Solar for Transportation – An Imminent Disruption

Disruptive Technologies and Business Models in Transportation
DV Satya Kumar

Shri Shakti Alternative Energy Ltd: Powered for full-spectrum Solar Services

**INCUBATED IN year 2000...**
- By IFC, Washington, under the Photo Voltaic Market Transformation Initiative (PVMTI)
- As an enterprise driven by innovation and market transformation

**PARTNERED WITH best of breed global Solar specialists...**
- Idom, Spain (Engineering)
- STA, Spain (R&D)
- Brooks Engineering, USA (Training)
- Shift, New Delhi (Master Planning)
- Alectris, Greece (Solar ERP and O&M)

**EXECUTED projects successfully for prominent clients**
Outline

1. What is Disruption?

2. The Technology Trends Disrupting Transportation

3. Transforming Mobility Solutions – India to Leapfrog

4. Future Projections for “Transformative Mobility Scenario in India” by NITI* Aayog and Rocky Mountain Institute

5. The Impact - Solar for Transport

* National Institute for Transforming India
What is disruption? 5th Avenue New York City in 1900
This was disruption! 5th Avenue, New York City in 1913
The Five Disruptions in Clean Energy and Transportation – Tony Seba

**Storage Batteries**
Since 2010 battery costs have dropped at 16% per year - ACCELERATING

**Electric Vehicles**
EV 5X more efficient. Low Maintenance – Tesla’s Infinite Mile warranty

**Autonomous / Self Driving Cars**
LiDAR Cost reduced From $70000 in 2012 to $250 in 2016
Computing Power Cost reduced from $50 million in 2000 to $50 in 2016

**Business Models – Shared Economy**
Uber & Air BnB use the cloud and smart phone and others’ infrastructure. Car sharing and bike sharing are business innovation in transportation?

**Solar – To power all this technology**
PV technologies gone down in cost 200 times since 1970.
Installed base doubled every 2 years since 1990. 302GW installed worldwide.
PoP Quiz

What is the name of this plane?

What are the names of the two pilots who circumnavigated the world in this plane?
India is at a critical juncture for planning the future of its urban mobility.
Follow The Western Model OR Embrace Transformative Systems

Private vehicle growth
Private vehicles grew 2.7x from 2002–2013 to 160M

<table>
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<th>Year</th>
<th>Supply</th>
<th>Demand</th>
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<tr>
<td>2002</td>
<td>59</td>
<td>100</td>
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<tr>
<td>2013</td>
<td>160</td>
<td>340</td>
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Public transit shortage
Demand for 340k buses exceeds India’s 100k stock

Number of cars per 1,000 people

- India - Average
- Delhi
- Los Angeles (USA)
India - Fast-paced transformations in mobile phones, LEDs, and solar PV

**Mobile Telephony**
- Led largely by the private sector
- India Leapfrogged the transition to landlines
- **1 billion** mobile phone subscribers
- **220 million** smartphone users
- Digital transactions valued at INR 24.25 billion in the month of March 2017

**LED's**
- Nationwide replacement of incandescent lights with LED’s.
- **Target of 35 million street lights and 770 mn household lights by 2019**
- Aggregated demand and procurement lowered lamp costs 76% in 2014 alone
- **Reducing energy use by 114 TWh peak load by 21.5GW by 2019**. Reducing emissions by 85 MTCO2 per year in 2019
- Estimated saving of INR 4.55 bn per year for consumers

**Solar Photovoltaics**
- **India aims to install 100 GW of solar by 2022**, a core part of its INDCs
- Competitive auctions are placing Indian solar bids among the world’s lowest
- India’s installed capacity reached 12.2 GW by March 2017, sustaining a 59% CAGR since 2013
Mobility as a Service (MaaS) – a move away from traditional product driven and ownership based approaches
SMARTPHONE the NEW status symbol – It’s not the CAR

Mobile will be a key element in the New “Shared” “Electric” and “Connected” Transport Paradigm
Follow The Western Model Or Embrace Transformative Systems

**SUPPORTIVE ATTRIBUTES OF INDIA’S CURRENT MOBILITY SYSTEM**
High share of non motorized transit, low private –vehicle ownership, prevalence of mobility services
Rethinking Mobility – A whole-system approach to Mobility Transportation

**OPPORTUNITY AREAS**

*Assembling the pieces*
1. Mobility as a Service
2. Interoperable transport data

*Building the ecosystem*
3. Mobility-oriented development
4. Vehicle-grid integration

*Creating the supply*
5. Product manufacturing
6. Electric vehicle deployment

**NEW MOBILITY PARADIGM**

- Shared
- Electric
- Connected
Transformative vs Business–as-usual (BAU) scenarios

A shared electrified, and high-public transit future can reduce transportation energy requirements by 64%

Passenger transportation emissions are reduced by 37% from business–as-usual with the increasing adoption of renewables

Modeled energy requirement (in millions of tonnes of oil equivalent) for passenger mobility in India, 2015-2030
The transformative scenario delivers the same access with 60 million fewer vehicles.

Modeled fleet size (in millions of vehicles) and breakdown by vehicle type and technology in India for “business as usual” (BAU) and “transformative scenarios”, 2016-2030.

2030: Total number of motorised vehicles is 10% lower than BAU and EVs increase 9-fold in number.
Early examples of Disruptive Mobility Solutions in India

Lithium Urban Technologies Private Limited
Tomorrow’s Transportation. Today.

January 2017

Solar Pro
Corporate Employee Transportation by Lithium in Bangalore, India

Simplifying the Management of Transportation Complexity
India’s Changing Energy Mix – Major additions through Renewables predominantly Solar

56% of the Power by 2027 will be from Renewables
India imports 80% of its oil & uses ~50% of its forex for oil

India no.3 in oil consumption

4159000 bbl per day = 1518MTOE = 17654 TWh

156MTOE savings equivalent to 1814 TWh

1007GW of Solar capacity can generate 1814 TWh.

As per Niti Aayog and RMI report, the move to EVs for transportation is estimated to save 156 MTOE by 2030.
Thank You

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