

SmartGreenCharge an off-grid mini-grid to charge till 24 electric vehicles simultaneously with 100% local renewable electricity

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Executive Summary

SmartGreenCharge unlocks e-mobility development by adding a 100% renewable high-power electric charging station inside an existing gas fuelling station on highways, e-bus stations, airports, e-ferries stations, supermarkets, islands, ... Other concerned sites are stressed/ weak grids or where local grid mix is obviously fossil or fissile thus not sustainable. SmartGreenCharge is a patent pending self-financed mobile mini-grid made of 3 renewable sources – ie solar photovoltaic pannels, windturbine, back-up genset with recycled cooking oil/ 2nd generation biofuel – supplying clean electricity to an AC or DC bus charging the storage battery and 12/ 24 electrical pumps till 1 200kW DC per single socket.

1 Our vision of E-Mobility

Our project started in February 2014. The patent pending owner has to solve three bottlenecks to boost E-Mobility deployment on a global scale :

Firstly, we want to increase the public acceptance towards electrical cars charging by using 100% guaranteed local renewable electricity. Worldwide, electricity is travelling through the grid and a great majority is still produced from thermal fossils sources emitting GHG/ particules/ NOx/ SOx/ Mercury ...with great live consequences on climate change and human health (air quality, induced cancers, deaths, ...). To be accurate : coal/ gas/ oil produce 67% of worldwide electricity, 69% of US electricity, 51% of UE electricity, 76% of Indian and Chinese electricity is coming from coal power plant [1]

Secondly we wanted to find a solution to overcome the limited capacities of the grid, for opportunity charging as a result of the increased amount of electrical cars sold.

Thirdly, we wanted to make quick, ultra-quick, mega-quick electrical pump business model economical without any public subsidies. Our target was to improve the electrical pump TCO (Total Cost of Ownership) with CAPEX including high electrical grid connections, studies, permitting costs, and OPEX including 1st, 2nd, 3rd maintenance level, land lease, CPO (Charge Point Operator) MSP (Multi Systems Platform), Roaming services operational costs. To be crystal clear a 50kW quick electric pump is never reimbursed without heavy public subsidies. A quick electric pumps in New-York [2], has a NPV 10 years= - 41 417\$.

Nowadays, announcements about higher needs of electrical energy are heard every week :

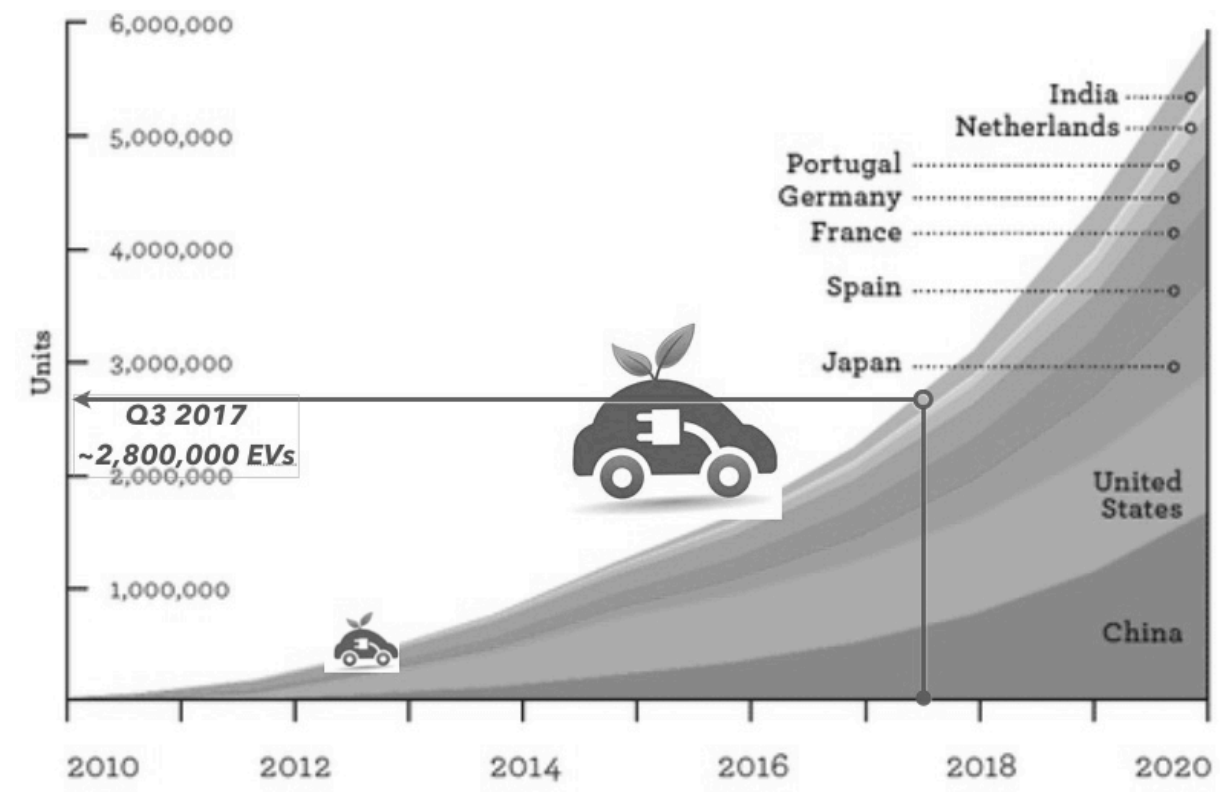
- Main and new cars manufacturers announce new e-cars models to replace fossil models
- The price of batteries is decreasing regularly as result of growing R&D budgets and ever increasing GWh of battery capacity produced and planned in the world
- The autonomy of each model increases regularly : range provides less and less anxiety but charge is still of concern
- New fast (50kW), superfast (120 kW) ultrafast (350 kW) megafast (650kW & more) chargers are developed and launched,

