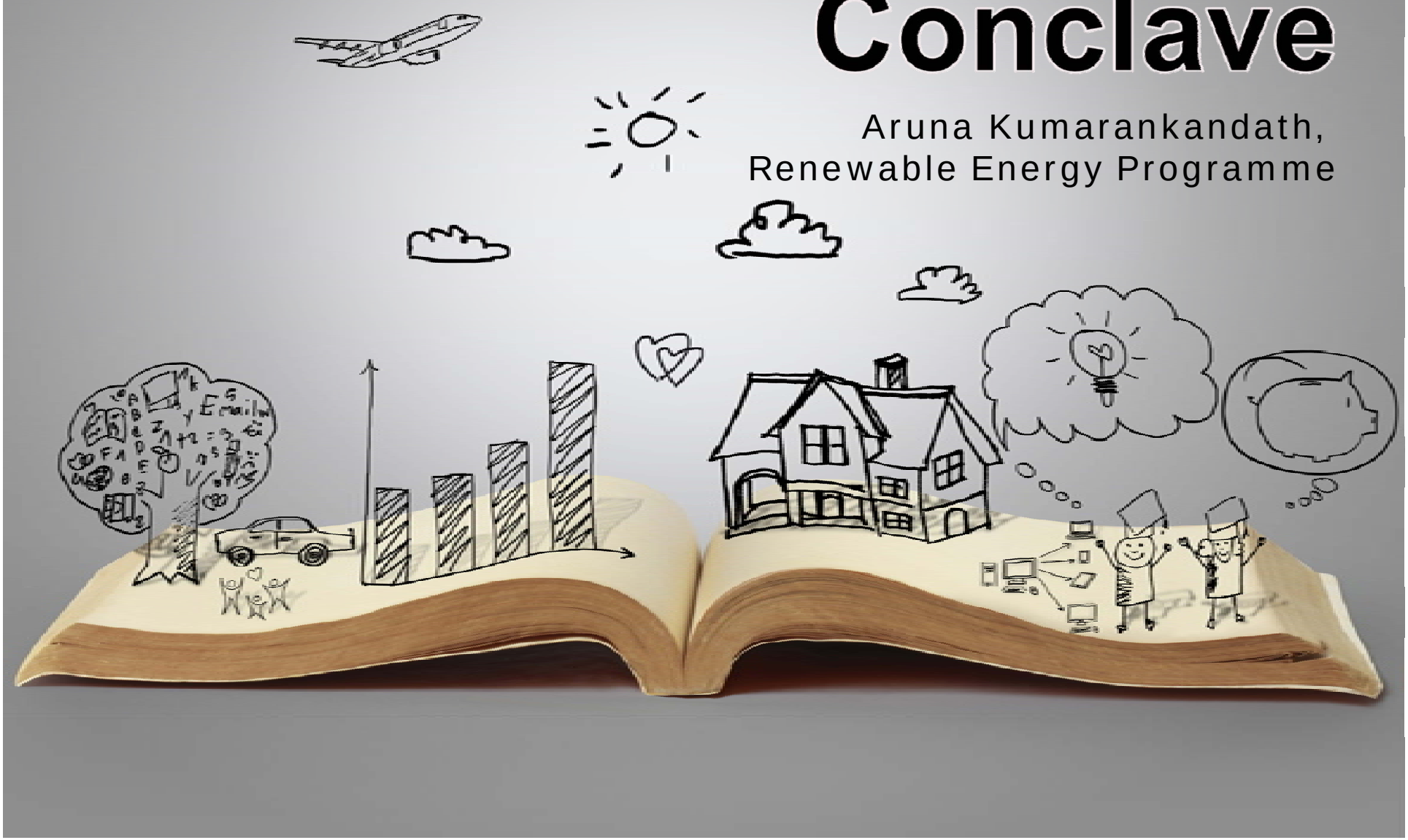
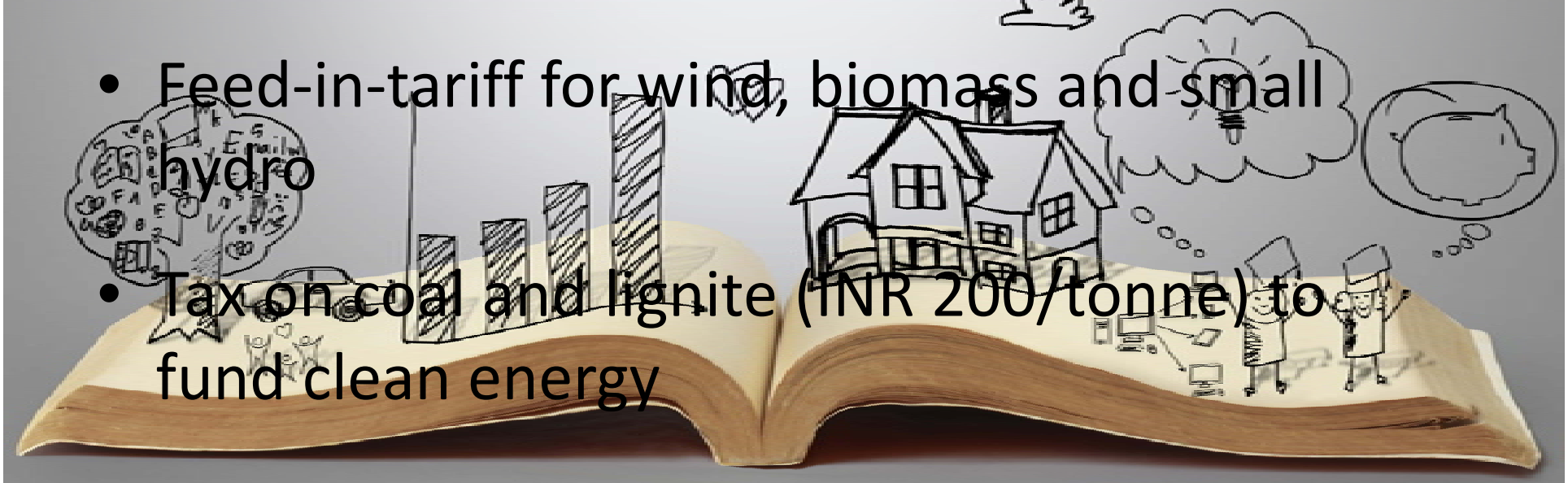
Knowledge Conclave

