

Market Deployment of EVs & HEVs: “Lessons Learned”

Sponsored by Sweden, Switzerland, Austria, Great Britain, USA

*International Energy Agency: Hybrid
Implementation Agreement, Annex 14*

Operating Agent: Tom Turrentine,

Country Experts:

Switzerland: Sigrid Muntwyler

Sweden: Kanehira Maruo

USA: Danilo Santini

Austria: Bjoern Budde

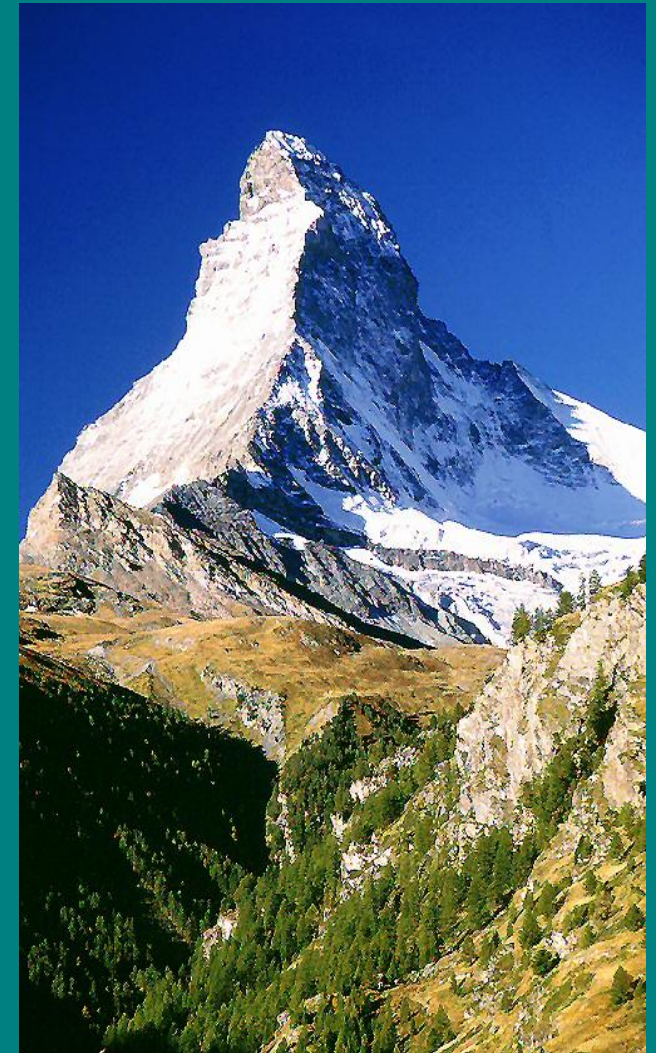
Great Britain: Robin Haycock

“Lessons Learned”

- Successes & mistakes in BEV (& HEV) deployments in Europe - USA - Japan in 1990s.
- Study period- Oct 2007 - June 2010.
- Workshops and interviews with veterans of 90’s & other experts
 - Completed: 2 in California, 2 in Japan, 1 in Switzerland, 2 in Sweden, 1 in London; 1 in Boston
- New workshops with “new deployment efforts”

And we compare deployment efforts

- **Switzerland:** Small market, innovative start-up OEMs, clean electricity, extensive experiment in Mendrisio
- **France:** Favorable electric system, OEM project, EDF involvement, La Rochelle project
- **Japan:** Favorable electric system, small vehicles, export oriented, GHG interest
- **California (USA):** Clean air regulations, practical household infrastructure
- **Sweden:** Procurement programs
- **New England:** Small EV company, cold weather issues



Participants

- Utilities: SCE, EDF, TEPCO, Fortum, Vattenfall, RWE
- OEMS: Peugeot, GM, Toyota, Nissan, Esoro , Volvo, Renault
- Governments: CARB, DOE, CRIEPI, Swedish Energy Agency, NY Power Authority
- Universities: Tokyo, UCD
- Project veterans: Mendrisio, La Rochelle, Gothenburg
- IEA representatives



What worked & what didn't work?

