Berner Fachhochschule
Haute école spécialisée bernoise
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Solar-E-Bus in Mumbai Changing circumstances

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Content

- Motivation of the NGO Clean Air Island (CAI) Mumbai
- Motivation Swiss supporter (Urs Muntwyler)

- Project 2008/ 9 – technical question marks?
- Security problems in Mumbai after terror attacks
- Support from REPIC 2009
- Problems with site for PV and bus company

- New PV site in Mumbai 2012
- New partner for the E-Bus and the PV site 2014
- Final status of the project in summer 2015
- learning from the project

Advantages of renewable energies in developing countries since the 70-ties

Founder of a 3rld world shop in Solothurn 1977

PV systems from Hasler AG/ Berne for dispensaire in Rwanda 1984
More systems in Rwanda: 86/ 87!

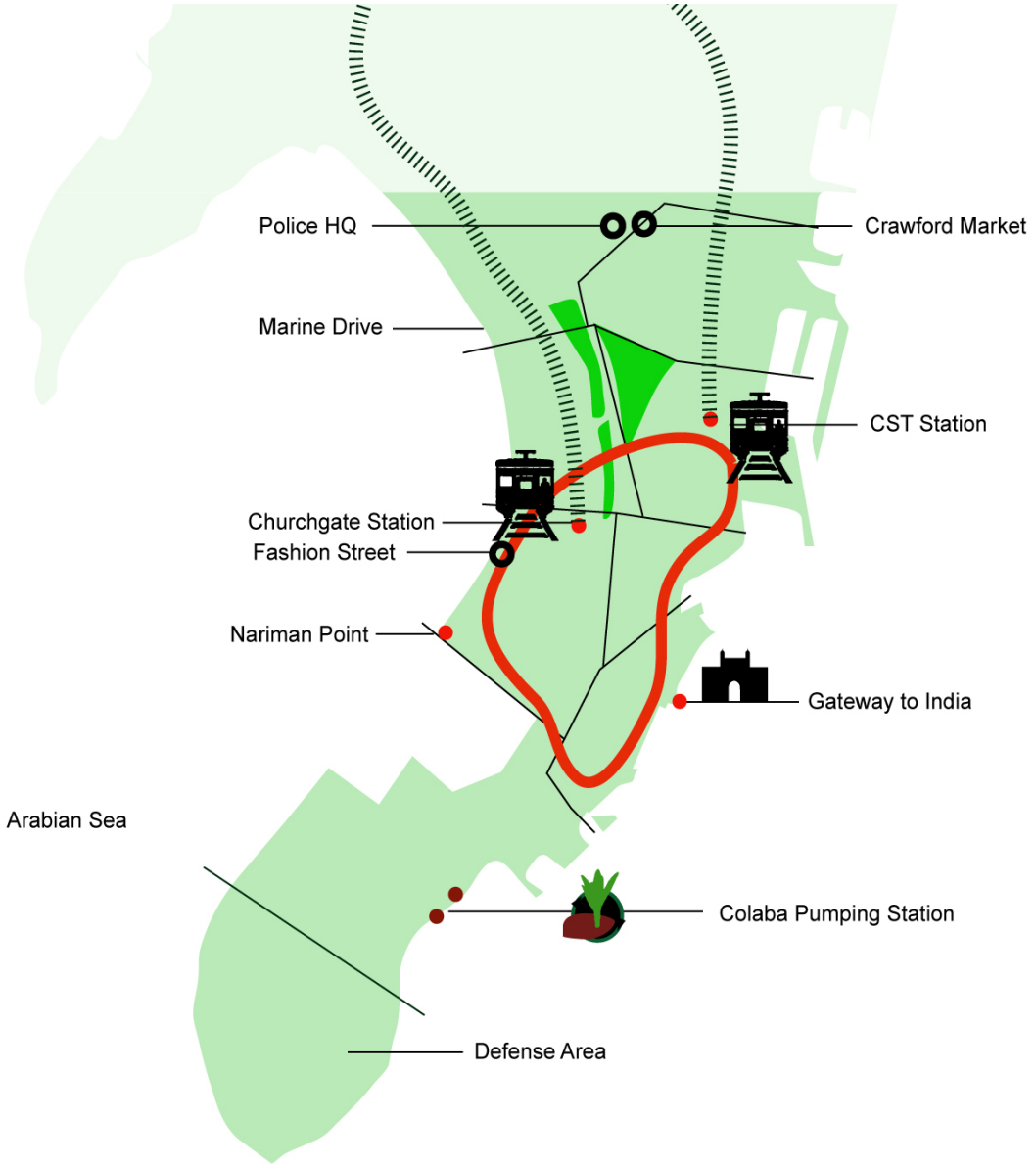
Learning: local people should make it – we must train and support them!