Aruna Kumarankandath,
Renewable Energy Programme



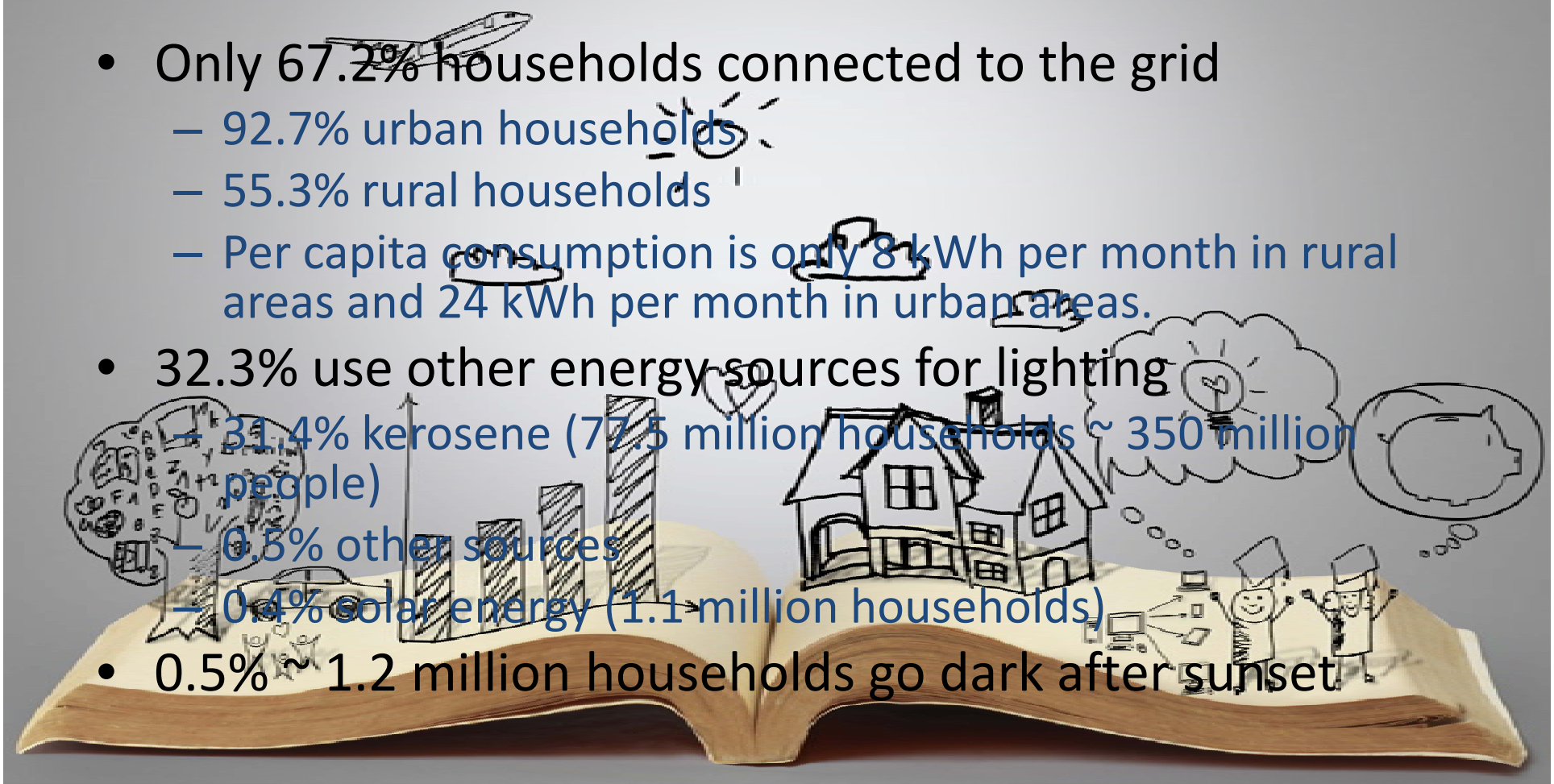
INDIA'S ENERGY PROGRAMME

- 24x7 power to all by 2019
- 175 GW of renewable power by 2022
- Feed-in-tariff for wind, biomass and small hydro
- Tax on coal and lignite (INR 200/tonne) to fund clean energy



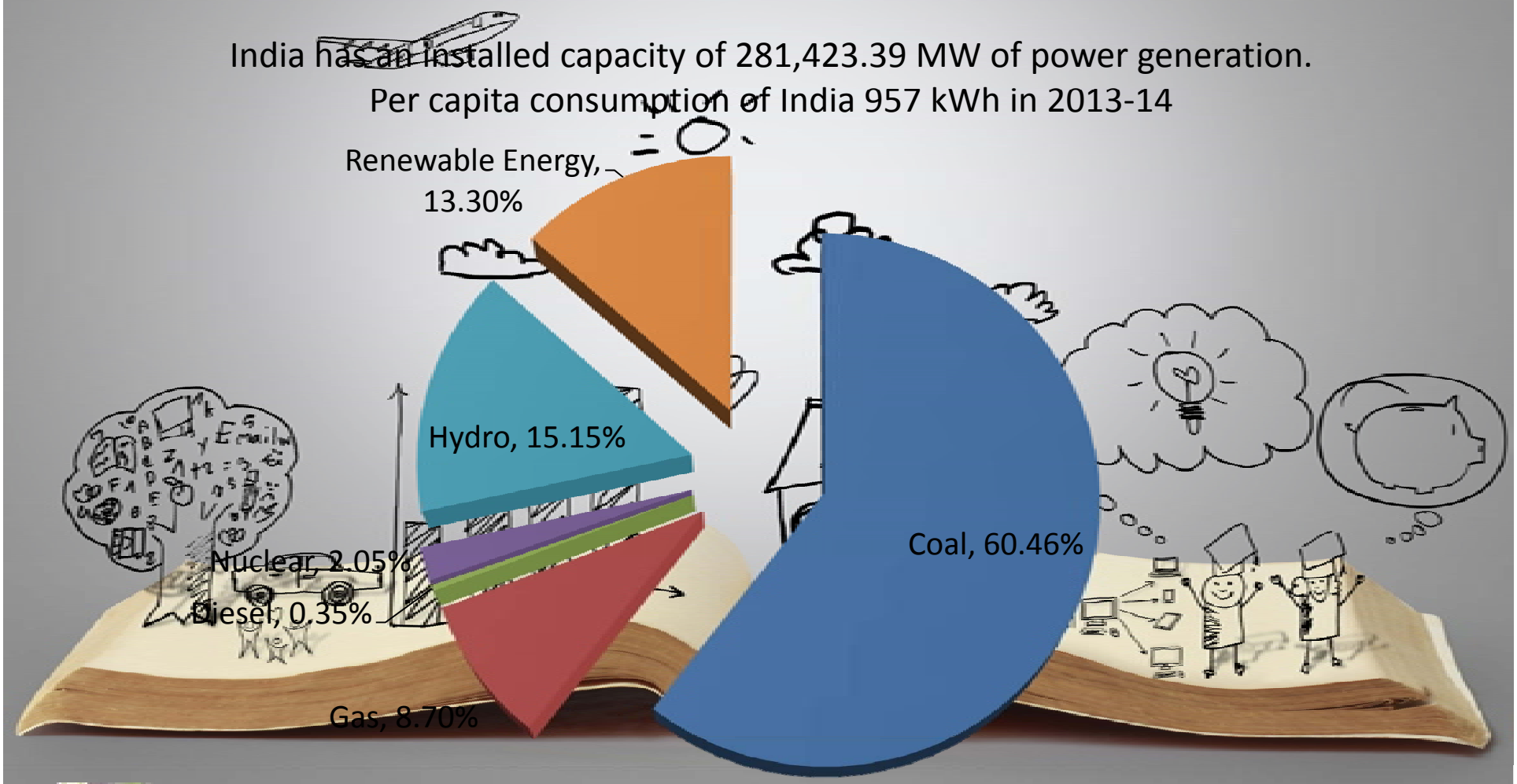
INDIA CENSUS 2011: LIGHTING

- Only 67.2% households connected to the grid
  - 92.7% urban households
  - 55.3% rural households
  - Per capita consumption is only 8 kWh per month in rural areas and 24 kWh per month in urban areas.
- 32.3% use other energy sources for lighting
  - 31.4% kerosene (77.5 million households ~ 350 million people)
  - 0.5% other sources
  - 0.4% solar energy (1.1 million households)
- 0.5% ~ 1.2 million households go dark after sunset