- Incentive programs (taxes, HOV lanes, free parking, etc...)
- Deployment approaches (mandates, procurement programs)
- Retail practices (market planning, fleets, dealerships)
- Infrastructure / utility lessons (slow & fast charging, billing)
- Market research practices (modeling, demonstrations)
- Commercial approaches (pay as you go batteries, leasing)

OEM lessons: Peugeot, GM, Nissan, Toyota, Esoro, Volvo

- Batteries were & are expensive (required subsidies).
- Minimum 20,000 units per year for profit (Peugeot built factory for 20,000 units per year, but sold only 2000 in the best year)
- US OEM planned for moderate future fuel costs
- ZEV program viewed as a cost by US OEM; as a threat by Japan OEM.
- 3 OEMs were unable to sustain long term R&D for BEVs when profits fall.
- Toyota says it has done everything technically, and still finds no business case for BEVs, says we must reshape car culture
- Nissan abandoned BEVs, now serious about development.

Some additional lessons



- EV deployments required education of consumers & industry
- Management support of sales was inadequate.
- NEV & CEV markets were small (not allowed on many roads)
- All small EV firms failed or were bought
- There was no culture of electronics (or batteries) in OEMs

Regulatory Lessons: California Air Resource Board

- Hard to justify forcing technologies that need long term R&D, don't have near term benefits & impact consumers
- But ZEV mandate resulted in much cleaner vehicles across fleet, so bold law was good
- And did result in R&D investments, particularly batteries
- And prepared market & CARB for GHG control
- NEVs found of little value for emissions regulations
- US fleet mandates were not applied well

Regulatory cont...

- Advance Technology Partial ZEV provision turns out key to keep technology development moving
- But need to maintain “technology neutral” regulations
- Can’t force OEM to do what it doesn’t want to do at the whole power train level.
- BEV experiment paved way for HEV market & recent development of PHEVs technology. Consumers were prepared.

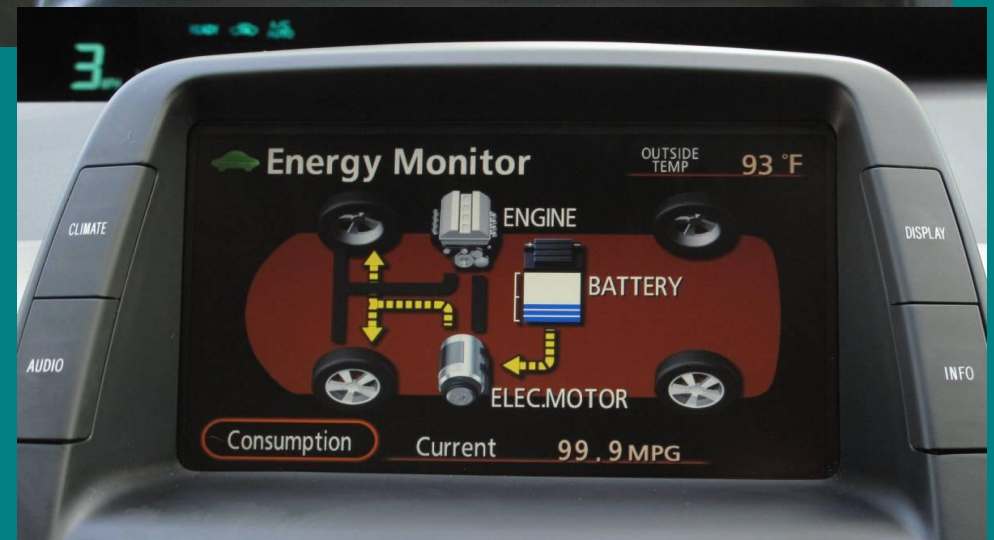
Utilities learned about getting customers plugged in.



