blue-mobility

# INFRASTRUCTURES FOR GREEN AND SUSTAINABLE TOURISM IN ANGKOR

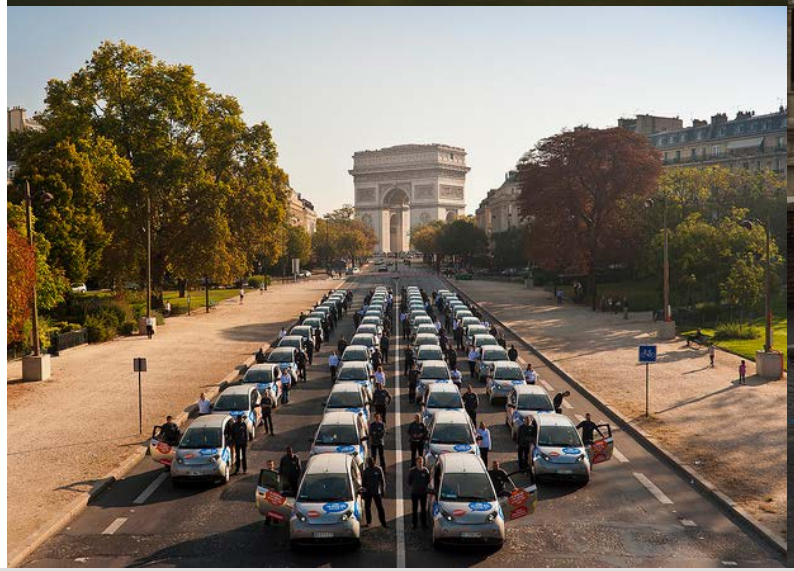
# ANGKOR : A WORLD HERITAGE SITE TO PRESERVE

First and foremost, the Bolloré group would like to express its gratitude to the RGC, especially to the APSARA Authority - in charge of the management of Angkor - for its support since 2013 and for its efforts in promoting Green Tourism, in particular the use of Electric Vehicles (EVs), to contribute to the preservation of the temples.

# A UNIQUE MODEL FOR WORLD HERITAGE SITES, BASED ON ITS EXPERIENCE IN ANGKOR, PARIS, ROME, MONT SAINT-MICHEL

As in Angkor, many other World Heritage Sites are now threatened by pollution and the growing number of tourists. And as in Cambodia too, Tourism is a pillar of the economic development.

Therefore, in order to **conciliate economic development, environmental policies and conservation, to allow a sustainable development of tourism in Angkor**, BlueSolutions has developed a unique model for historical sites, based on its experience in Angkor, Paris, Rome, Mont Saint-Michel (France) and various others locations (USA, Singapore, 9 European and 6 African countries) since 2011 .



BlueSolutions by Bolloré

# PRESENTATION

# • ELECTROMOBILITY SOLUTIONS

## PUBLIC TRANSPORTATION

- No noise nor smell, and easy access
- **Two models of Bluebus**:
  - 6-meter bus: 120 km range – 90 kWh of on-board power – capacity of 22 persons
  - 12-meter bus: 180 to 250 km range – 240 kWh of on-board power – capacity of 91 to 101 persons
- **Bluetram**:
  - Charges up in about 20 seconds. No rail nor overhead wire. Quick deployment with a reduced and controlled investment

## CARSHARING

- One-way car sharing solution using 100% electric vehicles
  - France: Autolib' (Paris) in 2011, Bluely (Lyon) in 2013, Bluecub (Bordeaux) in 2014
  - International: Blueindy (Indianapolis, USA) in 2015, Bluetorino (Turin, Italy) in 2016
  - To come in 2017: BlueSG (Singapore), BlueLA (Los Angeles) and Bluecity (London)
- This solution helps meeting the needs of towns and cities

## ELECTRIC VEHICLES

- Bluecar® range used for car sharing services, companies, private users
- E-MEHARI produced by PSA with LMP® batteries

# • 6-METER BLUEBUS

ODOR FREE

120 KM RANGE

100% ELECTRIC

NOISE FREE

ASSEMBLED AND BUILT IN FRANCE

EASY ACCESS

## MAIN FEATURES

- 90 kWh of on-board power
- Number of passengers: 22
- Accessibility for all thanks to the roof-mounted batteries
- An ergonomic operator cab
- An enjoyable space

# • 12-METER BLUEBUS

180 TO 250 KM RANGE

100% ELECTRIC

ODOR FREE

EASY ACCESS

NOISE FREE

ASSEMBLED AND BUILT IN FRANCE

## MAIN FEATURES

- 240 kWh of on-board power
- Number of passengers: 91 to 101
- Accessibility for all thanks to the roof-mounted batteries
- An ergonomic operator cab
- A space open to the city

# • BLUEBUS: OUR CLIENTS TRUST US

**+140** Bluebus currently operating in France and abroad

GUADELOUPE (2016)

RATP (2016): 1ST ALL-ELECTRIC LINE IN PARIS

RENNES-MÉTROPOLE (2017): INNOVATION PARTNERSHIP

TOURS (2012)

TARBES (2012)

VENTE-PRIVEE.COM (2015)

ISLAND OF REUNION (2012 & 2015)

LUXEMBURG (2012)

ANGKOR (2013)

ABIDJAN (2012)

# • BLUETRAM

UNLIMITED RANGE

NO RAIL

A WORLD FIRST PREMIERE

EASY ACCESS

NO LINE

MADE IN FRANCE

## MAIN FEATURES

- Powered by supercapacitors
- One LMP® battery pack
- Accessibility for all
- Number of passengers: 22
- Charging: 20 seconds at each stop
- A tram designed to be green

## SUPERCAPACITORS

It is an electrical storage component characterized by very **high power density** which can be **charged very quickly**.

It can cycle several million times without degrading.

## PARTNER OF COP 21

In winter 2015-2016, **the Bluetram ran up and down the Champs-Élysées in Paris, to mark COP 21**.