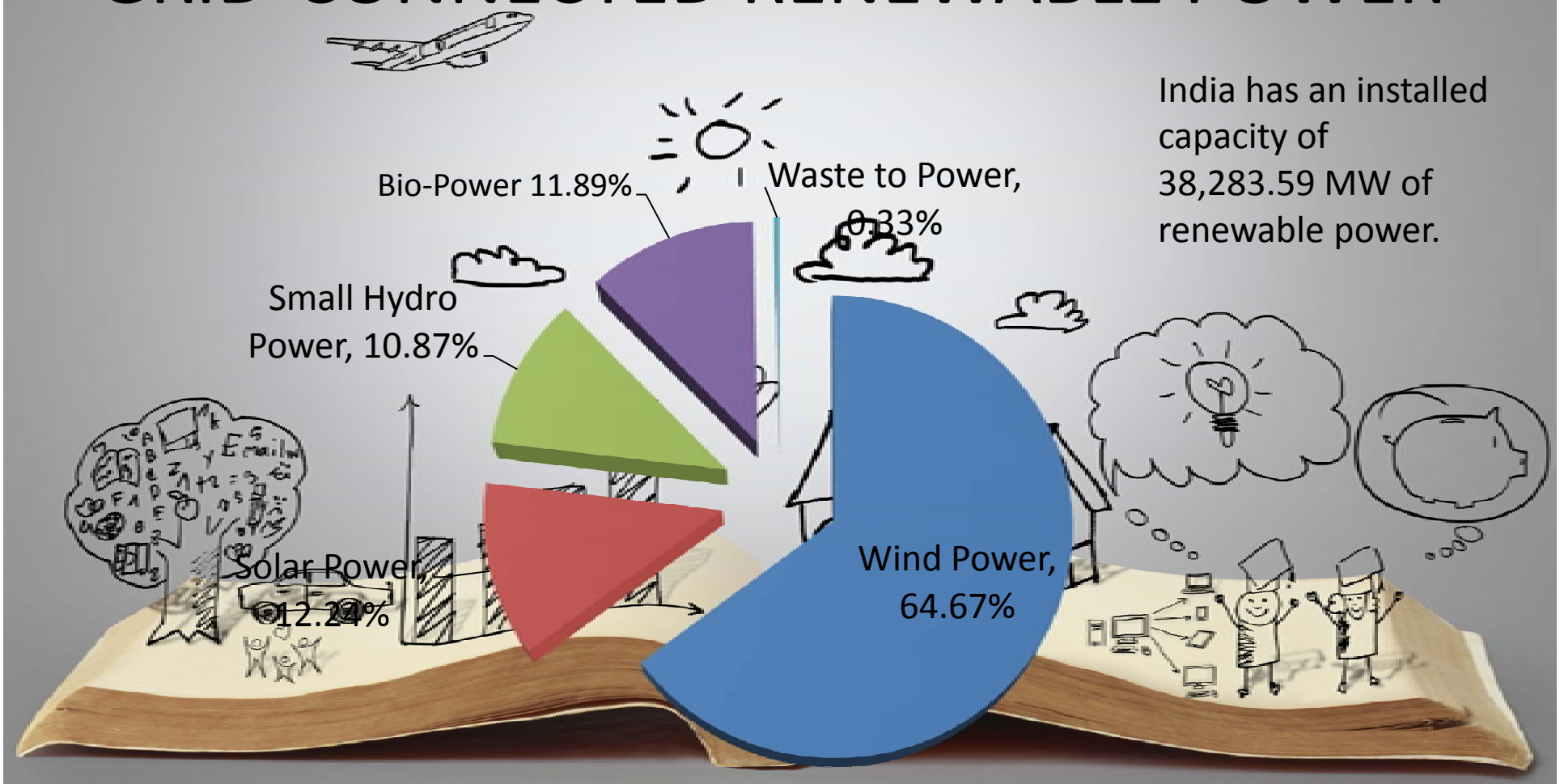
ELECTRICITY CAPACITY IN INDIA

India has an installed capacity of 281,423.39 MW of power generation.
Per capita consumption of India 957 kWh in 2013-14



As on November 30, 2015

GRID-CONNECTED RENEWABLE POWER

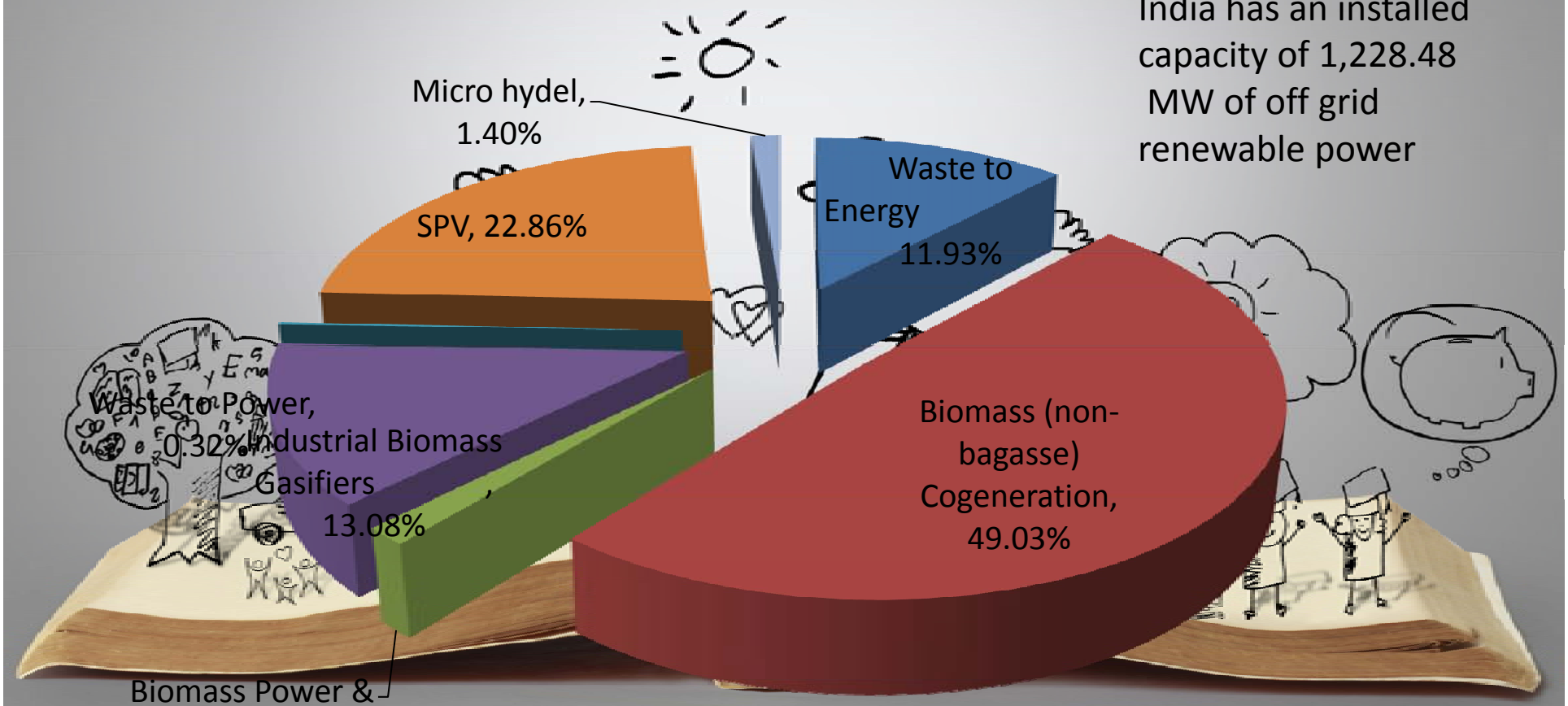


India has an installed capacity of 38,283.59 MW of renewable power.