- Public “fast” charging infrastructure was expensive, over subsidized & underused in most locations.
- Need to simplify purchase (shouldn’t have to sell charging infrastructure with car)
- “Charging standard wars” in US increased problems & expenses

HEV energy displays influence driver behaviors and change their experience of fuel economy

- HEV buyer spend lots of time looking at screen in first year
- HEV owner show researchers the screens, not the engine
- HEV owner understand and “value” their vehicle through their instruments
- HEV owner learns how fuel economy varies over speed, terrain, weather



Three conclusions

1. Need systematic cooperation between OEMs, government and power industry over at least 20 years
2. Careful timing of rollout of vehicles, infrastructure, incentives, taxes, rate
3. Must bridge chasm between early and main market with systematic education about vehicles and energy use and monitoring of market

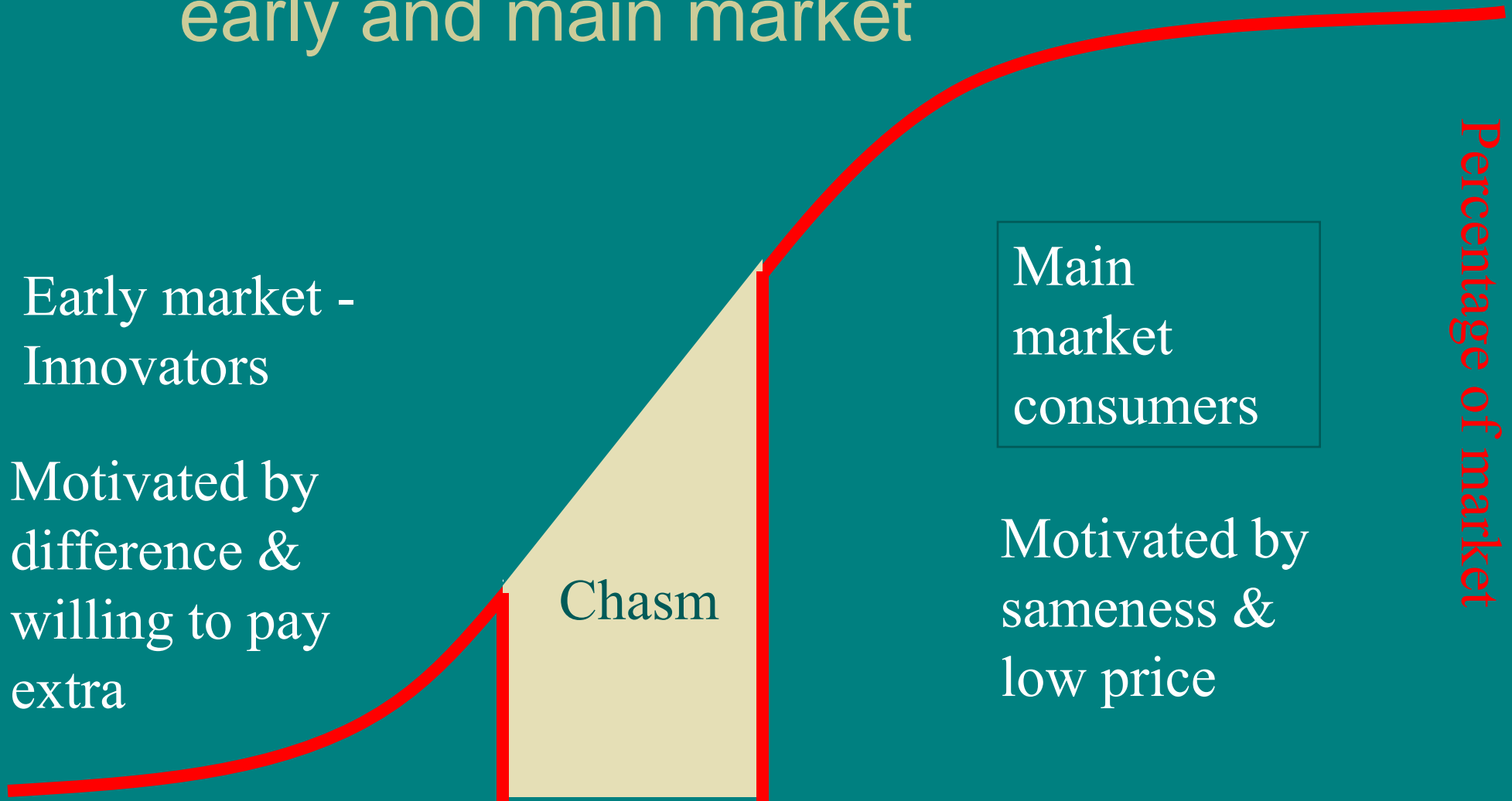
1. Systematic cooperation between OEMs, government & power industry at least 20 years