# • PARTNERSHIPS WITH CAR MANUFACTURERS: RENAULT AND PSA GROUPS

RENAULT
La vie, avec passion

**SEPTEMBER 9th 2014**

Signature of a partnership between Bolloré Group and Renault Group

PSA PEUGEOT CITROËN

**JUNE 17th 2015**

Signature of a partnership between Bolloré Group and PSA Group

# • CARSHARING SOLUTIONS

**PARIS – 1ST EV CAR SHARING SYSTEM IN THE WORD**

**AND ABOUT 100 SURROUNDING CITIES**

An average of **113,000**

**RENTALS PER WEEK**

More than **300,000**

**SUBSCRIBERS**

## OVER THE WORLD

**8** CARSHARING SYSTEMS

**3** CONTINENTS

Europe

USA

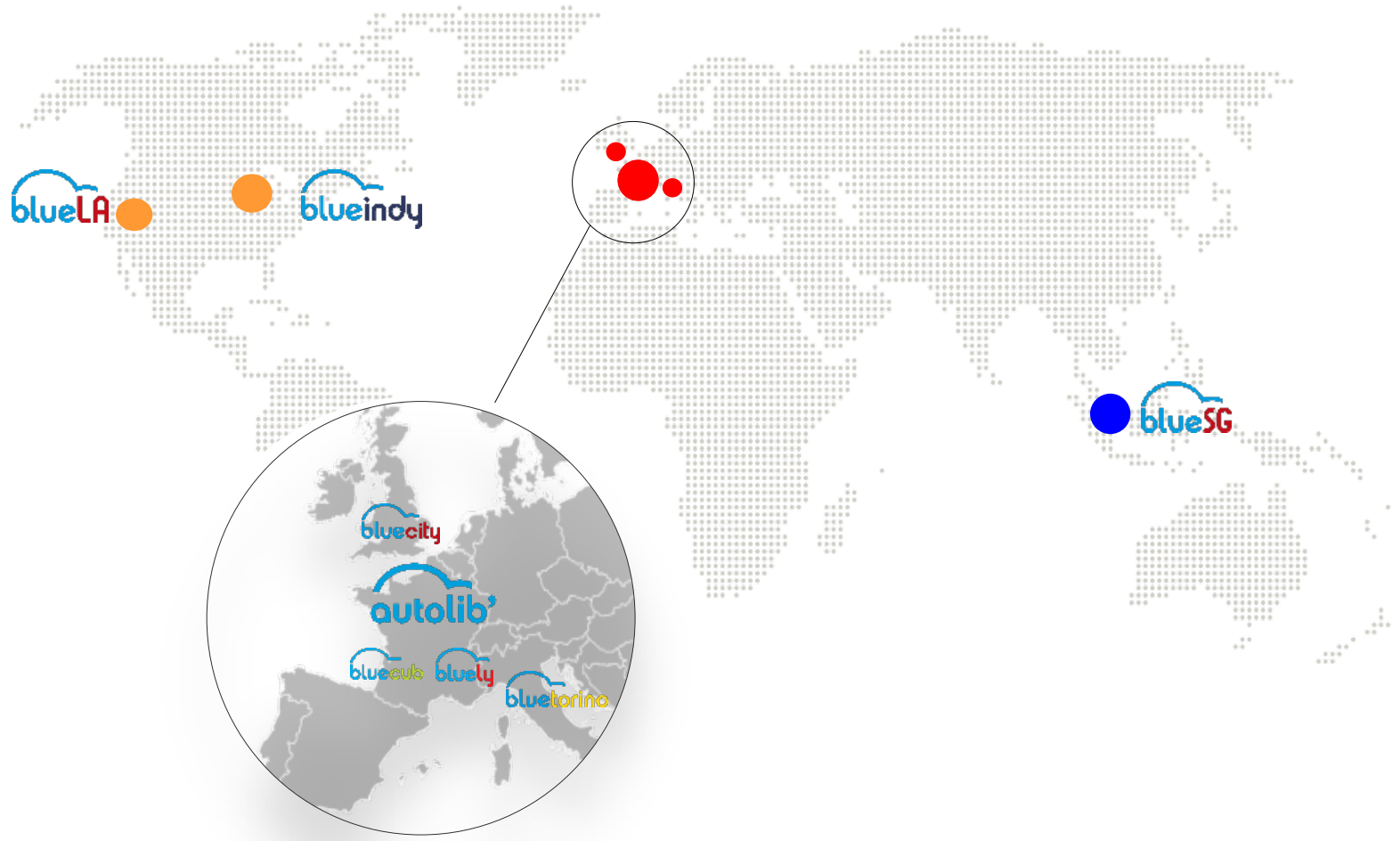
Asia

**5,000** ELECTRIC VEHICLES

**9,000** CHARGING POINTS

# • OUR CARSHARING SERVICES IN FRANCE AND ABROAD

**8** CARSHARING SYSTEMS **3** CONTINENTS **5,000** ELECTRIC VEHICLES **9,000** CHARGING POINTS




## AMERICA

**blueindy** — **282** electric vehicles – **425** charging points

**blueLA** — *Launch in 2017*

## EUROPE

**autolib'** — **4,000** electric vehicles - **6,200** charging points

**bluely** — **305** electric vehicles - **509** charging points

**bluecub** — **201** electric vehicles - **383** charging points

**bluetorino** — **77** electric vehicles - **132** charging points

**bluecity** — *Launch in 2017*

## ASIA

**blueSG** — *Launch in 2017*

# • ENERGY-INDEPENDENT TRANSPORTATION SOLUTIONS

**User-ready solutions in Asia and Africa**

- Entirely energy-independent transportation solution
- Charging points powered by solar panels coupled with LMP® batteries
- Vehicles charged during daytime or at night thanks to this system

**IMPLEMENTED IN SEVERAL COUNTRIES IN ASIA AND AFRICA**

Abidjan, Ivory Coast

Brazzaville, Republic of Congo

Yaoundé, Cameroon

Angkor, Cambodia

blue-mobility

# E-MOBILITY & SMART ENERGY SOLUTIONS FOR ANGKOR

## A MODEL FOR CONSERVATION AND SUSTAINABLE TOURISM

# PHASE 1 : 100% SOLAR-POWERED EV STATION

**In order to protect this World Heritage Site, a BlueSolutions Electric Vehicles station, consisting of a solar farm of 360m² connected to a BlueStorage of 180Kwh, set the example every day.**

**For the first time in Asia, while enhancing the strength of an abundant and free resource – solar energy – our solutions enables BlueCar and BlueBus to circulate but also to think of various stationary applications.**

# 100% AUTONOMOUS AND POWERED BY RENEWABLE ENERGIES

**360m² solar farm :**

- SunPower solar panels (best quality in the world)
- 6 groups, 10° inclination, 100% aligned East-West
- A max production of almost 400kWh

**1 BlueStorage :**

- A 180 kWh storage capacity
- Supplies the whole station with electricity 24/24h
- Charge the EVs
- Preserve local EDC network from power current draw

# Phase 2 : Pilot Project

and Phase 2 – a pilot project with 12 EVs – to test in real conditions the feasibility of the development of a fleet of EVs, offering its services to tourists. Now at the end of this test period, all assumptions have been validated.

# 12 EVs Pilot Project to test operational assumptions

As Phase 1 has been a success with both local and international guests visiting our « station show-room », as Cambodian authorities are satisfied, the Bolloré group has been implementing Phase 2 – a pilot project with 12 EVs – to test in real conditions the feasibility of the development of a fleet of EVs in Angkor Archeological Park.

