Research Paper
On

Development and Launch
Of

REVA electric car

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THE REVA ELECTRIC CAR COMPANY

Inception
The Reva Electric Car Company, RECC, was incorporated in 1995 as a joint venture between the Bangalore based Maini Group and AEVT Inc of Irvindale, California, to manufacture environment-friendly, cost-effective electric vehicles for city mobility.

Vision
The RECC has been established with the vision of combining a tradition of excellence and leadership in environment friendly urban transportation, offering the best value and highest quality electric vehicles anywhere in the world. The key tenets are to promote environment friendly technologies, to always be at the forefront of development and innovation in the field, to ensure the highest levels of quality and reliability, thereby giving the 'Made in India' tag respectability and acceptance globally.

Philosophy
The "zero principle" - philosophy of the Maini Group has been the guiding principle of the RECC - zero defects, zero time delays, zero inefficiencies and zero pollution. This is achieved through Zero Wastage and Zero Compromises.

Location
The RECC is at the Bommasandra Industrial Area, Bangalore. The company has an installed capacity of 5000 units and employees over 180 people. The Production Centre is based on an advanced flexible assembly line that ensures high productivity at lower breakeven volumes.Its R&D Unit has a DSRI recognition for further indigenisation and development of newer models of EVs. The unique Testing Centre ensures that every Reva rolling out is totally safe and reliable.

DEVELOPMENT AND LAUNCH OF REVA

Stage 1: IDEA GENERATION

Almost 30 years ago Sudarshan Maini conjured the vision of a small car for city commuting. When his son Chetan Maini led a solar car team to victory in the GM Sun Race in 1990, it prompted Sudarshan to add electricity to his dream car. He named this car Reva Reva, which in Sanskrit means "a new beginning"
Idea 1: Electric Car
Idea 2: Hybrid Car
The car was designed based on the feedback from 3000 people in 9 Indian cities. The requirement range from low purchase price, low operating cost, ease of driving and parking.

Stage 2: IDEA SCREENING

Hybrid Car:
Probability of success very less
Because: Less developed Technology
High development costs

Stage 3: CONCEPT GENERATION AND TESTING

Earlier known as Maini Amerigon, the Reva Project was first conceived in July 1994, when Chetan Maini, Managing Director of RECC, initiated the Reva Project at the Amerigon Inc.

Who is the customer, the unique benefit to him/her and occasion of use ?

Target Marget Segment	Benefit to TMS	Occasion of use
Small Families	Low operating costs	When going out for shopping etc.
Office Going people	No need to stand in queues for gasoline	Daily commuting to and fro from office
College going youngsters	Styling looks	Home-College commuting
Old aged people	Safety, Hassle free driving	Going to office, market

Where RIVA Stand vis-à-vis competitors and substitutes?
Competitors: Ashok Leyland(makes only electric trucks)
Substitutes: Small Cars: Maruti 800, Maruti zen running on petrol/diesel
2-wheelers

What can be the Emerging products that can be a threat ?
Hybrid cars which run on both gasoline and electricity

How can REVA create Differential advantage?

a) **REVA deploys the following 3 key proprietary technologies:**

1. **The integrated power system (IPS)**:. The system is a proprietary technology developed by Amerigon and is patented. All major battery functions from charging and monitoring to range indication, motor control and power conversion for auxiliary systems and system diagnostic are managed by the IPS

2. **The Engine Management System (EMS)**: EMS has five key functions, which are: charger control; state of charge (SOC) estimation; vehicle diagnostics; batter warranty verification and vehicle date acquisition (DAQ). The EMS also controls the outputs on the instrument panel of the Reva

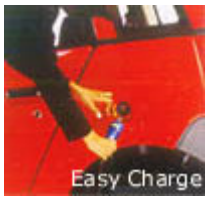
3. **Climate Control Seats (CCS)** : The next critical piece of equipment used in the Reva is the cooling, heating and ventilating system i.e. CCS. This equipment is protected by patents filed by Amerigon. The CCS has a solid state heat pump and is extremely efficient (typically energy consumption is 10% less than that are used in conventional air-conditioner).