- Batteries are expensive, must be subsidized
- Minimum manufacturing levels (markets) 20,000 per year
- Must maintain R&D support during ups and downs in market
- Government: Long term, systematic “tilting of market”,
 - Regulatory constraints
 - Electricity prices
 - Structural shift (to smaller , limited range vehicle infrastructure (roads, parking, charging,
 - Development of lifestyle markets (resorts, city environments,
- Development of integrated vehicle and smart grid system

2. Careful timing of rollout of vehicles, infrastructure, incentives, taxes, rate

- Infrastructure should not lead market, should be installed in systematic way, in response to
 - 90% of charging energy will (and should be) done at home/ night parking locations
 - Careful selection of locations, should be well used
 - Avoid growth of free daytime charging
 - Focus initially on simple charging opportunities owners with simple demands

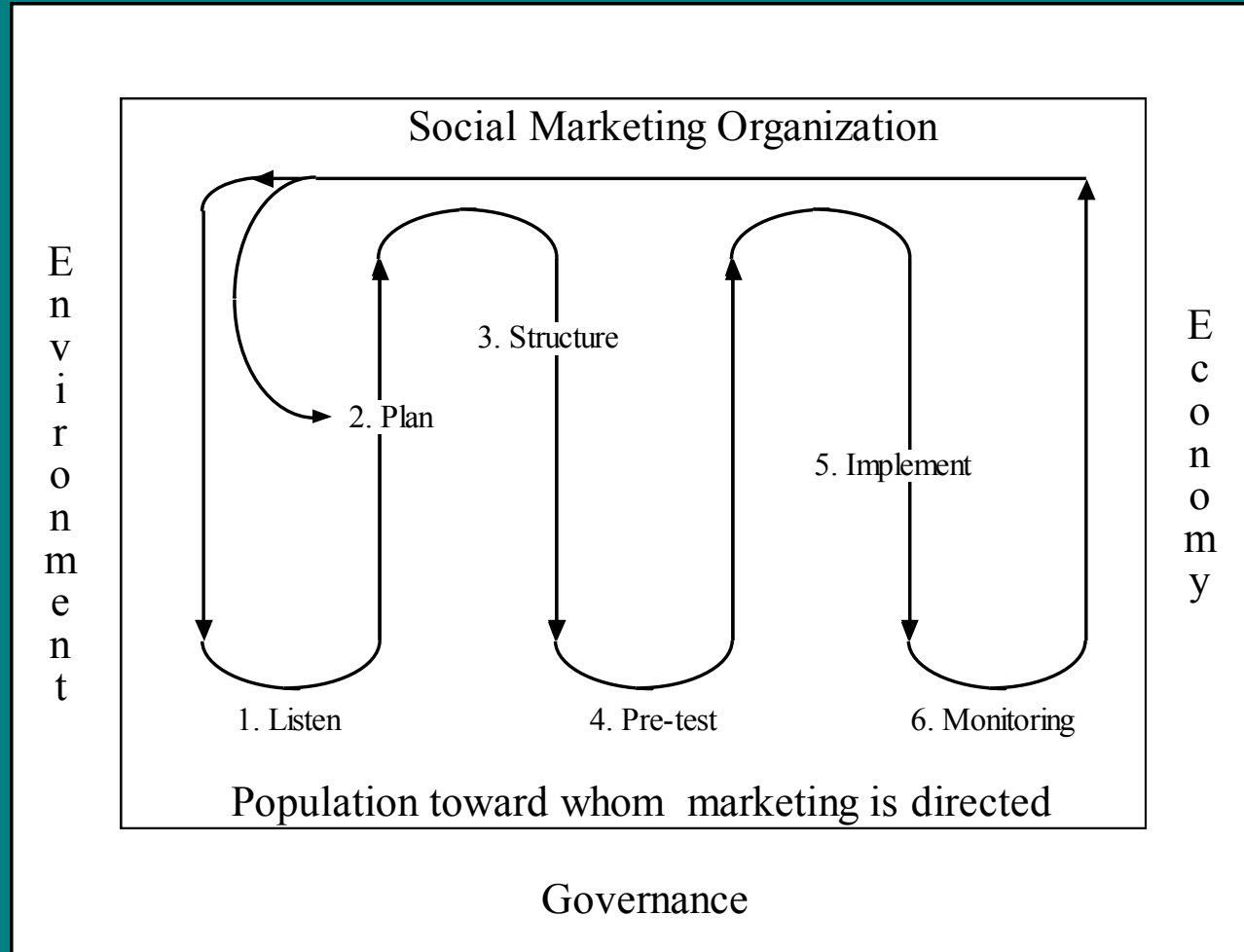
3. Must bridge chasm between early and main market