In order to do so, the Bolloré group has presented to the ICC international conference in December 2014, the BlueSummer electric car – the new Bolloré electric car which design is perfectly adapted to visit Angkor – and has announced its intention to operate, for a 1-year period, 12 BlueSummer to test and validate operational assumptions.

At the end of this 1-year test period, once all assumptions will be validated and Phase 2 a success, the Bolloré group will submit a proposal during the ICC conference in June 2016 for Phase 3, to launch a fleet of 50 BlueSummer.

# PROHIBITIVE IMPORT DUTIES & TAX

Thanks to the partnership with the Royal Government of Cambodia, the project successfully overcame all the administrative and legal obstacles. However, after 2016, with the **expiry of the import duties and taxes exemptions**, the project has come up against a major obstacle – the Bolloré Group cannot import more EVs or equipment without paying almost 100 000$ per car and more than 300 000$ for a mini-bus.

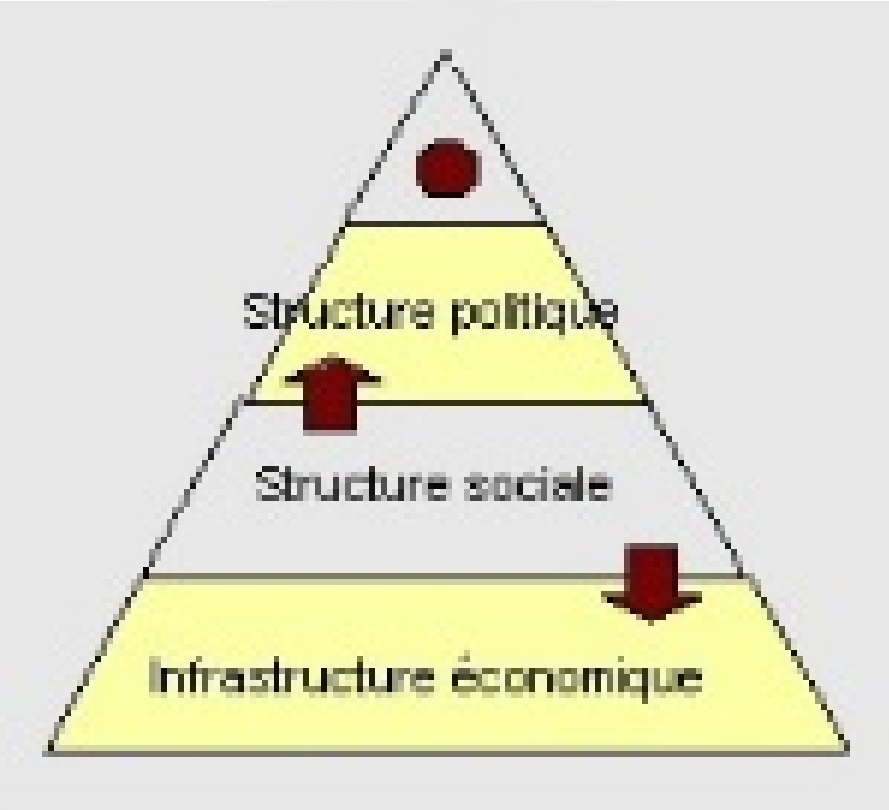
**Amount of Import duties, Special Tax, VAT (2013) :**

- **1 Electric car = almost 100 000 USD**
- **1 Electric bus (6m) = more than 300 000 USD**
- **100 Electric cars = 100 000 000 USD !?!**

# IT'S ESSENTIAL TO UNDERSTAND ALL THE ELEMENTS OF THE INFRA-STRUCTURES

Since the last 2 years, the Bolloré Group has sought the assistance of the Government to help the project to continue moving forward again, in order to quickly launch a fleet of EVs and, thus, to successfully complete the project's mission. But, as the procedure is a long and complex process involving various government entities, Bolloré Group **hasn't secured the exemption necessary to develop its model yet**.

Therefore, I would like to use this project in Angkor as a case study to show that between the dream of a greener future and the actual implementation of sustainable and green tourism, **it is essential to understand,** as a preliminary step, **all the elements of the infra-structure**. Indeed, even if we understand that these EVs are a form of infrastructures, these green and sustainable means of transportation are in fact just the tip of the iceberg.



# 1. It takes more than just EVs to build a green and sustainable transport infrastructure. A model and criteria to assess sustainability are also needed.

# A. THE TEMPTING ILLUSION OF TECHNOLOGIES, A MODEL IS NEEDED

- Creating new jobs and opportunities for Khmer people
  - Drivers
  - Maintenance
  - Mechanic & Repairs
  - Engineers & electro-technicians
  - Management

- Setting the example :
  - Good salary and bonus practice
  - Fixed salary through the year
  - More holidays than legal obligations
  - Health insurance
  - Driving license offered
  - English training
  - Computer Training
  - Internal Promotion

- Defining a social model for tuk-tuk drivers

# DREAM OF A GREENER ANGKOR

For decades, many of us have been dreaming about a greener future for Angkor:

- H.E. Sok Chenda while Under Secretary of State of MoT (1993-1997) was probably the first to imagine EVs in Angkor,
- In the APSARA land planning (2003) was already figuring a station for EVs.

But at the time, **the technology wasn't ready**.

Futurist dream in the late 90's, the use of EVs in Angkor now urgently need to become a reality. Indeed, the impact of air pollution on Angkor monuments is now clear and monitored. **Toxic fumes from tourism vehicles and trash burned by the villagers are damaging the carvings of the temples.**

**APSARA Press release on air pollution in Angkor**

*"The air pollution problem in Angkor is in fact not a new issue, as well as Angkor is not the only World Heritage Site in the globe to face this problem of air pollution. From the Acropolis in Greece, to the Taj Mahal in India, the Yungang and Longmen Grottoes in China and the Seville Cathedral in Spain – all are facing a similar threat.*

*APSARA is committed to the implementation of an increasingly eco-friendly and green tourism with an integrated and holistic approach. There will be a systematic and scientific collection of new data to evaluate the extent and the effects of pollution at Angkor. All efforts are being made to reinforce an ecological approach that, while reducing emissions and improving air quality. This will not only reduce negative impact on Angkor but at the same time enhance the visiting experience and involve the local community in the development process with education programs and incentives to recycle.*

*This action is in the fact the main condition to preserve the values of the World Heritage Site."*

***Written by Sok Sangvar (July 21st, 2014)***
***Deputy Director of the APSARA, Head of Angkor Tourism Management Plan***

# TECHNOLOGY DIDN'T MEET THE EXPECTATION

**Until recently, green technologies were not meeting the expectation, in regards performance, rendering the transition to a greener future impossible**. But new technologic developments are now offering plenty of tools to realize this dream :

- Effective and affordable solar equipment
- Increasing number of EVs featuring safety standards and performance identical to modern vehicles
- Improving energy storage solutions (Lithium/Polymers batteries)
- Ultra-fast communication technologies (3G, etc) allowing real time monitoring.

