



APEIS Project:

Development & Applications of Strategic Data Base (SDB) for India

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Technological Innovations

- **Demand Side Technology**
 - Transport Sector
 - Household Sector
 - Industrial Sector
 - Agriculture Sector
- **Supply Side Technology**
 - Power Sector
- **Institutional Governance**
 - Finance Sector

- REVA Electric Car Company (RECC) designs, develops, manufactures and markets electric vehicles under the brand name “**Reva**”
- It is the cheapest commercially produced electric car in the world
- It is an extremely safe car, has been specifically designed for congested city driving conditions
- **Features**
 - Easiest car to drive
 - It is twice as efficient as a petrol driven vehicle and has an operating cost as low as 0.4 Rs. / km
 - Requires extremely low maintenance because of the minimum number of moving parts
 - Environment friendly - No CFC's or fluids
- **Significance**

An average car in India emits :

 - 5 gm / Km of NO_x and HC / 24 g / Km of CO
 - Reduction of noise pollution

- **Market Potential**

- Around 1000 cars in the domestic market
- 600 in overseas markets
- Major export to USA, Norway, Switzerland, Cyprus, Japan, Srilanka and Malta
- Reva has received the EEC (European Economic Community) Certificate

- **Constraints**

- High cost of ownership due to the stiff price
- Limited range of driving for those whose usage is not be restricted within the city
- The perception that electric vehicles are not safe to drive

- **Cost Information**

Car Type	Price (Rs. 000)	Driving range (Km)
Standard (non a/c)	310	80
Classe	405	60



- Eco friendly battery operated vehicle
- Introduced by **Bharat Heavy Electricals Ltd. (BHEL)**
- **Technical features**
 - Range per charge : 70 Kms/ Max. Speed : 40 KMPH
 - Energy Consumption : 0.5 KWH / Km
 - Smokeless, noiseless, oil free battery powered vehicle
 - Seating capacity : 15 +1
- **Significance**
 - Ideal vehicle to keep environment clean
 - Reduction in noise pollution
 - Recurring savings of petrol or diesel
 - Less operating and maintenance cost
- **Cost information**
 - >than Rs 1.2 million
 - Running cost : about Rs 1.50 per km



- The most economical and battery (rechargeable) driven two wheeler
- **Electrotherm India Ltd**, the promoter of the YO-BYKES in India
- YObykes work on a completely new technology where the two-wheelers do not have any engine and exhaust
- **Significance**
 - It is cheapest to buy, cheapest to run and cheapest to maintain
 - No license, no PUC, no Registration Certificate required for YO-BYKE
- **Cost Information**
 - Cost lesser than regular petrol vehicles (0.15- 0.18 Rs./km)

Model	Range / Charge Mileage	Price (Rs.)
YOSmart	75 Km	23249
YOSpin	55 Km	20749
YOTrust	75 Km	17499
YOTeen	50 Km	16499
YOTrend	50 Km	15749
YOTuff	50 Km	13999



- Ashok Leyland has signed an agreement with Brehon Energy PLC, Australia, for technology for the use of ecologically superior Hythane gas in Compressed Natural Gas (CNG) engines
- Offers 6-cylinder 'H' series engines to operate on Hythane – "clean fuel"



- **Features**
 - Use of Hythane, which is a prepared blend of hydrogen and natural gas, dramatically reduces gaseous emissions compared to CNG
 - Max.speed : 75 Km/ Hour
- **Significance**
 - Used for Passenger mass Transportation
 - Ideal for city bus application

- CNG Auto-rickshaws are three wheelers fitted with engines using CNG as fuel
- Developed by Bajaj Automotives Ltd
- Features
 - The CNG has a low cost and high performance which assure to save 65% of fuel expenses
 - 4-stroke, air cooled spark-ignited engine
 - Has a CNG cylinder (22 liter water capacity) capable of holding ~ 3.5 kg of CNG at 200 bar pressure
 - Fuel efficiency of ~ 45 km per kg of CNG
 - Complies with all notified safety standards
 - Emissions substantially lower than the prescribed limits
- Cost Information
 - The CNG Conversion kit : Rs. 50000/-
 - The CNG Auto rickshaws : Rs. 150000/-



Constraints

- Deficiency in CNG supply system
- Uncertain future
- Assurance of supply
- Uncertain fuel price
- Dependence on a single source
- Long queues at CNG dispensing stations
- Inadequate supply of conversion kits.
- Inadequate training & awareness amongst auto rickshaw & bus drivers, other users, technicians & mechanics.

