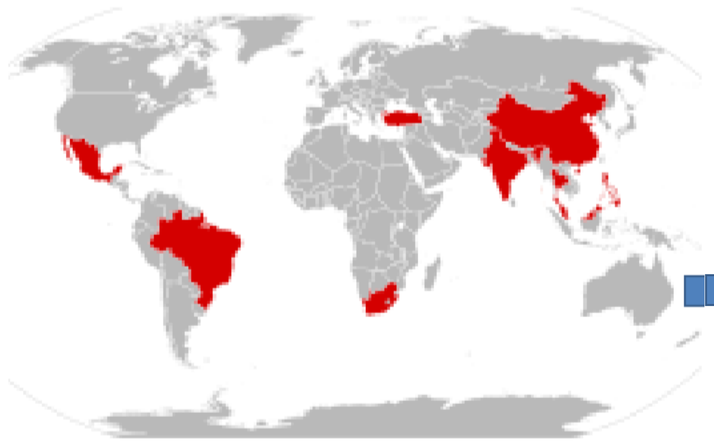
# *Solar Powered Reefer Containers for Supporting Cold Chain in South Asia by C. Maheshwar*

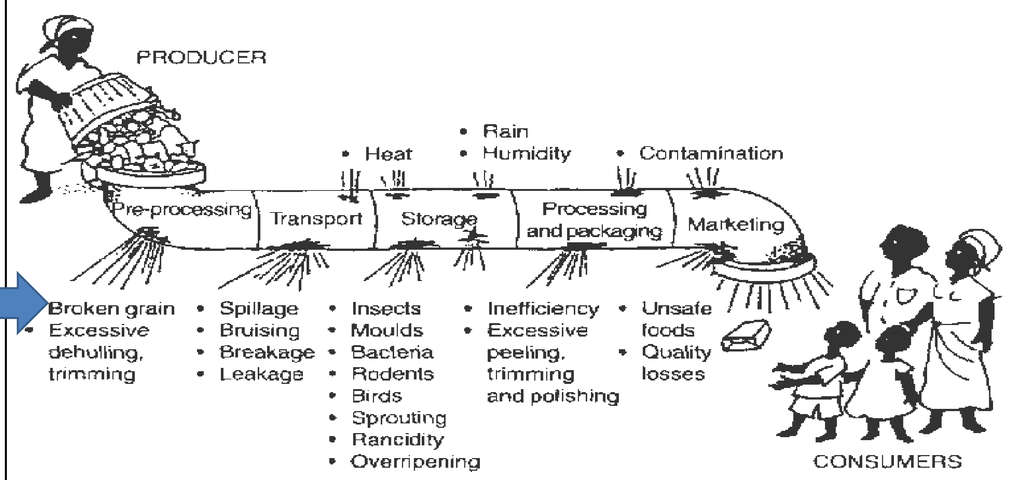


## *Emerging Economies / Developing Countries*

•Perceived as growth centres of the future
•Drivers of future economic growth
•Bullish investor confidence
•Show higher economic growth rate compared to developed countries
•Expected to play a greater role in areas like financial markets, consumption of goods and services, trade and commerce, sustainable development, innovation, infrastructure development and research.


## *South Asia – a land of contradictions!*

•Second largest producer in the world of fruits and vegetables -
•Second highest producer of milk
•Fifth largest producer of eggs
•Sixth largest producer of fish –




## *The South Asian Cold Chain*

•About 30% of South Asia's production of fruits and vegetables gets wasted because of poor post harvest management practices.
•In India, the value is about US$ 13 billion every year.
•Tomatoes, Cauliflowers, onions and watermelons are thrown on the highway because it is not worth the effort to transport it to the markets.
•Cold storages are uneconomical to run, inadequate and are located far away from the farms and harvested products have to endure the ambient heat.

## *What India Consumes Everyday*

•WHEAT: 1,97,260 tonnes equal to 82 train loads of 40 wagons each with a per capita consumption of 179 grams
•RICE: 2,19,178 tonnes equal to 100 train loads of 40 wagons each with a per capita consumption of 199 grams
•SUGAR: 52,054 tonnes equal to 3,500 truck loads with a per capita consumption of 47 grams
•COOKING OIL: 30,136 tonnes equal to 3,000 tanker loads with a per capita consumption of 25 grams
•FRUIT: 86,671 tonnes equal to 9,000 truck loads with a per capita consumption of 79 grams
•VEGETABLES: 1,94,520 tonnes equal to14,000 truck loads with a per capita consumption of 176 grams
•MILK: 2,46,757 tonnes equal to 89 Olympic size Swimming Pools with a per capita consumption of 224 grams
•CHICKEN: 13,39,726 birds equal to population of Gwalior
•COFFEE: 219 tonnes equal to 15 truck loads with a per capita consumption of 20 milligrams
•POTATOES: 68,000 tonnes equal to 4,000 truck loads with a per capita consumption of 62 grams
•ONIONS: 1,64,383 tonnes equal to 8,000 truck loads with a per capita consumption of 149 grams