But this recent booming offer of green technologies has also created a risk. **It takes more than just EVs to create green sustainable transportation**. As a testimony, the failure of the previous trials in Angkor with electric bicycles and electric cars (3 models).

# THE ADDITION OF THESE TOOLS DOES NOT CONSTITUTE A SOLUTION, A MODEL IS NEEDED

Let's take the example of car-sharing, it's tempting to look at all these green technologies as a tool box in which anyone could pick a solution. But, **the addition of these tools does not constitute a solution**.

**Electrical**

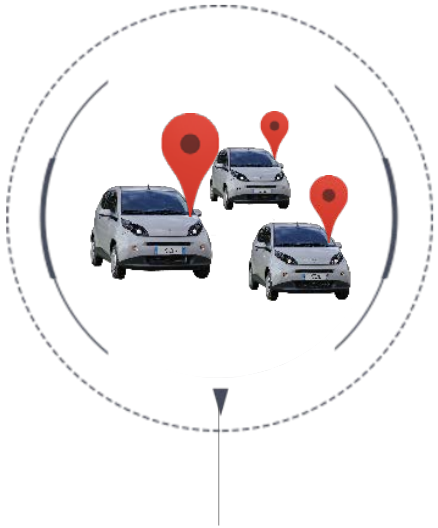
No noise

No smell

No $CO_2$ emission

**One way ride**

No need to go back to the departure station



**Stations**

Intermodality with public transportation

No parking fees

**Assistance 24/7**

By phone or via the button inside the car

**Complete solution**

Access via your computer, mobile or on-board computer

# A MODEL ELABORATED BY PROFESSIONALS IS NEEDED TO EFFICIENTLY COMBINE THESE TECHNOLOGIES AND THEIR MANAGEMENT IN AN INTEGRATED SYSTEM

Battery Recycling

Battery

Electric Vehicle

On-Board IT

Customer Relationship Management

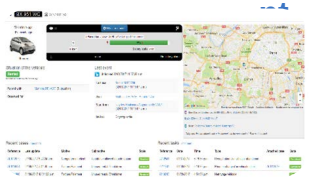
BlueSolutions by Bolloré

*All the know-how and the experience of Blue Solutions and Blue Applications*

IT Infrastructure

Charging Stations

Vehicles and Charging Points Management



Subscription Stations

Rental Stations

A comprehensive approach to car sharing positioning Blue Solutions as a unique integrated offer in the market

# AUTOLIB' IN PARIS: THE 1ST EV CAR-SHARING IN THE WORLD

- 45 towns
- 250 Bluecar vehicles
- 1,300 charging points
- 5,650 subscribers
- 4,600 rentals
- 41,900 km

**December 2011**

**The world's first and largest EV car sharing service**

An in-depth real-life test, challenging the technology in tough conditions

A **commercial success** reflecting the public's interest for car sharing

A success driving interest from other large cities

Autolib' rides with **green electricity**

- 100 towns
- 4,000 Bluecar vehicles
- 6,200 charging points
- 329,000 subscribers (since Dec 2011)
- 19.6 million rentals
- **178.5 million km**

**March 2017**

# B. THE IMPORTANCE OF CRITERIA AND EIA AGENCIES TO ASSESS SELF-PROFESSED GREEN & SUSTAINABLE INITIATIVES

Unfortunately, nowadays Green is too often used purely as marketing and with green marketing comes green lies. Therefore, in order **to assess a green initiative for Angkor and confirm its legitimacy, experts should ask the right question : is it really green and sustainable?** In the case of an electric bicycle, would it still be green if you illegally dump the worn-out batteries every six months, polluting ground waters for decades ?

Concerning the positive outcomes :

**Cambodia**

- Reduction of X tons of $CO_2$ emissions and improvement in global energy ranking
- Increase in the production of solar energy and reduction in energy dependence
- Pioneer in Asia in the promotion of the use of green means of transport such as EVs powered by solar energy

- Promotion of a Green, responsible and sustainable tourism
- Creation of jobs
- Boost to Cambodia's international reputation and recognition, especially in neighboring countries

**Angkor**

- Reduction of air pollution and acid rains that

# QUESTIONS – SOCIALLY FAIR ?

**Therefore, the role of EIA agencies is crucial but the real challenge is to determine the criteria to assess these initiatives. I would like to show you what kind of study should be done.**

- **Could the introduction of EVs in Angkor be a source of conflict ?**

If in the past, tuk-tuk drivers have violently reacted to the introduction of EVs, their issues were not about the EVs but about the APSARA management of the EVs and the conditions of their introduction into the Angkor transport market. For most drivers, an EV is a popular and attractive technology most welcome in Angkor. As a testimony, BlueSolutions has never had any conflict with anyone since the launch of its project in 2013.

- **Do EVs create competition with the tuk-tuk ?**

In fact, if competition exists, it's with the taxis, not with the tuk-tuks. Indeed, both their prices and services differ too much (tuk-tuk 15$ ≠ EV 60$) to consider EVs as competitors. Plus, looking at figures, 12 EVs could not constitute a threat to the 7000-strong tuk-tuk industry operating in Siem Reap.

- **How could you assert that there won't be any issue with the tuk-tuk ?**

Since the earliest stage of the project, the Bolloré Group has deemed it necessary to gather all the main stakeholders in order to discuss the social and economic stakes with a view to fine tuning its model for Angkor, in particular the social aspects. Indeed, BlueSolutions has utilizes the social platform and tools set up by the Japanese JDI — implemented to defuse what was expected to become the "tuk-tuk issue" — to carry out interviews and surveys with the main tuk-tuk union representatives (IDEA, CCDA). As a result, both tuk-tuk unions are supportive of the project but under certain conditions and constraints to ensure the competition is fair :

- No APSARA or government or public agency could be accepted on the transportation market. To guaranty a fair competition, only private companies should be eligible as they bear all the costs of their investment.
- No privileges and same rules for every stakeholder are needed to ensure a fair competition. 7 Makara EVs have privileges that tuk-tuks do not have which is infuriating the drivers. Similarly, EV rental prices should not be included in the price of the Angkor ticket.
- With driver ! More and more tourists drive themselves e-bike and moto which tuk-tuk drivers see as a direct threat to their profession.
- Information and transparency are necessary, drivers want access to information which in return will allow to avoid rumors and conflicts.