As on November 30, 2015

OFF-GRID/ CAPTIVE POWER RENEWABLE POWER

India has an installed capacity of 1,228.48 MW of off grid renewable power

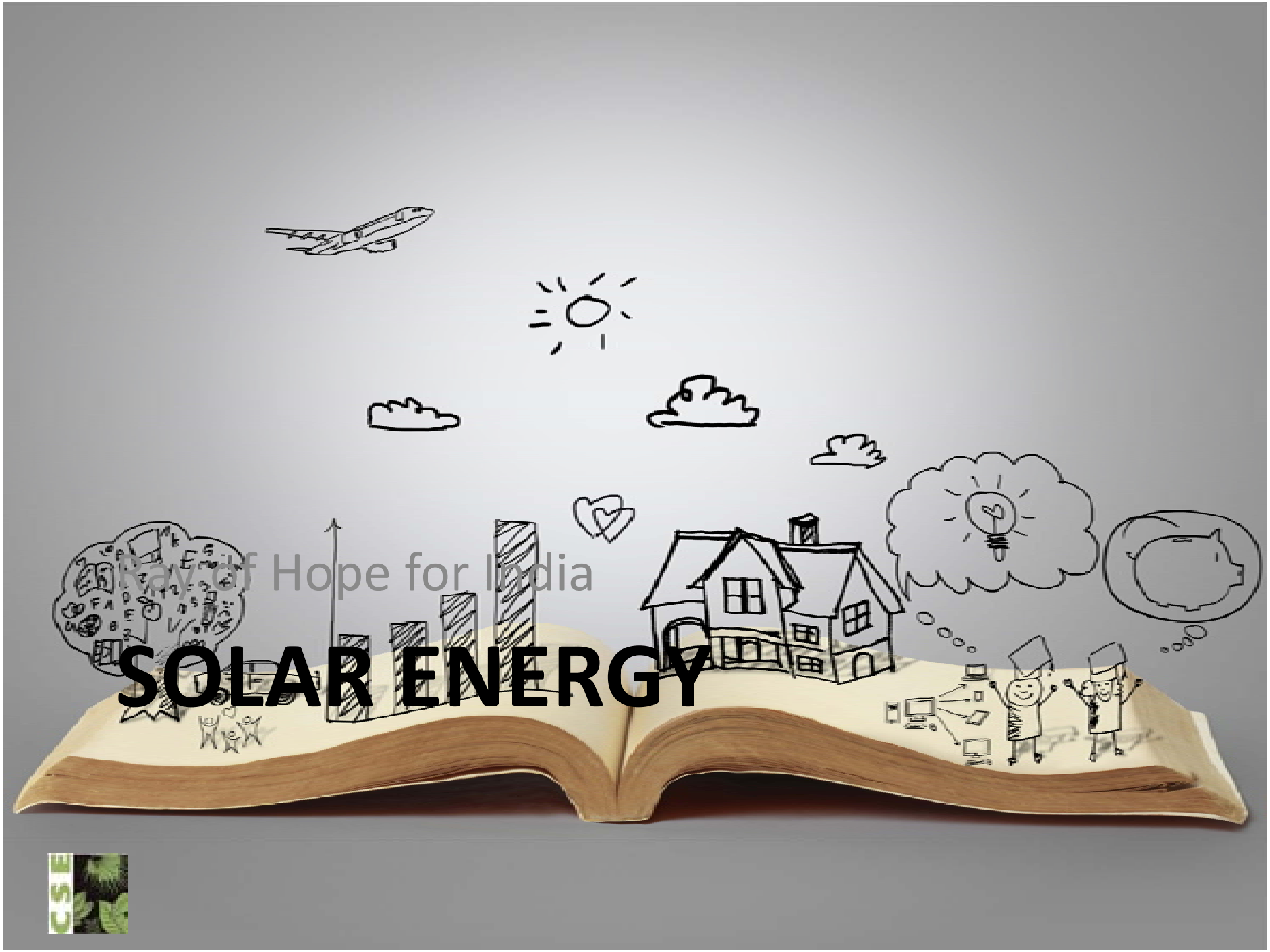


As on November 30, 2015

NEW AMBITIONS

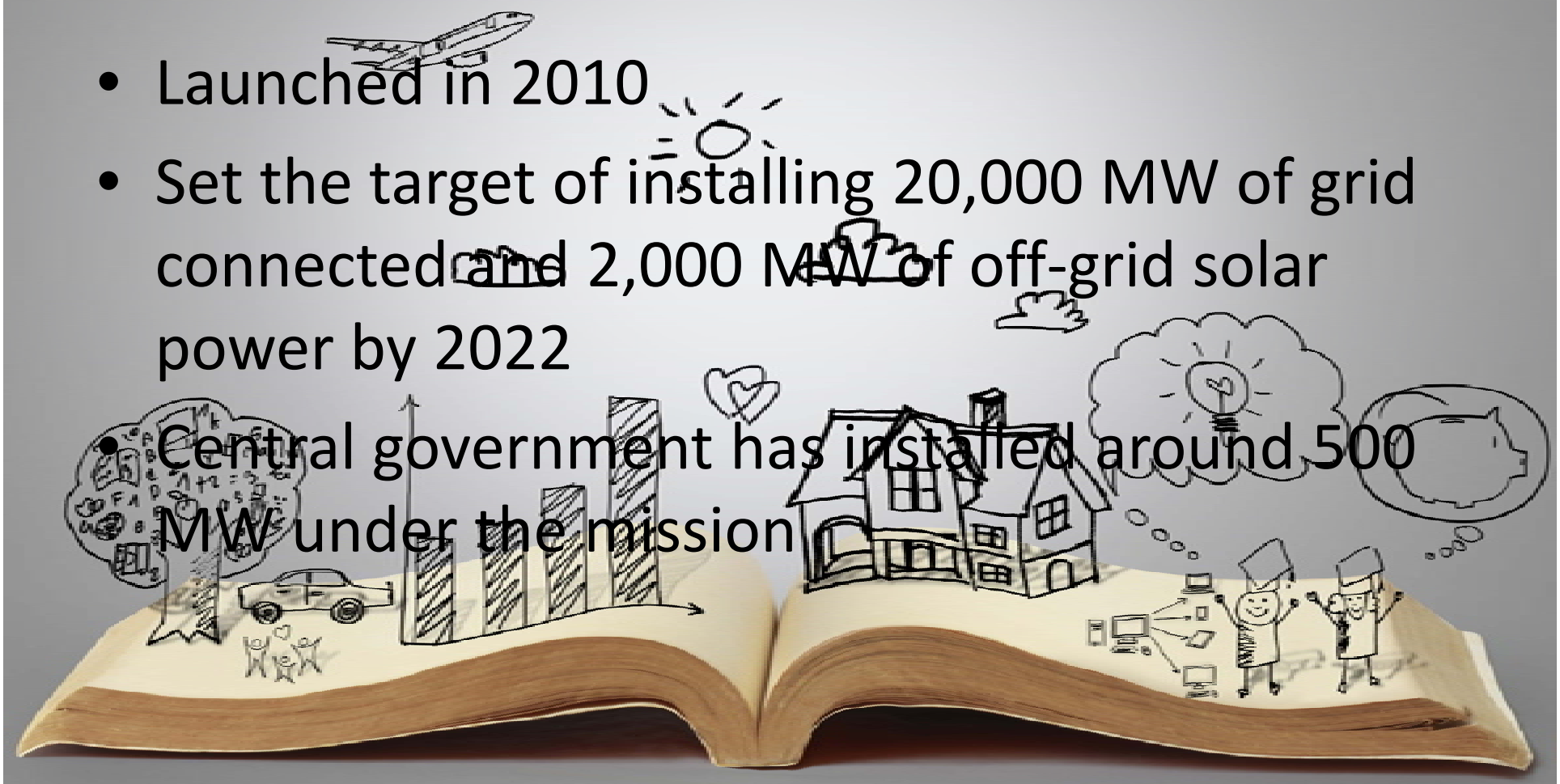
This year's budget announcement for renewable energy set new ambitions

- Solar – 100,000 MW
- Wind – 60,000 MW
- Biomass – 10,000 MW
- Small hydro (≤25 MW capacity) – 5,000 MW