## *The agricultural marketing chain*

•Farmer
•Village agent at Taluka Level
•Market agent at Mandi level
•Wholesaler
• Semi-Wholesaler
• Retailer
• Consumer
Contributes to Product Deterioration, especially in case of perishable products like fruits and vegetables due to extended post harvest time lag without any value addition.

## *The Solutions*

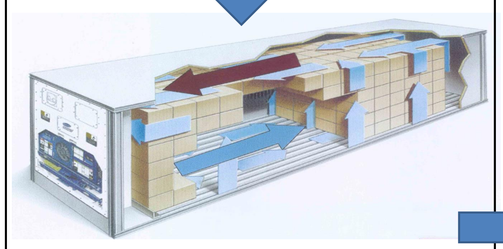
•What we need is a seamless gap-free cold chain.
•About one-third of these post harvest losses of perishable products can be reduced by using Solar Powered Refrigerated Containers to transport harvested products from farms to cold storages.
•For India, optimum usage of the containers can yield an annual savings of about US$ 4.5 billion.
•The investment is US$ 2.5 billion and the payback period is just 6-9 months.

## *The problem*

The break up of these Losses which occur due to poor Post Harvest Management facilities and practices is as follows:
a) Poor handling 30%
b) Poor storage 30%
c) Poor transportation 30%
d) Presence of large number of middlemen 5%
e) Lack of knowledge about better preservation techniques 5%.

## *Why such losses in this region?*

•High Ambient temperature
•Poor transport infrastructure
•Lack of knowledge and awareness
•Poor roads and poor connectivity
•Dusty atmosphere
•Non availability of refrigerated carriers
•Difficult Geographical terrain
•Cold Chain Infrastructure is a Non priority sector for the administration as there are more important priority areas where funds need to be deployed
•Less evolved cold chain shipment regulations
•Unreliable grid power



## *Specifications Of A Standard 20 Feet Refrigerated Container*

xternal Dimensions: 20x8x8.5 Ft.
Internal Dimensions: 18x7.5x7 Ft.
Internal Volume: 1000 Cu. Ft.
Payload Capacity: 21350 Kgs
Gross Weight: 24000 Kgs
Temperature : -25 To +35 Deg C
Power Consumption: 5 Kwh

## *Solar Powered Refrigerated Containers*

### *Why Solar Power*

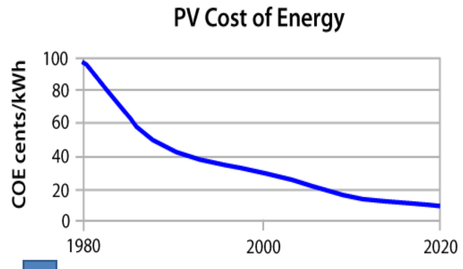
Depleting Fossil Fuels
Growing Environmental Concerns
Erratic and Unreliable Grid Power
Sustainable Source of Energy

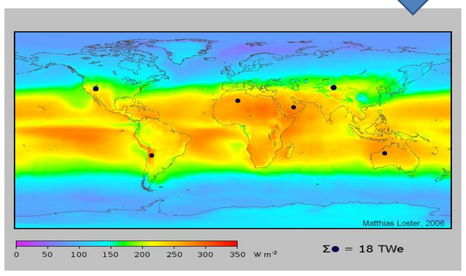
### *Myth about Solar Power*

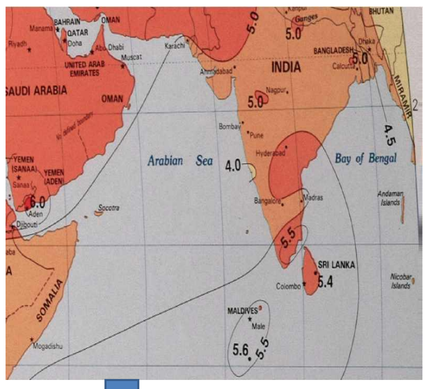
Solar PV power is very expensive

### *Reality*

Following Moore's law, it is expected that with the new generation technology with concentration equivalent of more than 1,600 times the sun's energy onto solar cells, it would be possible to produce electricity at a wholesale cost of US $0.05 per kilowatt-hour (kWh)