# BOLLORÉ SOCIAL MODEL

Since the first stage of the project, Mr Bolloré has expressed his concerns for the tuk-tuk drivers and wished to make them an active part of his model. As consequence, the Bolloré Group has elaborated a social model - **employing tuk-tuk drivers as a priority** - in an attempt to :

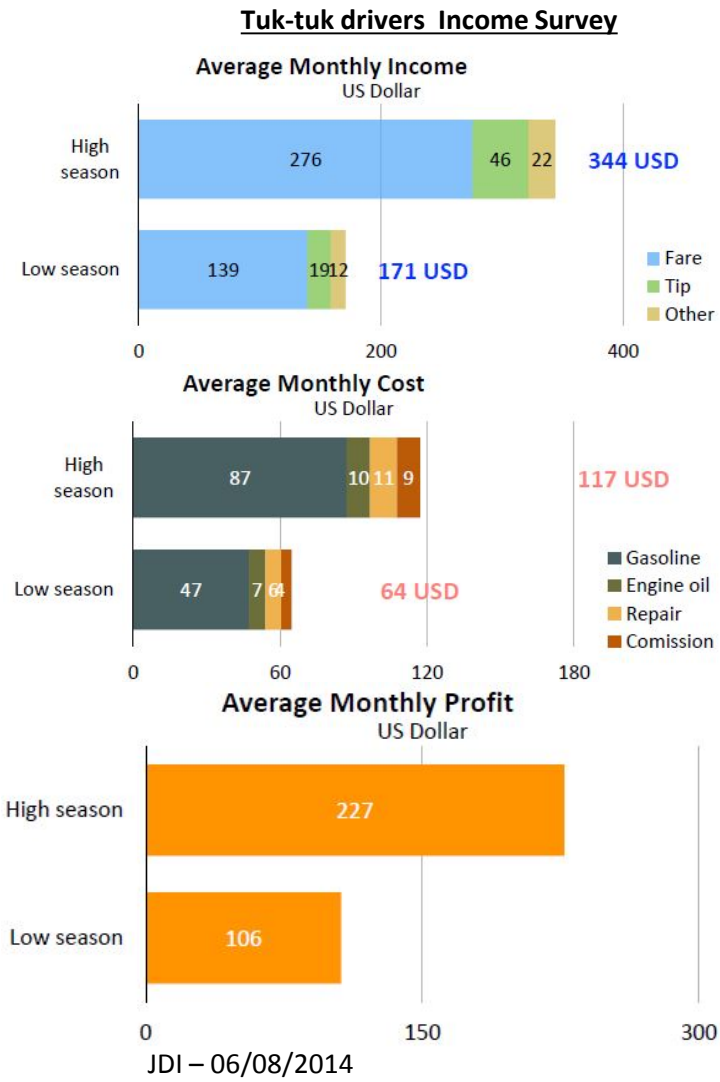
- Provide them **better working conditions** through the year (better salary, bonus practice, fixed salary, holidays, health insurance, driver training, English training, VIP behavior training, internal promotion, etc)
- Offer **reconversion jobs** as the tuk-tuk industry is now saturated with more than 7 000 tuk-tuks.

From 2013 until 2016, this project had exclusively employed tuk-tuk drivers, except for the position of CEO and Operation manager. The minimum income, for the position of driver, is on average 225$ per month, equivalent to the profit tuk-tuk drivers could generate at the peak of the high season.

If all of them have started as drivers, in accordance to Bolloré Social model, most of them have been trained for another position and promoted :

- Mr Dara, the first tuk-tuk driver hired is now our technical expert, assisting engineers in France. He has been trained to repair EVs and the energy storage (salary 420$).
- Mr Manin had been trained to become junior accountant and admin clerk (salary 385$)
- Mr Darith has been trained to become Customer Service Officer (salary 385$)
- Mr Sin has been trained to become Maintenance team leader (390$),
- Etc.

3 years have past since the launch of this project and the social model seems to work perfectly and tuk-tuk drivers are satisfied by the reconversion opportunity given by the Bolloré Group. As a testimony, none of them has resigned from their position so far.




JDI – 06/08/2014

# QUESTIONS – IS IT REALLY GREEN ?

To continue reviewing the main questions/critics made to BlueSolutions since the beginning of this project, we also would like to report the answers made about the environmental impact as we anticipate that some of the experts may ask the same questions :

- **Are EVs really Green ?**

BlueSummer EV is 100 % recyclable as well as its LMP battery which has no toxic components and can be recycled at multiple times.

- **Most EVs' batteries have short life and last only a few months so if you change the battery often, it's not totally green.**

Bolloré LMP battery guarantees a minimum of 3000 charging cycles or a minimum of 600 000km/battery.

- **Is the electricity used to power the EVs green ?**

Bolloré model for Angkor is based on the use of renewable energies such as solar energy to power its EVs in order to limit the demand on the local power grid and the energy dependence on neighboring countries. Plus, solar is a free and abundant energy. At this stage, 50 % of our needs are covered by solar energy.

- **To cover the rest of its needs, BlueSolutions is connected to the local power grid, so does it damage the grid to charge many EVs on it ?**

Bolloré model for Angkor is based on the use of energy storage in order to avoid power current draws while EVs charge that could result in stressing the local power grid. For the moment, our station is home to a 180 kWh storage capacity, enough to cope with power current draws.

- **As Bolloré EVs are not 100% powered by solar energy in a country where most of the energy comes from fossil fuels – most of Cambodia's power plants are diesel or coal plants which are very polluting – therefore, in this context, does the use of EVs still really reduce the emissions of $CO_2$ ?**

It's important to remember that even if the EVs were powered only on the local grid, their use in Angkor would still contribute to reducing air pollution locally and preserving the temples which is the main objective of this project. To precisely determine the $CO_2$ emissions of Bolloré EV in Cambodia, complex calculations are required and figures needed from the Ministry of Energy.

# $CO_2$ EMISSIONS CALCULATIONS – WORST SCENARIO

To precisely determine the $CO_2$ emission of Bolloré EV in Cambodia, complex calculations are needed as well as figures from Ministry of Energy about electricity production and imports. Indeed, to calculate emission of an EV, the first step would be to determine the quantity of $CO_2$ emission for 1 kWh of electricity in Cambodia. To do so, domestic electricity production figures are needed (% hydro, % coal, % diesel, % renewables) as well as figures from neighboring countries (Thailand, Vietnam, Laos) from which Cambodia imports a lot of electricity every year.

Therefore, the study will first focus on the worst case scenario – all EVs are powered by coal plants' electricity, the most polluting source of energy – to demonstrate that **even with the "dirtiest" energy available locally, Bolloré EV will still contribute to greatly reduce $CO_2$ emissions in Cambodia**.