Vertical shaft brick kiln technology is used To produce quality bricks which are **Energy efficient, Environment friendly & Economically viable**

- In 1995, the Swiss Agency for Development and Co-operation (SDC), New Delhi, launched an Action Research Project in India , to adopt the Chinese VSBK Technology to the Indian context
- The first VSBK became operational in India in May 1996 at Datia (near Jhansi) in Madhya Pradesh
- **Features**
 - Production of Bricks : 4000 bricks/day, 1batches/day depending upon shaft size.
 - Energy saving of about 50% compared to clamps and 20 to 30% compared to BTKs(Bull's Trench Kilns)



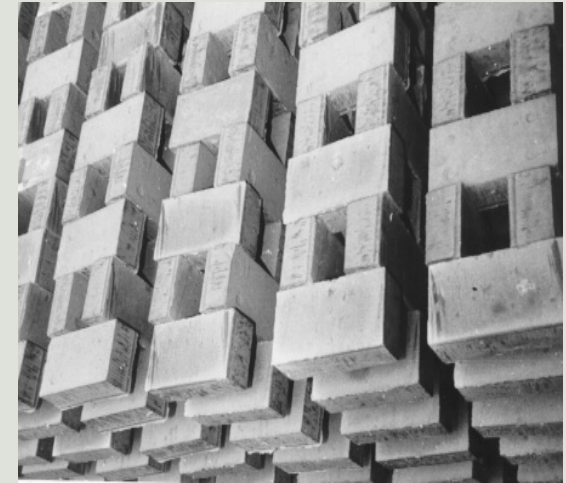
- **Significance**

- Occupies less space - low land requirement
- Minimal maintenance requirements
- Flexibility in volume of production
- Environmentally sound technology
- Better quality bricks compared to clamps

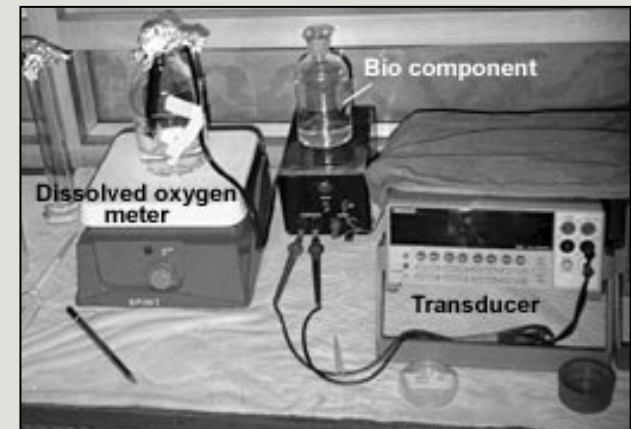
- **Cost Information**

- Rs.250000 for a 2 shaft kiln

- The technique to produce building bricks from fly ash is developed by Central Fuel Research Institute- Jharkhand
- Used in construction
- Environment friendly process
- **Commercialization Status**
 - Four commercial plants have been set up (15,000-90,000 bricks per day)
- **Cost information**
 - About Rs.1200/- per thousand bricks (size 225x112x75mm)
 - Rs.1300/- per thousand bricks (size 250 x 125 x 75 mm)
 - Plant cost Rs.6 million for a 20,000 bricks/day plant (3 shift)



- A device is used for instant monitoring of organic pollution in wastewater
- Developed by Institute of Genomics and Integrated Biology (IGIB) in Delhi
- **Features**
 - Consist with a bio component, a dissolved oxygen (DO) probe and a transducer
- **Significance**
 - Biosensor can analyze a sample and generate the results of BOD / DO, in less than 10 minutes, at the site itself
- **Cost information**
 - DO meter :About Rs. 100000
 - Biosensor : About Rs 30000-40,000
 - Durability : One year