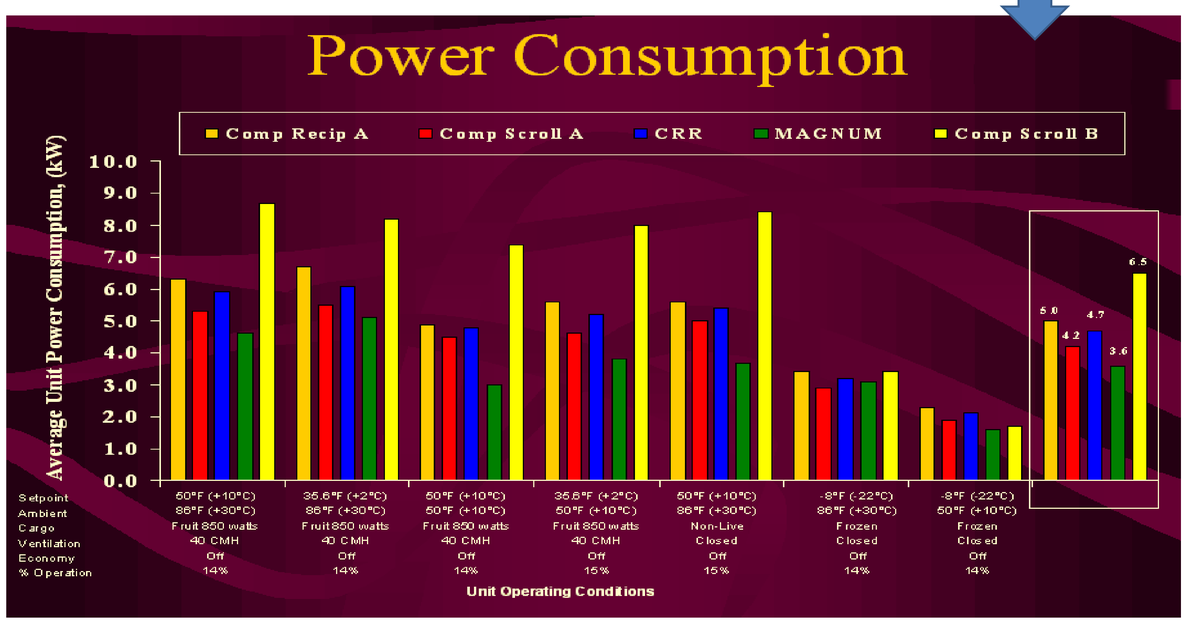



## *South Asia – A Sunshine Region*

The solar energy available averages 5.0 kw/sq. m/day
South Asia has abundant solar resources, receiving about 3000 hours of sunshine every year,
Has a potential of about 20 MW per sq km




## *Economics: Solar Powered Reefer Containers vs D G set*

Cost Of 1 Kwh Using DG Set: 15 Ct
Cost Of Running Reefer Container Per Hour @5kwh: 75 Ct
Cost Of Running Reefer Container Per Day (12 Hrs.): $9
Cost Of Running Reefer Container Per Year (365 Days): $3,285
Cost Of Running Reefer Container Using Solar Power: Nil
Cost of fitting Solar PV panel on a 20 ft Reefer container: $ 37,400
Cost of a 6KVA DG Set: US$7,000
Cost of maintenance of a DG Set: US$ 3,000 per year
Payback Period Of Solar Power Vs. DG Set: 27,400/3285= approx 8.4 Years
Other long term environmental and social gains.

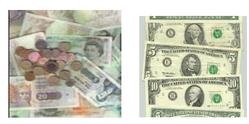
## *Economics For INDIA:*

•Total Annual Losses in Fruits and Vegetables: 40 million MT of Value: US$ 13 bn (30% of total production)
•Payload per Reefer Container: 21 MT
•Containerisability Factor of Fruits & Vegetables: 0.5
•No. of Containers required to transport the total produce: 16 million
•No. of Containers required if each Container makes one trip a day: 42,000
•Cost of a 20 ft. Container with Solar PV panel: $ 15,000+$ 37,400=$ 52,400
•Cost of 42,000 Containers: $ 2.2 bn
•Reduction in Post Harvest Losses achieved per year: $ 4.5 bn (35% of Total Losses).
•Payback Period: 0.5 years or 6 months

## *The Business Opportunity*

Refrigerated Containers: upto 42,000 to start with (India alone)
Solar PV Panels: upto 18.4 million square feet

## *The Gains*



The 69% of South Asian population depending upon agriculture and allied activities will be lifted up into positive economy.
Better quality and nutritious food for our population.
Better health standards.
Increase in awareness of the availability and use of technology for preservation of food products.
Better export potential and increased foreign exchange earnings