**Hypothesis** (Cambodia) :

- Most cars in Cambodia are old Toyota Camrys and large SUVs which are highly polluting vehicles, to the point that the French evaluation system (left) is not adequate for Cambodia. In this system, Cambodia ranking would be G, the lowest ranking : on average, **a Cambodian car produces more than 250g of $CO_2$ per km.**
- **Coal power plants** in Cambodia produce in average **804g $CO_2$/kWh** (International Energy Agency 2011)
- Bolloré EV range is 250km per full charge.

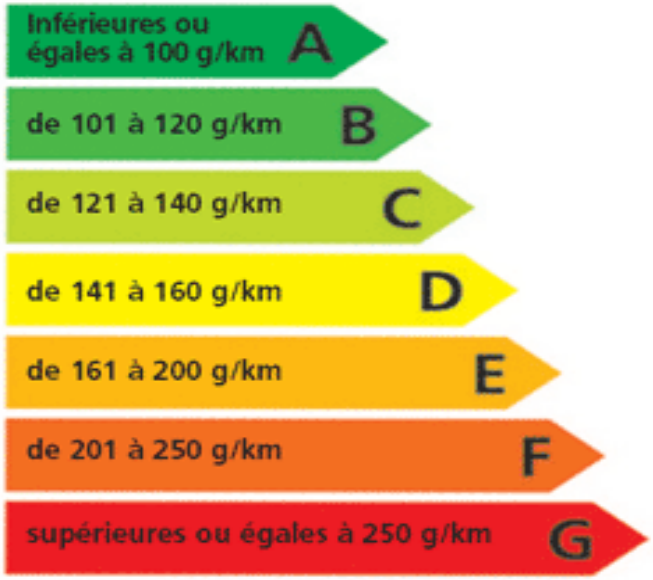
**Deductions** :

- EV consumption in kWh/km = 30 kWh / 250 km = 0,12 kWh/km
- **EV emissions of $CO_2$/km** = 0,12 kWh * 804g $CO_2$/kWh = **96,5g $CO_2$/km**

**Conclusions** :

Even in the worst case scenario – all EVs are powered by coal plants' electricity – each EV would :

- Emit **2,5** times less $CO_2$ than an average car in Cambodia.
- Reduce $CO_2$ emissions by **61,4%** compared to an average car in Cambodia.




**Cars $CO_2$ emissions - FRANCE**

# $CO_2$ EMISSIONS CALCULATIONS – 50% SOLAR ENERGY TO CHARGE EVs / 50% EDC

For an evaluation more in tune with reality, figures from Ministry of Energy will be needed but for the purpose of this study, World Energy Council figures will be used.

**Hypothesis** (Cambodia) :

- 50% of the power to charge the EVs is generated by a 360m² solar farm (Sunpower)
- **Coal power plants** in Cambodia produce in average **804g $CO_2$/kWh** (International Energy Agency 2011)
- Diesel power plants produce in average little less g $CO_2$/kWh than a coal power plant
- **Solar power plants** produce in average **60g $CO_2$/kWh**
- **Hydro power plants** produce in average **4g $CO_2$/kWh**

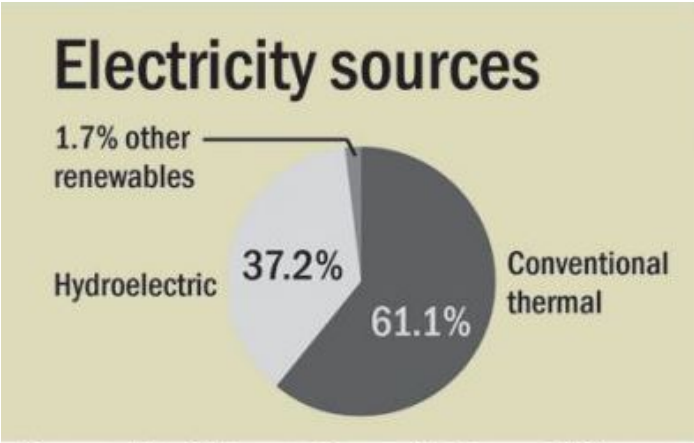
**Deductions** :

- Power plants in Cambodia produce on average = 493,8g $CO_2$/kWh
  = (0,611 * 804g $CO_2$/kWh + 0,372 * 4g $CO_2$/kWh + 0,017 * 60g $CO_2$/kWh
- Power used to charge EVs produce on average = 276,9g $CO_2$/kWh
  = 0,5 * 493,8g $CO_2$/kWh + 0,5 * 60g $CO_2$/kWh
- **EV emissions of $CO_2$/km** = 0,12 kWh * 276,9g $CO_2$/kWh = **33,3g $CO_2$/km**

**Conclusions** :

Finally, in the most realistic scenario – 50% of the EVs are powered by EDC electricity, 50% by solar energy – each EV would :

- Emit **7,5** times less $CO_2$ than an average car in Cambodia.
- Reduce $CO_2$ emissions by **86,7%** compare to an average car in Cambodia.




Source: World Energy Council's Energy Trilemma

**Données CAMBODGE 2015**

Emissions en $CO_2$ des différentes filières de production d'électricité

| Modes de production | 1 kWh Hydraulique | 1 kWh Nucléaire | 1 kWh Eolien | 1 kWh Photovoltaïque | 1 kWh Cycle combiné | 1 kWh Gaz naturel (TAC pointe) | 1 kWh Fuel | 1 kWh Charbon |
|---|---|---|---|---|---|---|---|---|
| Emissions de $CO_2$ par kWh (en grammes) | 4 | 6 | 3 à 22 | 60 à 150 | 427 | 883 | 891 | 978 |

Source : Etude ACV - DRD **Données FRANCE**

# $CO_2$ EMISSIONS SAVED SINCE 2013

In order to calculate **how many tons of $CO_2$ have been saved so far**, we need to take into account the total distance covered by our EVs as well as the total production of electricity of the solar farm .