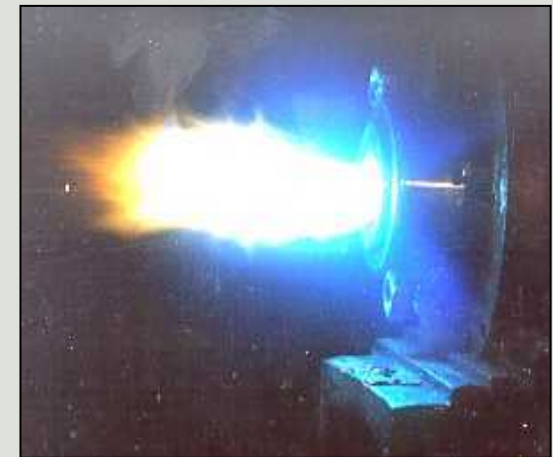
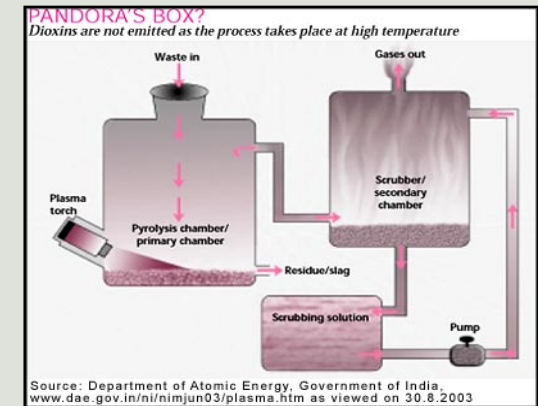
- An eco-friendly technology converts waste into commercially useful by-products
- Developed by Facilitation Centre for Industrial Plasma Technologies (FCIPT)
- The system runs with the help of plasma
- The whole process takes place in absence of oxygen
- Useful for management of hospital waste

- **Significance**

- Compactness
- Can be fully automated
- Can be located inside the hospital building
- Heat recovery for hospital utilities
- No waste segregation required
- above 95% volume reduction

- **Cost Information**

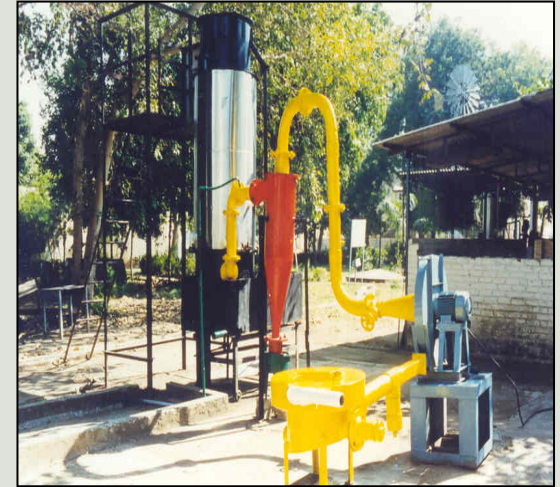
- Capacity of treatment : 15-20 Kg / hour
- Set-up cost : About Rs 1-1.2 million



- Plastic waste along with bitumen are conventionally used as ingredient to make roads
- Technology developed by K K Plastic Waste Management Limited – Bangalore
- **Significance**
 - Can help to overcome the drawbacks of conventional system
 - Roads containing plastic do not easily develop cracks
 - Resists at high temperature and friction
 - Two tonnes of polyblend (plastic bags) is required for each Km of road
- **Cost Information**
 - Dry mixing : 15-20 % higher
 - Wet mixing : about 30 %higher, Than conventional technology



- Used for the Conversion of biomass to producer gas for industrial thermal applications
- **Features**
 - Moisture content in fuel : less than 12% & good flow ability
 - Gas calorific value around 1100 kcal/Nm³
 - Ash removal unit Manual for small systems
 - 4 kg of groundnut shell replace 1 litre of LDO
- **Cost Information**
 - Rs. 2500 to 3500 (US\$ 55-77) / kg biomass conversion capacity