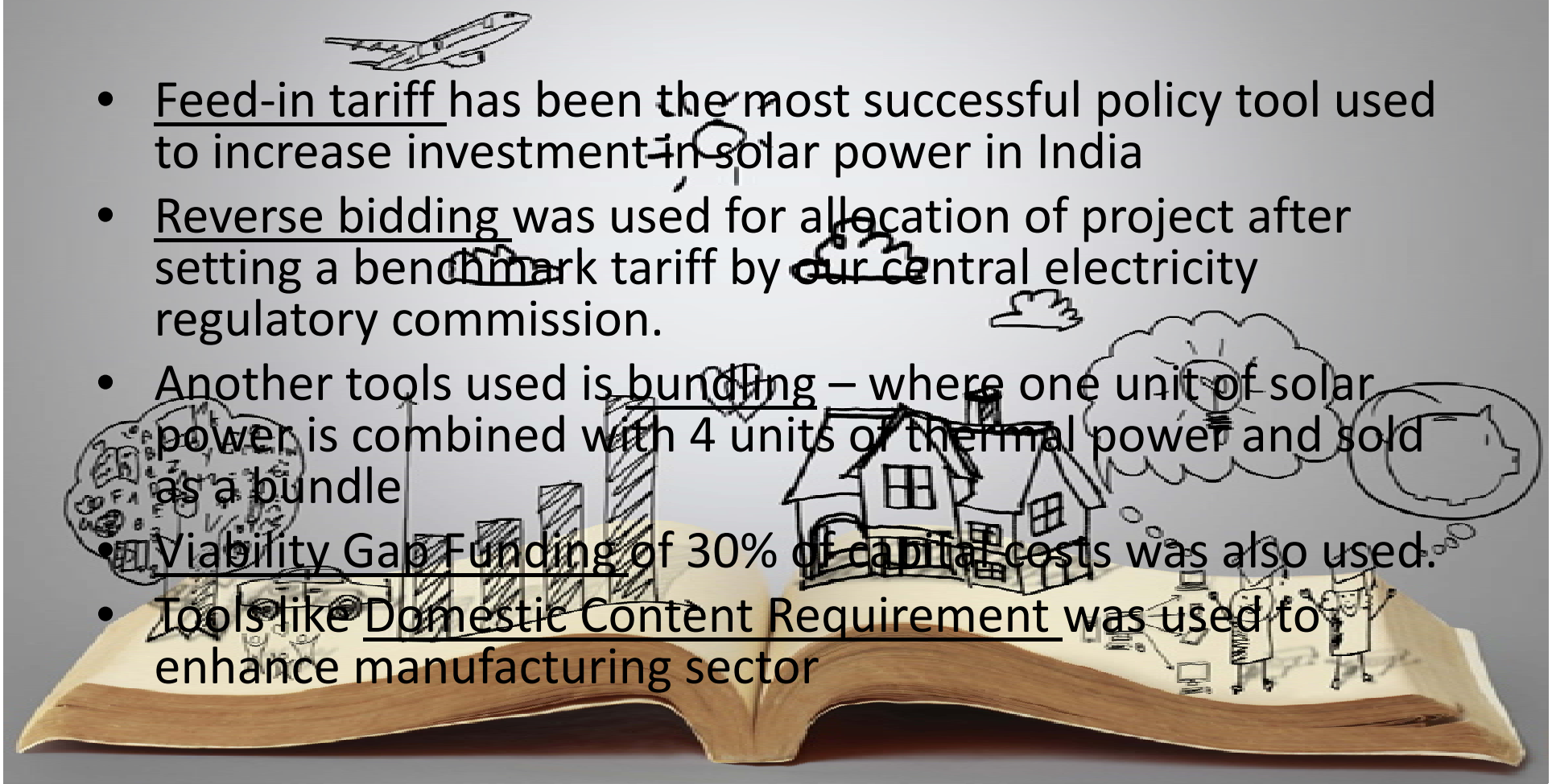

Ray of Hope for India
SOLAR ENERGY

NATIONAL SOLAR MISSION

- Launched in 2010
- Set the target of installing 20,000 MW of grid connected and 2,000 MW of off-grid solar power by 2022
- Central government has installed around 500 MW under the mission



SOLAR POWER: POLICIES

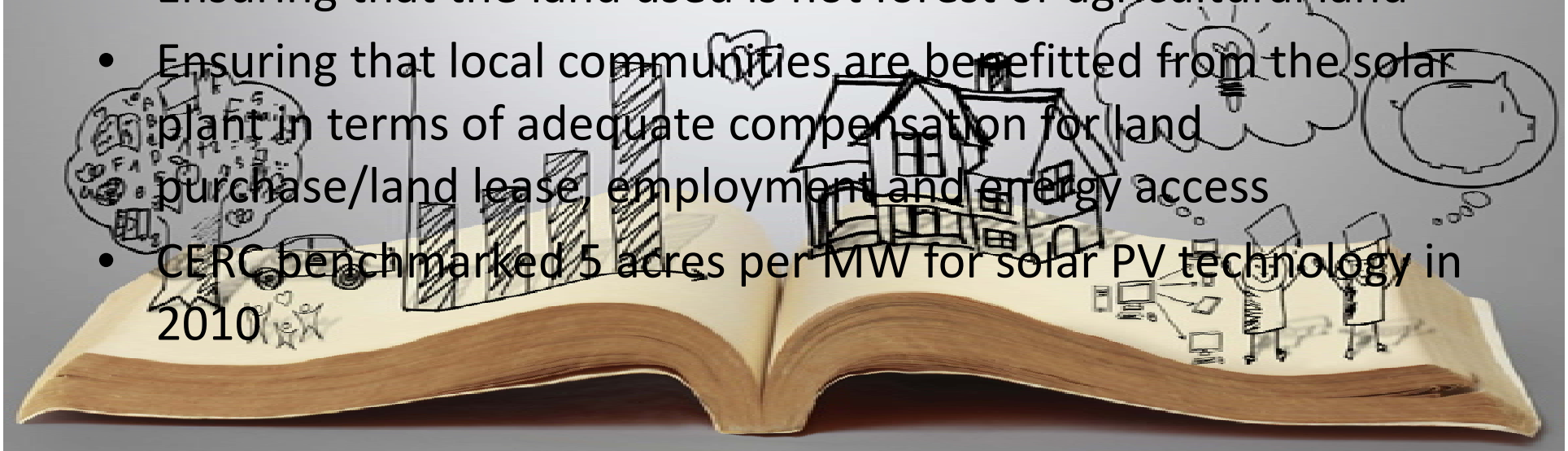


- Feed-in tariff has been the most successful policy tool used to increase investment in solar power in India
- Reverse bidding was used for allocation of project after setting a benchmark tariff by our central electricity regulatory commission.
- Another tools used is bundling – where one unit of solar power is combined with 4 units of thermal power and sold as a bundle
- Viability Gap Funding of 30% of capital costs was also used.
- Tools like Domestic Content Requirement was used to enhance manufacturing sector

LAND ISSUES

Land is scarce and highly contested in India. Hence, there are three important concerns to keep in mind with

- Land is used optimally based on technology adopted
- Ensuring that the land used is not forest or agricultural land
- Ensuring that local communities are benefitted from the solar plant in terms of adequate compensation for land purchase/land lease, employment and energy access
- CERC benchmarked 5 acres per MW for solar PV technology in 2010