Where will the electrical energy come from?

- Most of electric grids must be reinforced to accept such powers
- Many places as highways fuelling station can hardly be reinforced economically
- Such works take more time :
 - than the e-cars manufacturers launch their various models,
 - to enable interested users to accept to buy massively electric vehicles,

We have to meet transport sector global decarbonisation aiming at +1.5-2°C COP 22 target within 2050

EVs will only grow with a decent network of electric stations to confirm hesitating EV potential buyers to effectively buy an EV



How do we dream an e-fuelling station?

- independent of the grid power
- using 100% renewable electricity
- quick to install
- needing a minimum or no public subventions

Our dream is a technical solution answering all these bullet points :

- renewable electricity produced locally : photovoltaics + biofuel + wind electricity production on site + large industrial battery as energy buffer
- off-Grid AC or DC μ -grid
- containerized components easy to install with no building permits
- standard electrical pumps

Our economic solution: 4 income flows

1. renewable electricity sold to the e-cars,
2. surplus renewable electricity sold to the gas station in behind-metering, peak hours load shifting
3. advertisement revenues through eye-catcher towers
4. Carbon crédits/ Carbons tax/ ROC, ...

Initial CAPEX may as well be reduced if electric pumps costs is mutualised between all e-cars manufacturers as done by many large e-cars manufacturers on various scales :

1. World scale : TESLA for its network of more then five thousand 120/135kW DC SuperChargers,
2. Europe scale : 1billion€ German JV [3] for its 1st target of four hundred CCS2 350kW DC UltraChargers. This JV between BMW Gp, Daimler Gp, Ford Gp, VAG Gp (Audi, Porsche, VW)

1.1 Time to install a decent set of quick electrical pumps

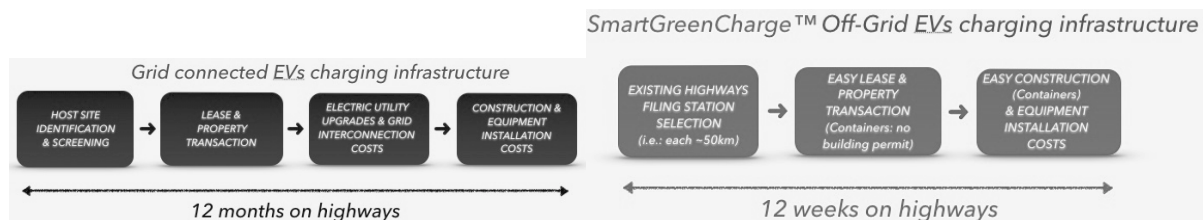


Figure 2: Planning from grid tied electrical pumps

Figure 3: Planning from off-grid tied electrical pumps

1.1.1 Host site identification & screening

As shown in Fig 3, this phase exists no more as far as the E-Stations will be first installed in selected existing highway gas fuelling stations every 80 km or in crowded areas (railways stations, e-bus stations, urban cities, islands, EV fleets, parking ...) : no more long site identification study, no site screening.