- Used for to get hot water in residential and institutional buildings
- Developed by Central Building Research Institute
- Made up by using GI pipes / fittings, GI sheets, aluminum sheets, mineral / glass wool insulation



Available Models	Capacity (L)	Temp. of water	Cost information (Rs.)
Domestic	140	Morning : 48-50°C, Evening : 55°C	12000
Large	600	Morning : 48-50°C, Evening : 55°C	30000
Low cost	Storage for one-day use	65-70°C	3000

- Used to dry various products for domestic use under hygienic conditions
- **Significance**
 - Includes high efficiency in uniform drying of products,
 - Suitable for rural/remote places
 - Drying temperature in desirable range
 - Light in weight
 - Easy to move
- **Cost Information**
 - Commercially available
 - Cost : Around Rs.1600/-



- Used to store medicine and vaccines at low temperature
- **Features**
 - Capacity 80 litres
 - Power Consumption : 60 W
 - Energy Consumption : 500-600 Wh/day
 - Inside temperature : 6° to $(-3)^{\circ}$ C
- **Cost Information**
 - Commercially available
 - Cost : Around 100000



- Designed for outdoor application in un-electrified remote rural areas
- Provided with battery storage to operate the light for 10-11 hours daily
- Require lower maintenance
- Has longer life
- **Cost information**
 - Rs.18,000 to Rs.21,000 per system



- **Features**

- It promotes biodiversity of the soil and surrounding environment
- Assurance of groundwater infiltration due to hazardous chemicals
- Basic aim of land cultivation & increase in crop production by keeping soil alive and in good health by use of organic wastes and other biological material



- **Significance**

- Maintain healthy environment
- Reduces level of pollution
- Increases the agricultural products
- Ensures the optimum utilization of natural resources for short-term benefit
- Saves energy for both animal and machine and reduces the risk of crop failure



- Ready to use live formulates of beneficial microorganism which on application to seed, root or soil
- Mobilize the availability of nutrients by their biological activity and help build up the micro flora and soil health
- **Godavari Fertiliser and Chemical Limited** produces eco-friendly Bio-fertiliser for different crops of Rice, Groundnut, Soyabean, Sugarcane etc.
- **Constraints**
 - Require care in storage
 - Biofertilizers are not replacement of fertilizers but can supplement their requirement



Biofertiliser
combination on
Ground nut

Agro Technologies

Agriculture Sector

1. Technology for Protected Cultivation of Vegetables in High Altitudes ----->
2. Mushroom Cultivation
3. True Potato Seed (TPS) Technology



TPS Technology



Mushroom cultivation

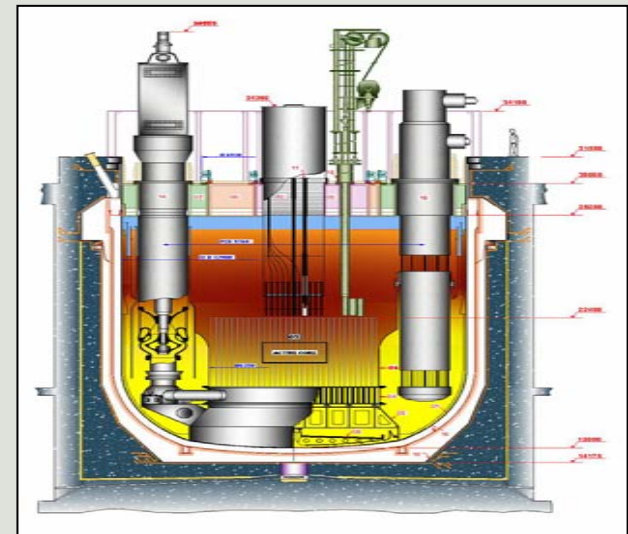
- Used for Agro industrial applications
- Useful for bulk drying of agricultural & industrial products at moderate air temperature
- The average temperature inside the tunnel : 15-18°C
- **Cost Information**
 - Materials and labour Cost : Rs 50,000
 - Cost of drying is reduced by around Rs.800 per tonne in solar tunnel dryer compared to the diesel fired mechanical dryer