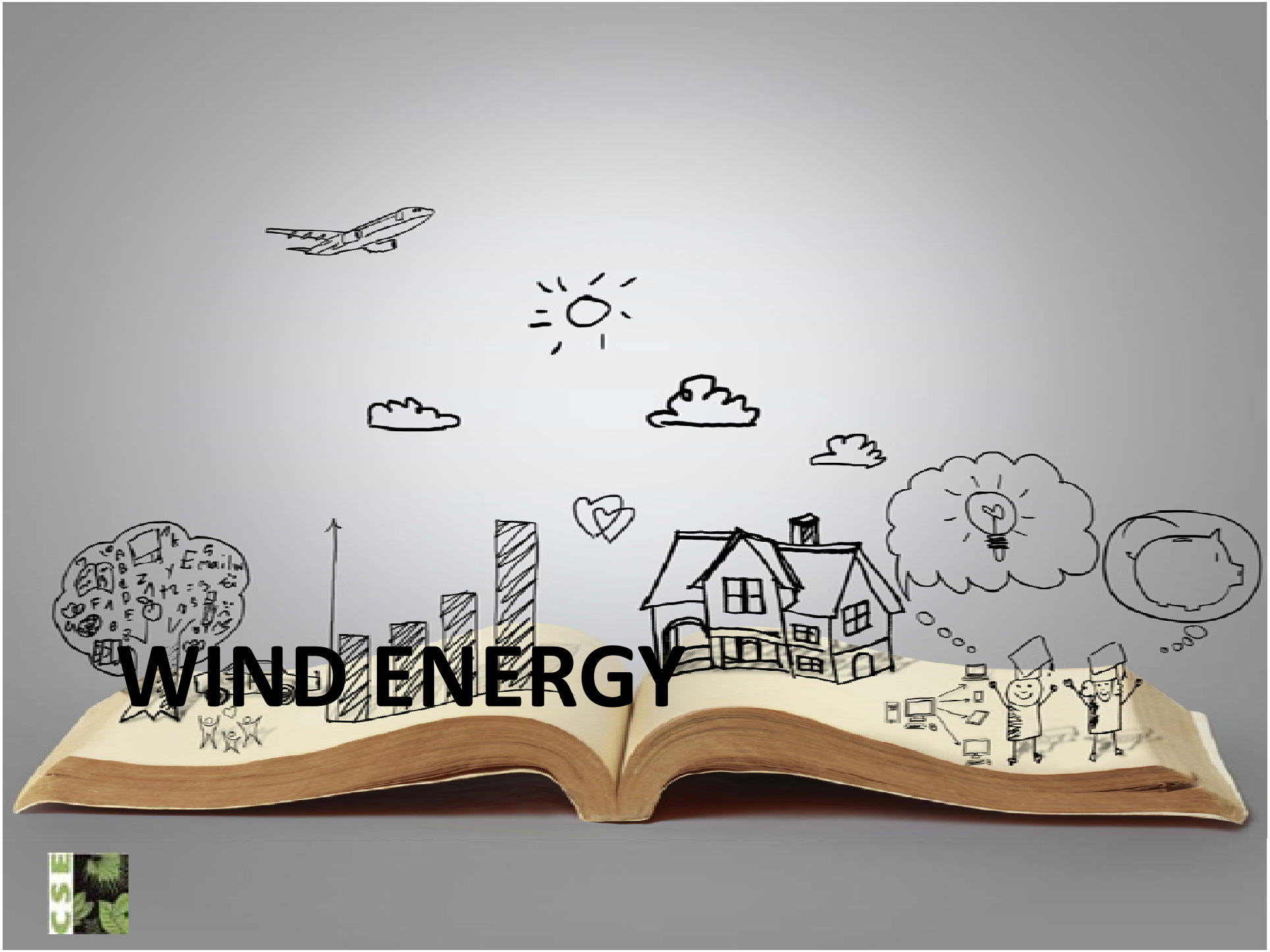


MURUGAN TEXTILES

First power loom producer to use 100% renewable energy

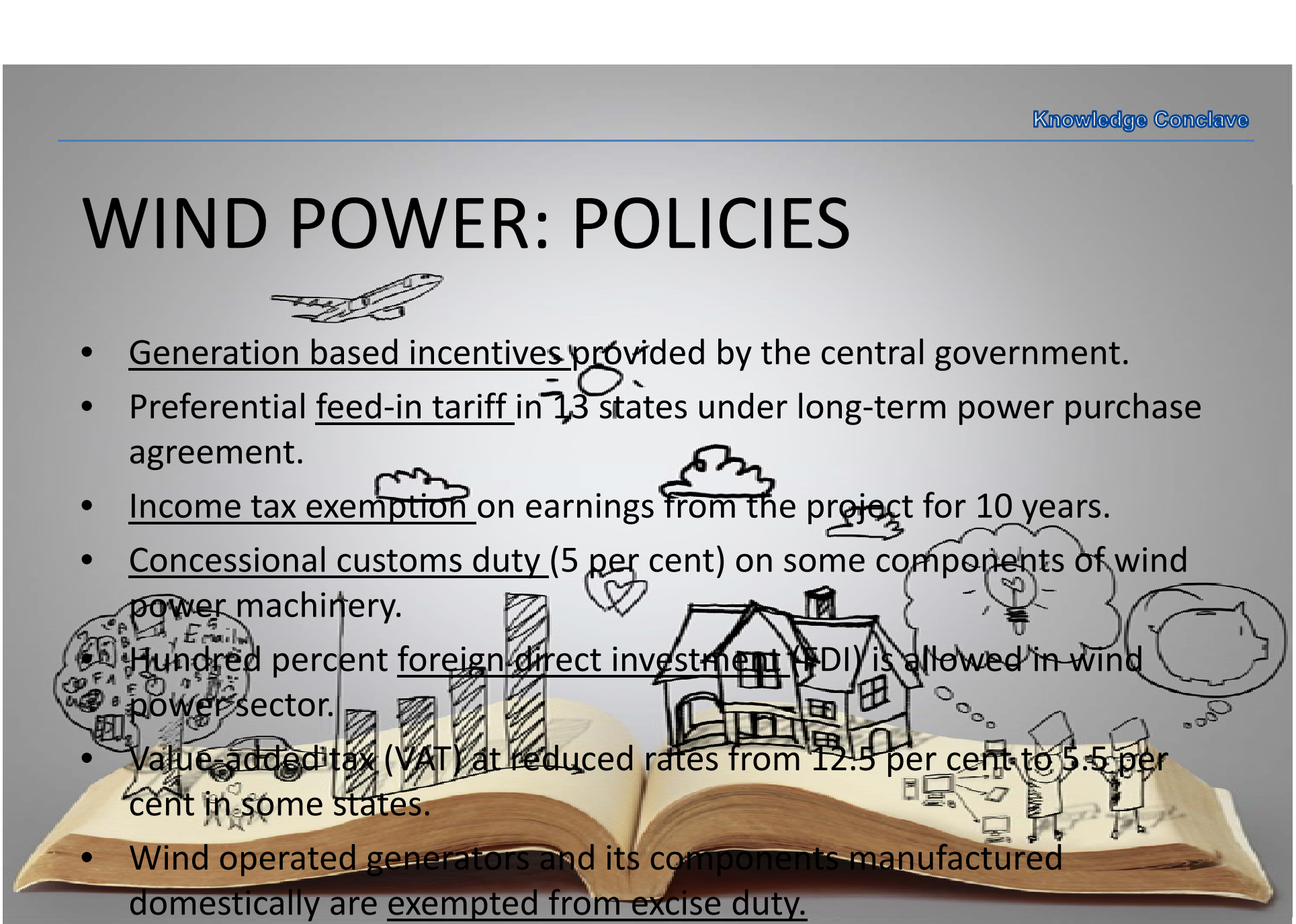
- 25% of their electricity requirement through solar, and the rest though wind energy.
- Installed the largest rooftop solar plant in South India – 2 MW PV plant in Palladam, Tamil Nadu
  - 700kW on 1 rooftop;
  - 650 kW each on 2 rooftops
- Estimated Energy Generation: 3 million (PA)
- Payback period – 6 years
- Saved nearly 10 acres of land space
- Projected Cost Savings of Rs 11 Crores in 25 years

WIND ENERGY



WIND POWER IN INDIA

WIND POWER: POLICIES



- Generation based incentives provided by the central government.
- Preferential feed-in tariff in 13 states under long-term power purchase agreement.
- Income tax exemption on earnings from the project for 10 years.
- Concessional customs duty (5 per cent) on some components of wind power machinery.
- Hundred percent foreign direct investment (FDI) is allowed in wind power sector.
- Value-added tax (VAT) at reduced rates from 12.5 per cent to 5.5 per cent in some states.
- Wind operated generators and its components manufactured domestically are exempted from excise duty.

