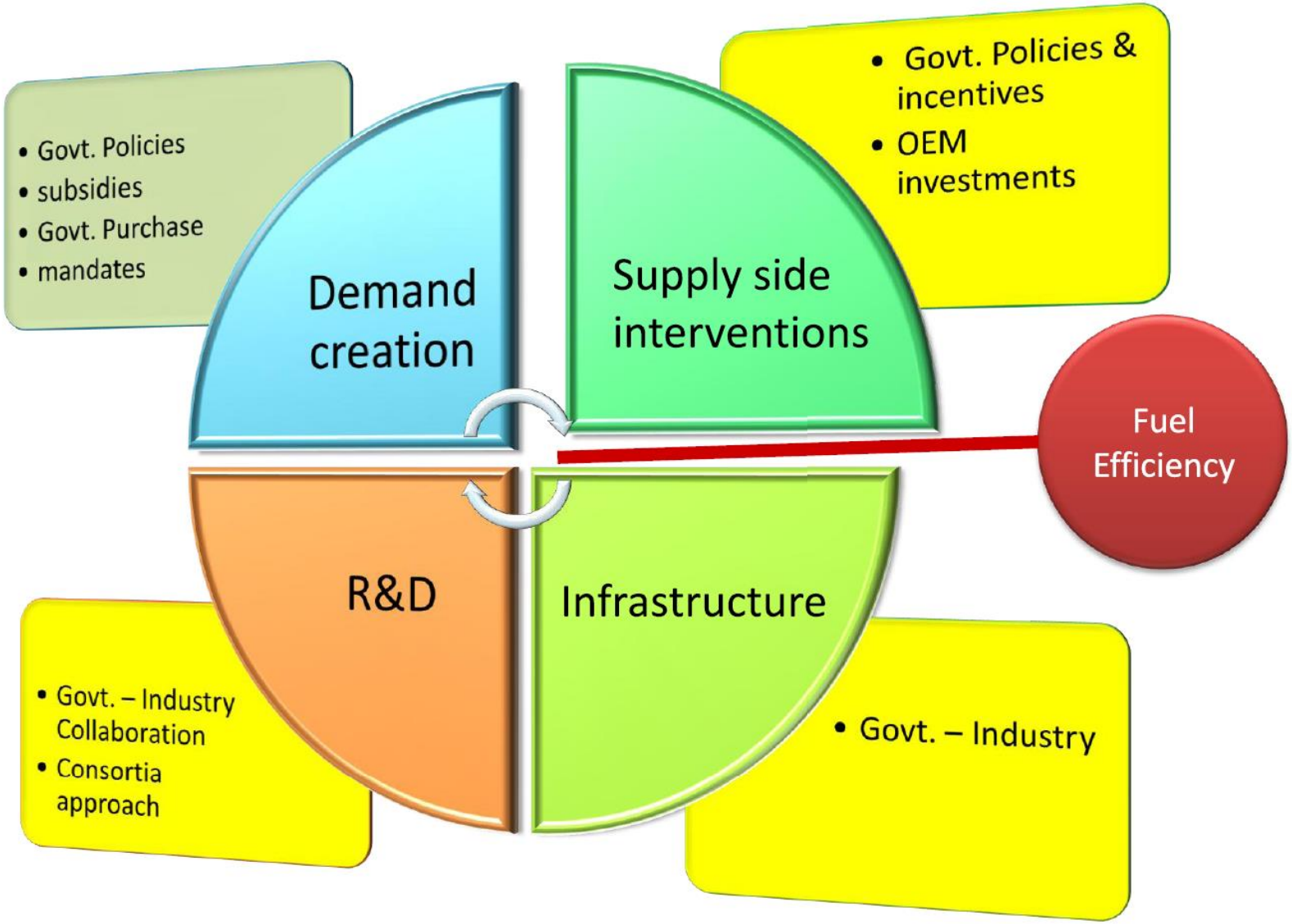
Flexible Mileage	Unlimited kms	Max number of kms	Pay as you go
Flexible Contract	The customer opts for the number of years and flexible mileage- customized lease		

Roadmap for Egypt

Barriers to Electric Vehicles



Levers to support xEV adoption



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