1.1.2 Lease & property transaction

This phase is easily done due to the “Plug & Play” design thanks to maritime containers that do not need building permits. This innovative E-Stations may be presented as a test period of 6 months depending on local regulation. If the average number of vehicles per day is not met within the test period, it can be moved to an other more favourable site. If the average number of vehicles per day is met within the test period, a building permit will be applied and a bigger wind turbine installed if local wind regime is sufficient.

1.1.3 Electric utility upgrade & grid interconnection costs

This phase shown in Fig. 2 exists no more with an off-grid mini-grid.

1.1.4 Construction & equipment installation costs

This final phase is quickly done within 1 to 3 months valorising our “plug & play” design thanks to maritime containers factory tested, the only remaining work on site is to link renewable sources, battery storage and electrical pumps charges to the smart low voltage panel. Commissioning would be easy as all components are factory tested.

2 SmartGreenCharge 400kW metrics

	POWER	RATE / YEAR	ENERGY / YEAR
solar panels	100 kW _{peak}	1 070 kWh/kW _p	107 000 kWh
biofuel generator	100 kVA	1 200 hours	120 000 kWh
2 Wintowers(wind/solar)	1kW wind/5kW PV		6 000 kWh
TOTAL	206 (kW + kVA)		233 000 kWh

Figure 4: base case sizing for France, Alsace region meteorological conditions,

3 SmartGreenCharge 400 mini-grid electric diagram

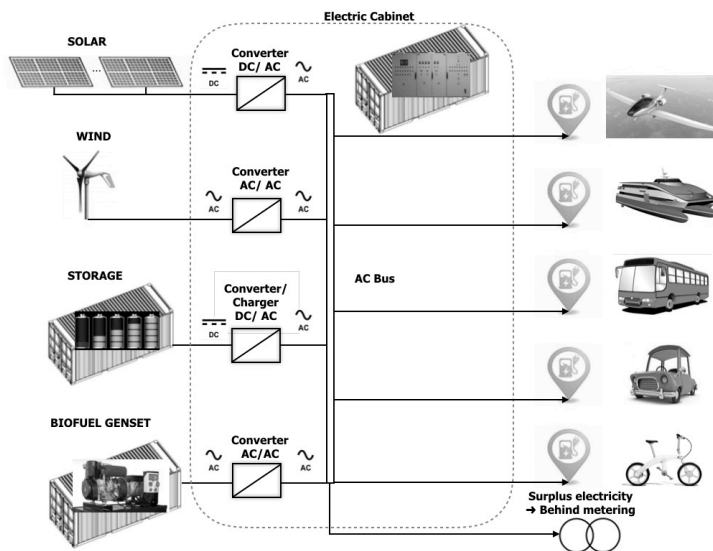


Fig. 8 : SmartGreenCharge 400kW AC

3.1 Charging power available with SmartGreenCharge

Table 1: Power levels for charging mobile accumulators
(AC bus = 400 VAC) (DC bus = till 1000/ 1500 VDC)

	Current (A)	Power
Slow	16	4 kW AC
Semi-fast	32	22 kW AC
Fast	85	50 kW DC
SuperCharger	192	120 kW DC
UltraCharger	650	350 kW DC
MegaChargers	800+	1200 kW DC

References

- [1] 2016 IEA Energy Outlook
- [2] page 9 « Strategic planning to implement publicly available EV charging stations: a guide for business and policy makers » (Author : C2S/ NASEO/ Clean Cities (US DoE)
- [3] German JV Joint Press Release may be read/ downloaded thanks to below link
<https://www.audi-mediacycenter.com/en/press-releases/bmw-group-daimler-ag-ford-motor-company-and-volkswagen-group-with-audi-und-porsche-plan-a-joint-venture-for-ultra-fast-high-power-charging-along-major-highways-in-europe-7124>

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