FOOTPRINT OF A WIND TURBINE

- Actual footprint of a wind turbine is not that significant.
- 250 square meter is required for an installation
- 90 per cent of the land impacted is only during construction phase

LINEAR INTRUSION: Access roads and transmission lines to and from multiple small plants lead to forest fragmentation – isolation of species and disruption of the movements of animals. **Increase in human-animal conflict**

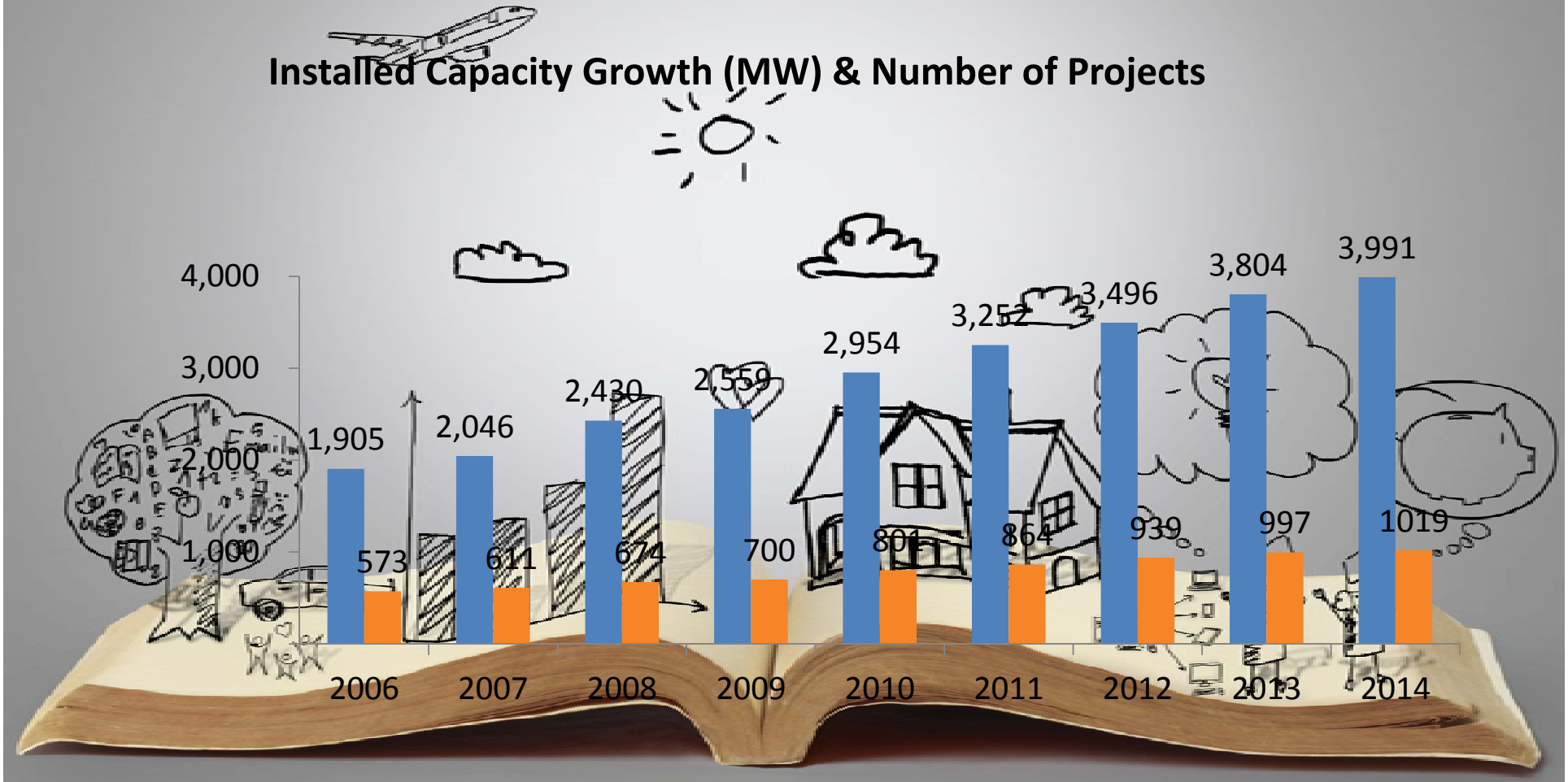
ENVIRONMENTAL IMPACTS

- Projects on forest land can impact local biodiversity; those on hilly areas exert higher impacts on forests, wildlife and water resources, compared to projects located in the plains.
- Linear fragmentation for roads and power lines for the project
- Wind power projects are not covered under the Environment Impact Assessment (EIA)

SMALL HYDRO POWER

SMALL HYDRO POWER GROWTH

Installed Capacity Growth (MW) & Number of Projects



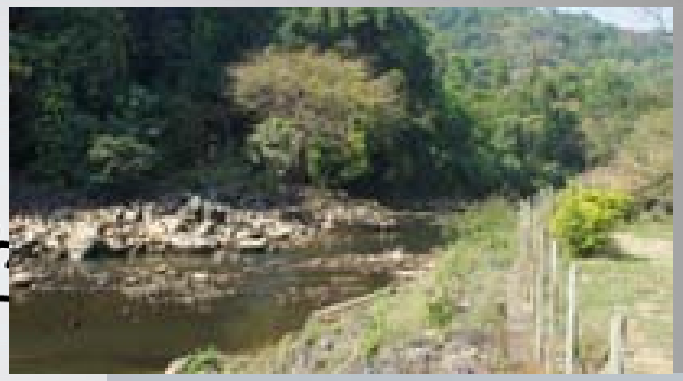
DEFINITION OF SMALL HYDRO

COUNTRY/ORGANISATION	LIMIT (IN MW)
Sweden	1.5
UK	5
United Nations Industrial Development Organization (UNIDO)	10
Norway	10
European Union	20
Australia	20
India	25
Brazil	30
China	50

But India is the only country that considers only SHP as renewable energy and has a separate ministry for it.