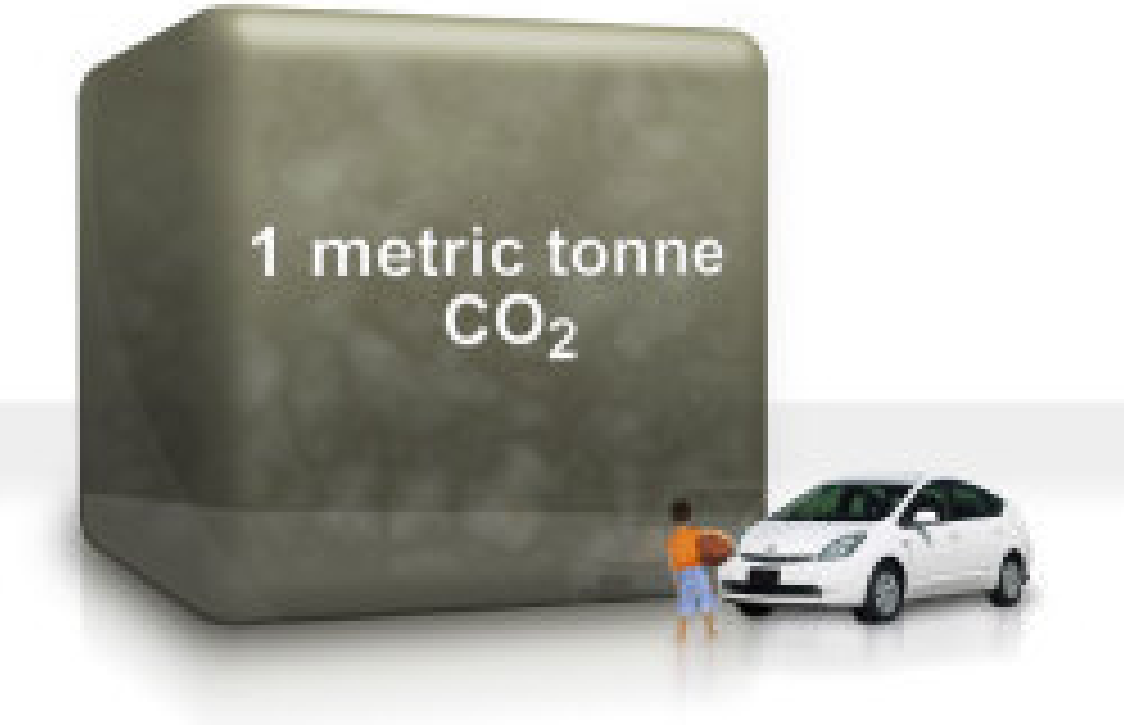
**Hypothesis** :

- Total distance covered, since 2013, by Bolloré electric cars in Cambodia (15 units) : 113 193km
- Total distance covered, since 2013, by Bolloré electric buses in Cambodia (2 units) : 12 401km
- Estimated solar farm production : 160MWh

**Deductions** :

- $CO_2$ emissions saved by the cars = 113 193 km * (250g $CO_2$/km - 33,3g $CO_2$/km) = 24,6 tons
- $CO_2$ emissions saved by the buses = 12 401 km * (1800g $CO_2$/km – 166,1g $CO_2$/km) = 20,2 tons
- $CO_2$ emissions saved by the solar farm = 160 000 kWh * (493,8g $CO_2$/kWh - 60g $CO_2$/kWh) = 69,4 tons

**TOTAL = 114,2 tons of $CO_2$ saved in Angkor**



# 100% Green & Sustainable model

In this prospect, Bolloré Group has always looked forward to sharing its model and its criteria to help experts evaluate all existing and future EV projects for World Heritage Sites :

- **A social model** for tuk-tuk, taxis and buses. All our BlueSummer are driven by ex tuk-tuk / taxi drivers.
- **A fleet management system and services**, including the technical maintenance of the EVs.
- **An energy model that requires a part of renewable energies**, to limit the demand on the local power grid and the energy dependence. At this stage, 50 % of our needs are covered by stored solar energy.
- **A technical model that requires energy storage**, to avoid power current draw during EVs charge that could stress the local power grid. We have a 180 kWh storage capacity, enough to cope with power current draw.
- **A sustainable technological model**, EVs and batteries must have a long life expectancy (which can be measured in cycles or km). Our battery guarantees a minimum of 3000 charging cycles.
- **A recycling model for EVs and particularly batteries**, to avoid the temptation to illegally dump them. Our BlueSummer is 100 % recyclable as well as our battery which has no toxic components and can be recycled at multiple times.

But being green and sustainable is not sufficient for a model to be successfully implemented.

# 2. A MODEL THAT NEEDS TO BE COMPATIBLE WITH THE LOCAL "SUPERSTRUCTURE" (TOURISM, CULTURE, LAWS, POLITIC, ECONOMY, ETC)

# A. COMPATIBLE WITH MASTER PLANS OF DEVELOPMENT AND THE LEGAL FRAMEWORK

**Projects from the private sector that fulfill all the criteria to be considered green and sustainable, must align with development master plans defined by the local authorities**. Indeed, the number of tourists visiting Angkor archaeological sites has now reached a critical threshold in terms of pollution and number of visits, therefore, the transportation development master plan will have to include not only the setting up of a fleet of electric vehicles (EVs) to reduce pollution but also new means of transportation as it will not be possible to double the present numbers of vehicles to ferry the forecasted additional millions visitors.