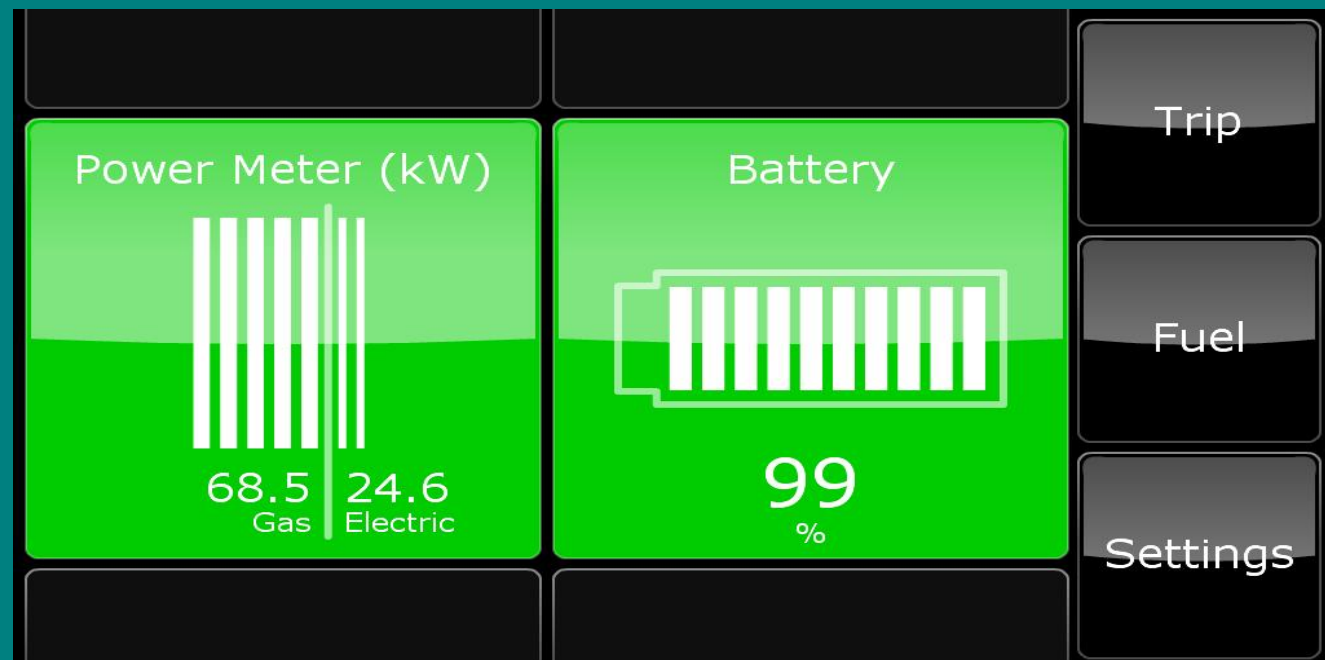
Comprehensive assessment of PEV market

- Regional analysis / spatial
 - Housing stock to identify distribution of EV readiness and willingness across market space
 - Location and number of easy locations (fixed night time parking and easy electrical hook-up)
 - Location and number of moderate situations (fixed nighttime parking, but greater expenses for charging)
 - Location and number of “difficult situations (no fixed parking and high installation costs)
 - Analysis of business fleets for appropriate duty patterns for PHEV and EVs

An iterative social marketing process, with iterative monitoring & adjustment of programs



- Systematic preparation of market through
 - Energy education
 - Vehicle instrumentation
 - Social energy accounting



EV & PHEV market rollout