Thus it creates Entery Barrier to competitors

b) Features, Attributes and Benefits

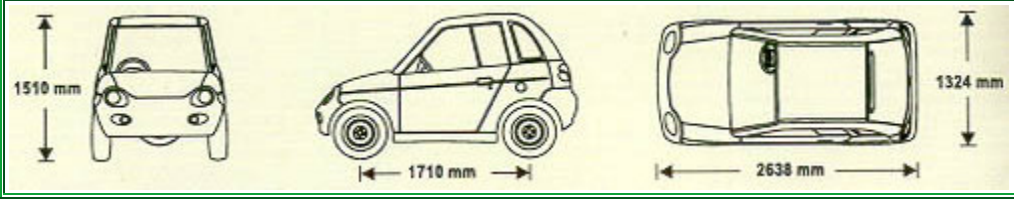
S.no	FEATURES/ATTRIBUTES	BENEFITS
1	The integrated power system (IPS)	significant cost and weight reductions
2	The Engine Management System (EMS)	Optimizes charging and energy output of batteries to maximise operating range and improve performance, improve efficiency and reduce cost
3	Climate Control Seats (CCS)	This ventilates and cools/heats the seats to increase driver comfort under different weather conditions
4	MacPherson single a-arm suspension in the front and coil spring in the rear	Facilitates good road handling and a smooth drive
5	Side impact beams, a specially developed steel frame and electronic regenerative braking	Contribute to a high level of reliability and safety

6	The high motor torque 70 NM	enables quick acceleration
7	The absence of an engine gearbox or clutch	Gives an excellent power to weigh ratio
8	higher seating position	provides a more convenient mode of entry and exit
9	smallest turning radius only 3505 mm (3.5 metres)	easy to maneuver and park.
10	Compact size	Hassle Free Driving ,low steering effort
11	on- board charger	can be charged anytime, anywhere
12	The specially designed steel space frame and side impact beams	cocoons passengers in the event of a collision, shielding them from an impact.
13	The body of the Reva is made of high impact ABS (Acrylonitrile Butadiene Styrene)	dent resistant and non-corrosive
14	The regenerative braking	recovers useful electricity by putting it back into the batteries
15	It runs 80 Km on a single charge of 9 units of electricity	
16	Eco-friendly	zero polluting and noiseless. It does not require frequent oil changes.
17	Efficient Charging System	Running cost per Km is 40paise.



Specifications

Type	:	Two-door hatchback
Payload	:	2 adults and 2 children
Top Speed	:	65 Km/hr
Charge time	:	80% charge in 2.5 hrs; 100% in 6 hrs
Integrated Power System		
Motor	:	High Torque (70NM), separately excited DC motor, 13 KW peak
Controller	:	400 Amp microprocessor-based with regenerative braking
Charger	:	220 V, 2.2 kW, High frequency switch mode type
EMS	:	Microprocessor based battery management system
Power pack	:	48V, 200 (C-5) Amp-Hr, EV tubular lead acid batteries
DC - DC Converter	:	48V to 13.5V, 400W
Dimensions		
Length	:	2638 mm
Width	:	1324 mm
Height	:	1510 mm
Ground Clearance	:	150 mm
Wheel Base	:	1710 mm
Turning Radius	:	3505 mm
Curb Weight	:	670 Kg