Fast Breeder Reactor

Power Sector

- Globally Advanced Nuclear Technology option
- In India one 40 MW Fast Breeder Test Reactor in operation since 1985. Another 500 MW Reactor under construction
- **Cost Information**
 - Capital cost : Rs. 52 million
 - Power generation cost: Rs. 151 per Kwe.
- **Constraints**
 - India is having a fuel embargo but the recent Indo-US Nuclear agreement will remove barriers



- Concept is developed to utilize the large amounts of **Thorium** deposits within the country
- A small test reactor of 30 KW called ***Kamini*** is under operation and a 300 MW reactor is under development
- **Cost Information**
 - Capital cost : > than FBR
- **Constraints**
 - The reactor is still under development
 - Take some time to get commercially exploited

- Biomass gasification is conversion of solid Biomass in to a combustible gas mixture normally called “Producer Gas”
- Three designs of gasifiers are
 - Updraft
 - Downdraft
 - Cross draft
- In Indian market downdraft gasifiers are available due to utilization of mechanical mode
- **Cost Information**
 - Cost based on electricity generation systems range from Rs. 40 million/ MW to Rs. 45 million/ MW



- Ethanol made from cellulosic biomass is known as Bioethanol
- Four technologies for bioethanol production
 - Concentrated Acid Hydrolysis
 - Dilute Acid Hydrolysis
 - Enzymatic Hydrolysis
 - Cellulose Enzyme Research
- The first three are based on producing sugars from biomass and then fermenting the sugars to ethanol.
- The fourth is a very different approach involving thermal processing of biomass to gaseous hydrogen and carbon monoxide, followed by fermentation to ethanol

- Bio-diesel is an eco-friendly, alternative diesel fuel prepared from domestic renewable resources and animal fats
- Bio diesel is produced by transesterification of oil obtained from the plants of *Jatropha curcas*
- **Significance**
 - It reduces vehicle emission which makes it eco-friendly
 - It is made from renewable sources and can be prepared locally.
 - Increases engine performance.
 - Increased safety in storage and transport because the fuel is nontoxic and biodegradable
 - Reduction of greenhouse gases at least by 3.3 kg CO₂ equivalent per kg of Bio-diesel

- Cost information

Activities	Rate (Rs. / Kg)	Quantity (Kg)	Cost(Rs.)
Seed	5.00	3.28	16.40
Cost of collection & oil extraction	2.36	1.05	2.48
Less cake produced	1.00	2.23	(-) 2.23
Trans-esterification	6.67	1.00	6.67
Less cost of glycerin produced	40 to 60	0.095	(-) 3.8 to 5.7
Cost of Bio-diesel per kg			19.52 to 17.62
Cost of Bio-diesel per liter (Sp. Gravity 0.85)			16.59 to 14.98



Jatropha
plant

Jatropha
Cultivation



- **Anaerobic Digestion Process**
- Biomass like animal excreta, vegetable wastes and weeds undergo decomposition in the absence of oxygen in a Biogas plant and form a mixture of gases.
- Used as a fuel for cooking and lighting
- **Significance**
 - Production of electricity and heat provides valuable income
 - A closed carbon dioxide cycle reduces atmospheric pollution
 - Positive use of organic waste materials reduces land and water pollution
 - Reduced use of chemical fertilizers minimizes leaching from soil

- SKS Microfinance, launched in 1998
- Offers interest-free loans for emergencies as well as life insurance to borrowers
- Its affiliate, SKS Education, provides education services to poor children, including running a government-funded school for girls who have dropped out of school
- **Cost Information**
 - The personnel and administration costs easily amount to 11% of total cost structure
- **Constraints**
 - Many poor do not fit within the current structure



Application of Strategic Database

The SDB of technological, institutional and management innovations enhances the choice set for strategic interventions in future scenarios.

In Indian modeling, SDB is used for (some examples):

- Developing descriptions of future Scenarios
- Specifying and quantifying drivers of Sustainable Development in Assessment of technology transfer and market penetration analysis – e.g. Energy Snap Shot (ESS) Model presented separately
- Introduction of innovations for cost-effective transition in scenarios: e.g. Low Carbon Society Scenario which is presented separately

Thank you