Project: E-bus route in Mumbai

Idea: small bus route circling in the most dense part of the city (I mean “dense”…)!

One electric bus for about 20 persons an improved version of a Chattelec-bus!

PV – installation on bus depot!



Motivation “Clean Air Island CAI…”

- Clean Air Island (CAI) is **a foundation led by** Shanta Chatterji
- Island means the very south part of Mumbai - very dense populated
- CAI improves the quality of life with ecological measures (planting trees/ recycling/ compost etc.)
- Mrs Chatterji was in Chattelec - E-vehicle company –contact to Muntwyler in the 80-ties (Tour de Sol)
- Mrs Chaterij was later WWF director for a national resort near Mumbai

➔ visit Clean Air Island CAI on Facebook!

The Environmental Family REPIC

CHATELEC

Engg. Office Muntwyler

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Saboo Siddik Engg. College

IIT Bombay

Bern University of Applied Sciences

Project ideas Solar E-bus in 2008:

- Service in Mumbai
- E-Bus with lead-acid batteries
- fast charging from another lead acid battery similar to a project in Luxemburg
- PV should charge the big battery – grid connected was not allowed at that time!
- special electronic needed – should be produced from Belgian specialists (charger electronics and consultants would consume nearly 50%)

Battery-battery fast charger in Luxemburg (2008)

Repic project:

- Project accepted for sFR. 100’000.—
- My idea: CAI got all the money and I would advice them for free…
- I would calculate the PV installations and - components (easy) and check the technical plans.
- REPIC acceptance was important for CAI because of the reputation (foreigner organization accept project) and the money too….
- CAI got my expertise for free…

First problems starts... technically:

- Lead-acid fast charging was too expensive and the battery lifetime of such a device would be short
- every replacement would cost sFr. 25’000.– which was very unrealistic to found – end of the project!
- We evaluated Li-Ion batteries in China (2010) – but the charger would cost sFr. 40’000.– plus the battery – too expensive too!

Solution: CAI had a (very old) specialist which worked for Chattelec – he was in favour for a battery exchange solution! – I preferred that!

Project Partners – many more …

First test ride with the E-Bus in Pune and many meetings in 2012

Sanjeev Mukherjee- Chatelec; Shanta Chatterji-Clean Air Island; Siraj Izhar-xyzLondon (middle); Prof. Urs Muntwyler/ PD Dr. Eva Schupbach, University of Applied Sciences Berne

Final results:
Route of Solar Electric Vehicle

A map closer to geographic reality

An abstracted map

The project moved to the site of the Indian Institute of Technology IIT - Bombay

Solar Electric Bus

28 Persons space: 25 standees with 3 seats in front
Range: 130 km/ battery charge/ top speed: 60 kph
120 V/ 420 Ah batteries/ 62 kWh per charge
Max. gradient: 1: 10/ turning radius: 6 m
25 kW DC series motor

Battery Change on rollers

New site for PV on the IIT campus

New site for PV brings new possibilities:

- first 8 kWp mono c-Si/ several 1 kWp with other technologies (p-Si and thin film)
- BUAS considers to expand their PV monitoring to India

Mitsubishi m-Si cells
260 Wp (dark colour)
36 modules- 9.3 kWp

Mitsubishi p-Si cells
225 Wp (blue background)
5 Modules- 1kWp

Learning from the REPIC project

- The budget for the project was by far not sufficient, then CAI started the project!
- The strong decline in prices for PV installations since 2009 helped a lot.
- In Switzerland the project would be stopped after 2 years. CAI could maintain the activities for years.
- Lack of funding and changing circumstances delayed the project beyond all I could imagine.
- The time needed from my side (weekly phone calls from India)–2 visits were beyond my imagination too!
- I still supposed that the project could be successful if Mrs Chatterji could lead the project.

Besides the functionality - the project could inspire students of IIT for the future!

More than predicted: Solar taxi with female driver

Not part of the REPIC - project but still finished: Solar taxi for woman with female driver. In India it's sometimes dangerous for woman to use public transport.

EV lane at IIT-B with solar taxi

6-11 Seats/
Speed: 50-55 kph/ range: 200 km
Battery: 120 V/ 300 Ah (36 kWh)

Bus design goes further …

New bus design with renewable materials goes further the REPIC-project – the body should be ready end of the year 2015!

No you can learn from CAI: buy a PV installation and an EV for yourself!

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