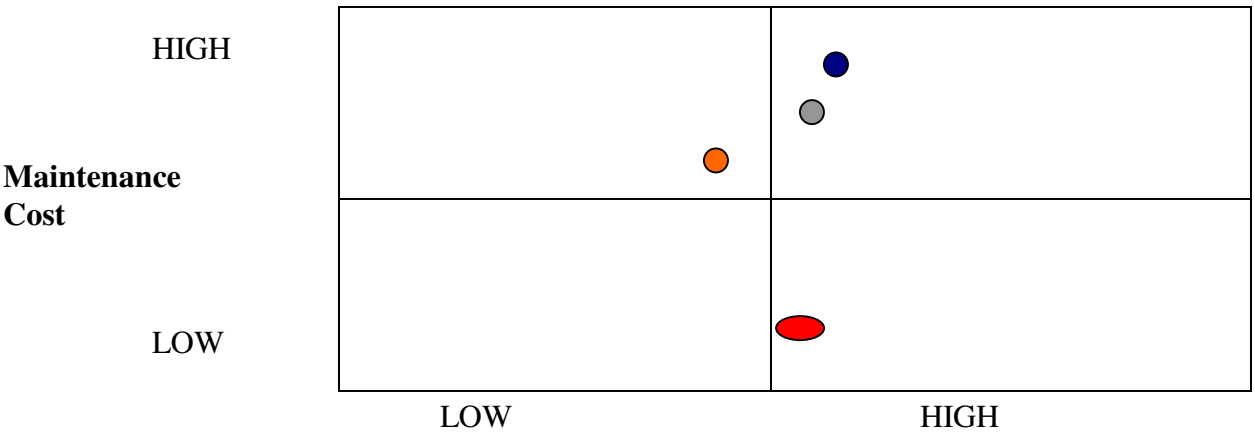
Price

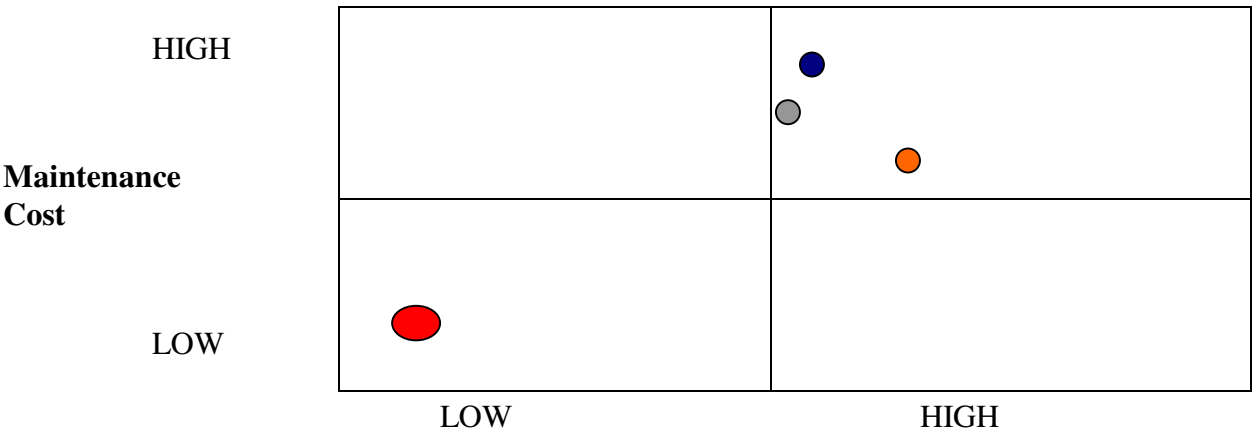
Price (ex-showroom, Bangalore) Rs 2.49-Rs 2.74 lakh
Top speed 50kph
0-50kph 18.3 sec
Range 80km

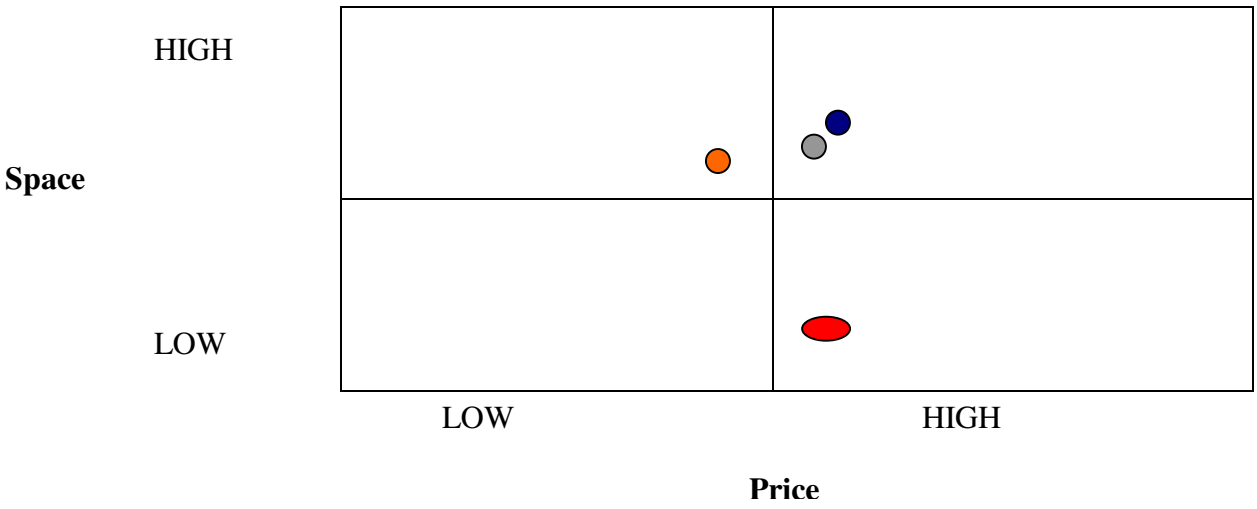
Perception maps:

Legends:

- Tata Indica diesel
- Maruti Zen diesel
- Maruti 800
- Reva







Stage 4 : MARKET STRATEGY DEVELOPMENT

TMS: nuclear families with 1 or 2 small children, students, housewives, retired people and corporate buyers

Brand Positioning: city car for the small family with low operating costs
Initial Sales: 1500 units in 1st year and 3000 units in 2nd year

Product Variety Plan:

REVA

The car of the future is finally here!

Reva the car for the 21st century heralds a new era of non-polluting, very affordable personal transportation that will be a boon to city commuters.

REVA Classé

Cool & Comfy with an A/C

Let your eyes indulge in wanderlust over the new, soft touch finish and luxurious look of the REVA Classe with allnew value adds.

REVA zephyr

Reva Revolution!. India's first electric car has taken a leap ahead with a new sporty convertible –Reva Zephyr for the young and young at heart.

Watch the world make way for you in awe as you cruise in your Reva Zephyr!!!

Price Plan
Reva is priced at Rs. 2,63,473
Reva Classé at Rs. 3,18,032.
Reva Zephyr at Rs. 3.75 lakh

Distribution strategy
The REVA electric car company, from the Maini group had appointed 90 dealers country wide, 40 of whom are around Bangalore

Promotion Strategy
The car was put on display at 'Cuhh 2000', the youth intercollegiate cultural festival held at Mount Carmel College earlier this month.

In a tie-in contest, couples were asked to strike an unusual pose in or around the car. And no, the winner was not awarded a car but a 1,000-rupee Shoppers' Stop gift voucher and a few tee-shirts.

A preview of the car was organised at 'Smiles 2000', an exhibition on renewable energy

Long run Sales
12000 units after 4 years

Stage 5 : BUSINESS ANALYSIS

Description	Yr0	Yr1	Yr2	Yr3
Units	1500	3000	5000	8000
Sales revenue	300 mn	600 mn	1000 mn	1600 mn

Since the cost of a Reva, has not been disclosed and marketing expenses and OHD are not available so cash flow can't be made

Stage 6: PROTOTYPE DEVELOPMENT AND TESTING

The first REVA prototype was ready in mid 1996, after which it was tested extensively at the Automobile Research Association of India (ARAI), Pune, for homologation and was certified for road-worthiness. The REVA prototypes have further undergone extensive road testing in USA and India successfully.

With the support of the MNES (Ministry of Non Conventional Energy Sources) RECC carried out intensive Vehicle Testing on Reva Pre-Production Models. 40 Pre-Production Model Reva' s were tested for over one million kilometers equivalent to driving around the Globe 25 times.

To understand the effect of harsh road conditions on its structural integrity Reva was put through the unique Shaker test, which it has completed successfully at the ARAI, Pune. During this test Reva was mounted on 4 posts which were moved independently simulating various road conditions over a cycle of 2,00,000 Kilometers.


Shaker test at ARAI -Pune


Endurance testing in progress

Considering unique road conditions coupled with high summer heat, humidity, monsoons and major fluctuations in supply voltage, REVA was tested on Indian roads in actual conditions.

A unique automated system with a tethered vehicle was developed. The vehicle is driven unmanned on a test track with power supplied to it via a cable. The entire test operation is computer controlled and runs 24 hours a day on a varying speed profile. The track includes bumps, potholes and a water trough with 45 centimeters of water.

In addition to this some further test were conducted on individual components like power pack, battery' s suspension transmission etc to ensure a high component reliability

Stage 7: TEST MARKET

The Company continued extensive testing and development before commercially launching the vehicle in 2001. Seven years of R&D has earned the company recognition in the form of 10 patents and a globally accepted product. The Car was first test launched in Bangalore because:

- Bangalore had a distinct advantage over developed countries in this respect due to low labour costs
- The presence of a good consumer base.
- Congestion favours nimble, small vehicles and operating costs are low
- The entire City is accessible by vehicles within the 60 km to 80 km radius
- Average speed is around 60 km per hour
-