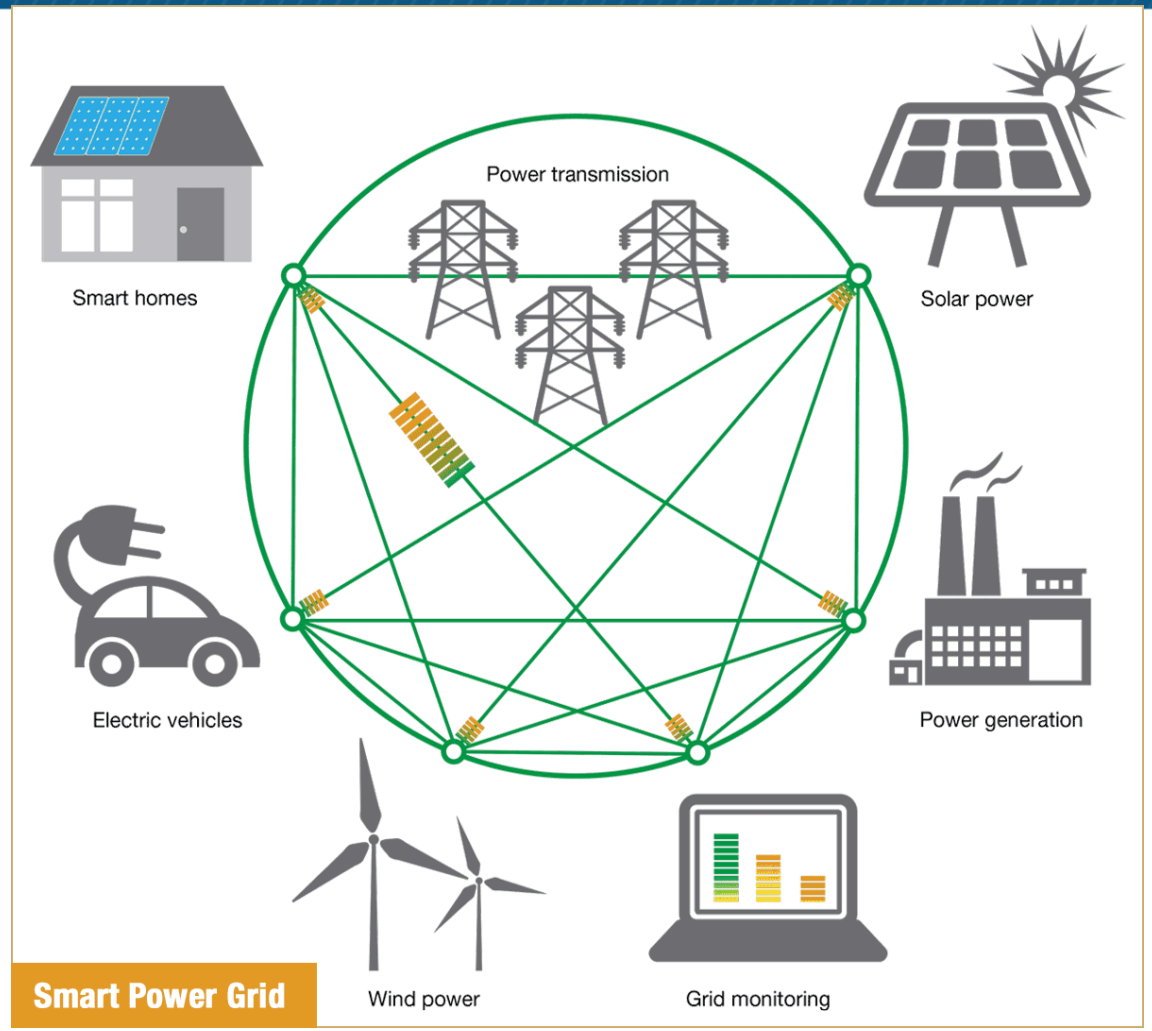
**Models also need to keep developing to be in accordance with master plans**. Bolloré Group has launched its model based on the BlueSummer electric car. The design of this car is perfectly adapted to visit Angkor but it is only as the long-term objective is to design a solution based on a shuttle service with EVs capable of transporting larger number of visitors.

**APSARA Tourism Management Plan**

# A LEGAL FRAMEWORK TO UPDATE

**A model need to be legal to be implemented**. In France, you can not have solar energy production without being connected to the national power grid, but in Cambodia, due to the absence of legal framework about renewable energies, it's impossible to connect to the grid.

This is a serious obstacle as it's impossible to launch a large fleet of EVs powered by solar energy without a connection to the grid (due to prohibitive costs of storage).



# B. COMPATIBLE WITH LOCAL INVESTMENT LAWS AND PUBLIC POLICIES, A MODEL NEEDS TO BE PROFITABLE IN ORDER TO BE SUSTAINABLE

From my experience as a founder/manager of a NGO, I've learned that while donor funding is indispensable to run a project, profitability is the best guarantee of its sustainability.

But at this stage, **Green is still a luxury. The private sector can not bear all the costs of a 100% green and sustainable model alone** as there will be no profit. In our model for Angkor, to make a perfect 100% green model millions of dollars have already been invested in equipment, infrastructures and operational costs. While this limited any potential negative impacts, it **tripled the investment cost compared to a profit oriented project**. And with more investment needed to launch a fleet of EVs sufficient to generate profit, the Return On Investment (ROI) needs to be measured in decades.

In this prospect, even if this project was conceived as a "Social Enterprise", with less focus on profit, without the **collaboration of the Government and International agencies to make it easier for private companies to invest,** there will be no profitability for my project nor for any future EV projects in Angkor.

# 3. SUSTAINABILITY : A PROFOUND SOCIETY CHANGE, A SHARED RESPONSIBILITY

# A. New technologies, new economic models, new laws, new philosophy = the setting up of a green superstructure implies a profound society change

Far from the initial illusion that it only takes green technologies to build a sustainable model, it seems that to go Green **a profound society change is needed**. To build a green superstructure implies major changes, especially for a society lacking environmental awareness, Green education and expertise. In Europe, it seems to be a smoother and more progressive process but Europe was a pioneer of this transition.

Focusing on the setting up of a legal framework for the EV sector in Cambodia, for example, the Bolloré Group has been collaborating since 2013 with **no less than 12 ministries and public agencies**. But even with the support of every ministry, no result has been reached so far.

Paradoxically, even with the support of its government, **a country may lack the internal resources to deal with this transition alone**. As a consequence and as this transition is a race against time, support from the international community is needed. Indeed, Cambodia's capacity to take advantage of this green transition is limited due to a lack of home-grown expertise.

# B. A SHARED RESPONSIBILITY = IMPORTANCE OF INTERNATIONAL SUPPORT

Without the strong personal commitment of the late President of the APSARA, Samdech Sok An, whom registered Angkor to the World Heritage list, the Group Bolloré would not have been able to create a unique model for Angkor (and other World Heritage sites).

Without the support of the Council Development of Cambodia and the Office of the Council of Ministers, we would not be so close to securing the indispensable import tax exemptions.

Without the support of the ministry of tourism, the ministry of Environment, international agencies, experts from UNESCO/UNWTO, ambassadors, development agencies, tour operators, hotels, tourists, etc, we would not have been able to fine tune our model for Angkor.

# B. A SHARED RESPONSIBILITY = IMPORTANCE OF INTERNATIONAL SUPPORT

But as it is a race against time, as the task is overwhelming, even if the Royal Government of Cambodia has already done an amazing job in recent years, **all the stakeholders need to join forces to make it a priority**. To be honest, even as the world leader in the management of EV fleets, after 5 years and more than 5 million USD invested, I doubt I will succeed to convince my top management to extend the deadlines of the projec because of the lack of infrastructures. And if we don't start to deal with the problem of air pollution in Angkor now, it may be too late to safeguard its carvings from severe damage from erosion.

In this prospect, I would like to praise the efforts of UNWTO and PATA in promoting sustainable tourism as it is crucial for the tourism industry. And also crucial for its watchdogs to encourage policy makers, government officers, NGOs, academics and industry practitioners to **step up their collaboration to build this Green superstructure which is indispensable in guaranteeing the sustainability of Heritage and attraction sites**. Otherwise, we will soon bear the responsibility for the destruction of the World Heritage Sites on which the tourism industry has been flourishing. To emphasize, the private sector alone can not bear all the burden, costs and responsibility of this transition to a much-needed sustainable green tourism.

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**I hope this presentation has helped you to understand the importance of all the elements of infrastructure for the transition to a green and sustainable tourism in World Heritage sites such as Angkor. To build these infrastructures, a Green “superstructure” is needed, as a solid base guaranteeing its sustainability.**

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