RATING THE MAINI REVA	
Looks and styling	★★★
Motor and performance	★
Comfort and interiors	★
Driver appeal	★★
Build, quality and finish	★★
Efficiency	★★★★★
Air conditioning	NA
Value for money	★★
Ownership experience	★★★

Stage 8: COMMERCIAL LAUNCH

The company talked with Karnataka Power Transmission Corporation (KPTC) to get the necessary clearances

Reva Company also talked with Bangalore City Corporation (BCC) to install recharging points at airports and shopping complexes

In preparation for its launch , the REVA electric car company, from the Maini group, has appointed 90 dealers country wide, 40 of whom are around Bangalore

Reva was initially introduced in Bangalore in July, 2001 and in Delhi in May, 2002 followed by Chennai, Mumbai and Pune.

Stage 9: POST LAUNCH

- Reva extended dealerships across Delhi, Bangalore, Chennai, Goa, Delhi, Surat and Jodhpur
- The group spends seven per cent of its turnover on research and development.
- The RECC plant expansion was under way, at the completion of which the plant would be able to produce 6,000 cars per annum
- Exports to countries like Nepal, Malta, the UK, the USA and Switzerland. The company expect to have at least 25 percent of our sales revenues to come from export
- The company was in talks with major hotels, super market chains and movie theatres in Indian cities for providing charging points for Reva cars
- The company was also planning to adopt advanced battery technologies for offering increased mileage for Reva cars in the near future
- Planning solar chargeable version of Reva. Plans are also a foot to enter into vehicles for the public and private transport sector
- REVA Electric Car Company (RECC) developed India's first fuel cell prototype car. Fuel cell vehicles are propelled by electric motors, by creating their own electricity through a chemical process using hydrogen fuel and oxygen from the air.

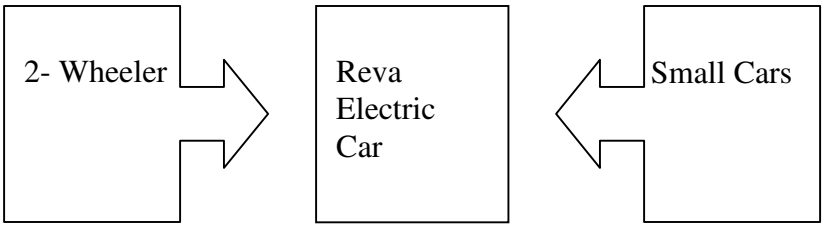
REASONS FOR FALIURE OF REVA

1. Market size overestimated: Company estimated to sell 1500 cars in the very first year of its launch. Even after 3 years of its launch it has sold only about 300 cars in India.
2. Product not well designed: the insides are incredibly cramped. The driving position is nicely elevated but your head disappears into the roof. It lacks basics like comfort and space
3. Everything around you feels like it has been shrunk one size smaller
4. Development costd higher tha expected: The exorbitant cost of vehicles entail due to complexity of its design
5. Government Regulations: the government has a five per cent duty for CNG/LPG kits as well as catalytic converters but the materials for electric vehicles attract a 20 per cent duty.
6. Over Priced: Priced at Rs 2.49-Rs 2.74 lakh, the Reva seems completely overpriced, especially as a Maruti 800 with air- conditioning is cheaper
7. Power Crazy Customers : REVA did not find wide acceptance in view of the power-crazy consumer mindset, Internal Combustion Engines (IC Engines) proving more powerful
8. Limited in scope owing to excessive weight of battery packs used in EVs as the main power source.
9. Frequency of charges necessitated by low battery storage capacity and long duration of charging times. The power pack needs 8 hours for a complete re-charge - although 80 per cent replenishment is possible in 3 hours

10. Future Costs: The replacement cost of the battery - Rs. 25,000 after 40,000 km
11. The truth is that the Reva lacks the practicality and convenience of an everyday car
12. Limited Payload: The payload of a laden car is 227 kg

CONCLUSION:

Market Research reveals that 98% of the Urban population travel an average of only 40 kms a day and require a maximum speed of 40 km/ hr. Hence the REVA is ably suited for the market requirement for city mobility provided the price is brought down below the ordinary small car like Maruti 800 but higher then 2 wheelers.



Creating Niche between 2 big segments

The company should create Electric Vehicle platforms that cater to the city needs of a complete range of vehicles. This would include small vehicles for city mobility all the way to minibuses for public transportation