ENVIRONMENTAL IMPACTS

- **Multiple impacts on the local environment and ecology**
  - **Ecological** - Aquatic flora and fauna specifically impact on fish.
  - Impact on wildlife due to forest diversion and linear intrusion
  - **Physical** – Flow of the river, Water quality, sediment carrying capacity, erosion, ground water quality and recharge, climate, soil and geology
  - **Humans** – Conflict over drinking and agriculture water availability and socio-economic impacts
  - **Cumulative impact**

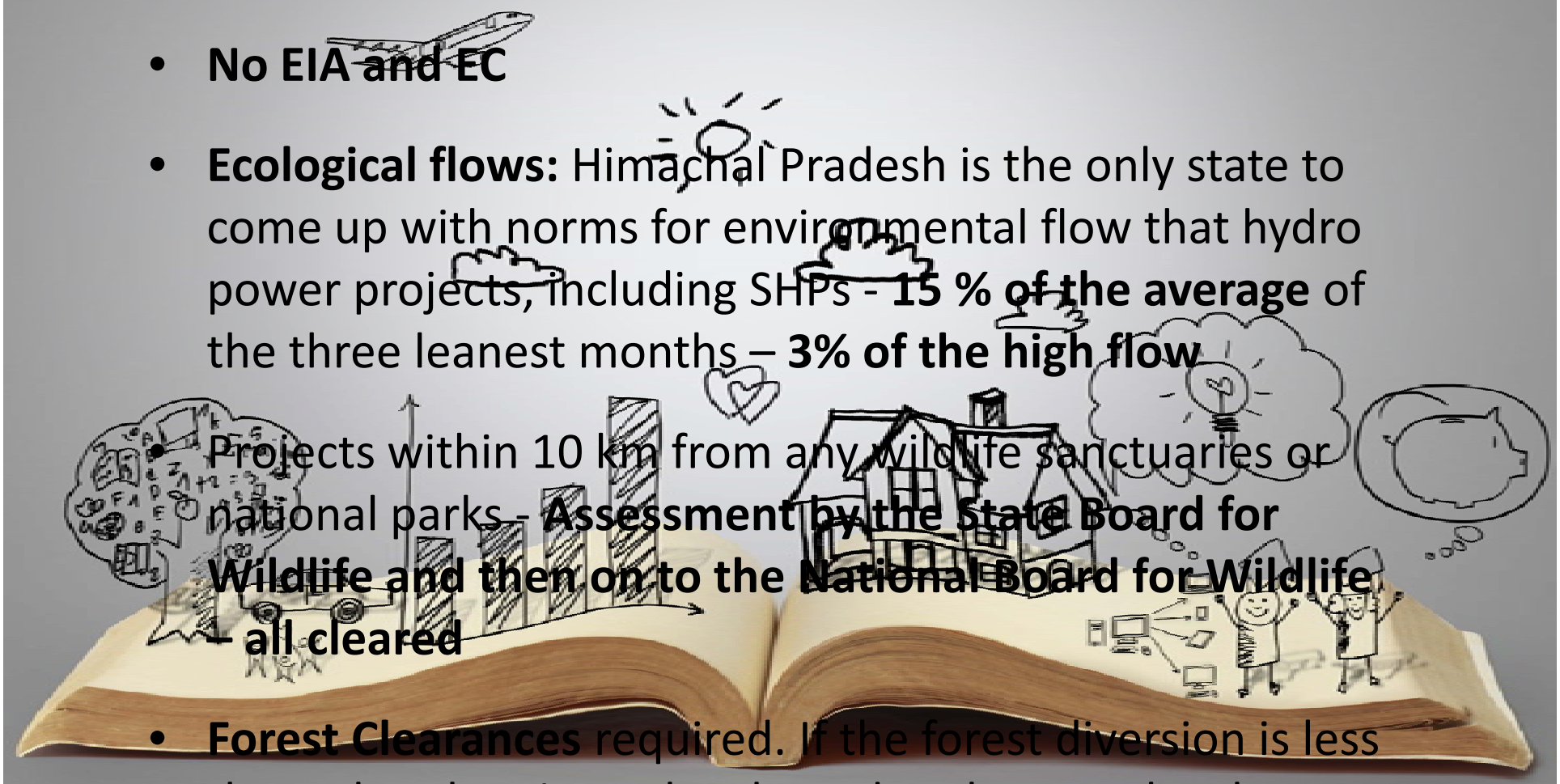


CUMULATIVE IMPACT

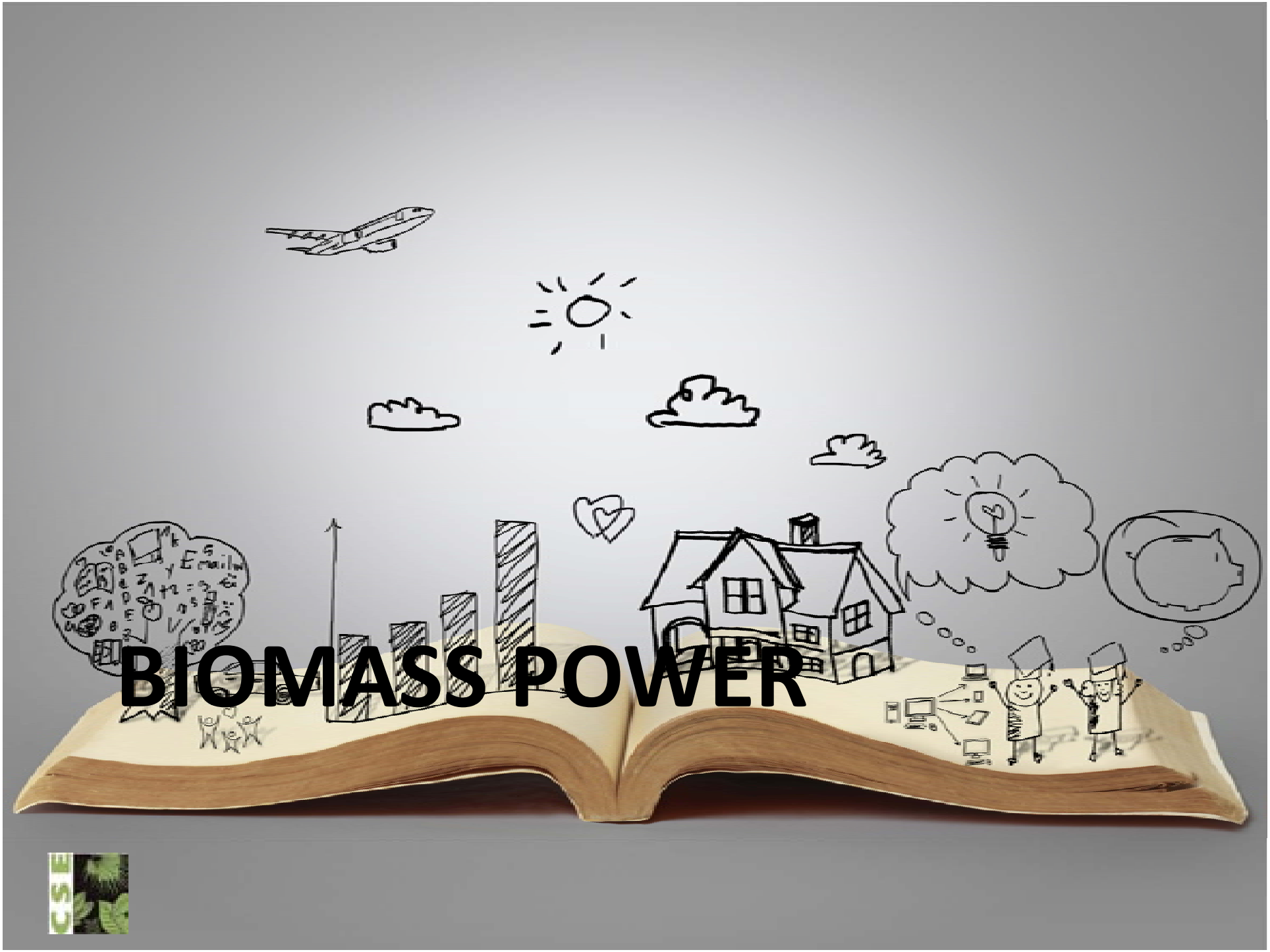
- Kempehole and Nethravati river in Karnataka: 44 SHP projects in various stages of development
- Alaknanda and Bhagirathi rivers have 70 hydro projects under various stages of development. In these 40 projects are SHP
- The impact is cumulative with many other development projects in terms of forest use and linear intrusion from roads and power lines
- Cascade operation of small hydro power stations leads to almost drying up of the natural channel of the stream during low flow periods.


Kudremukh National Park
Mudigere
Dharmasthala
Subrahmanya
Proposed mini-hydel projects
Netravathi river and tributaries
Protected areas

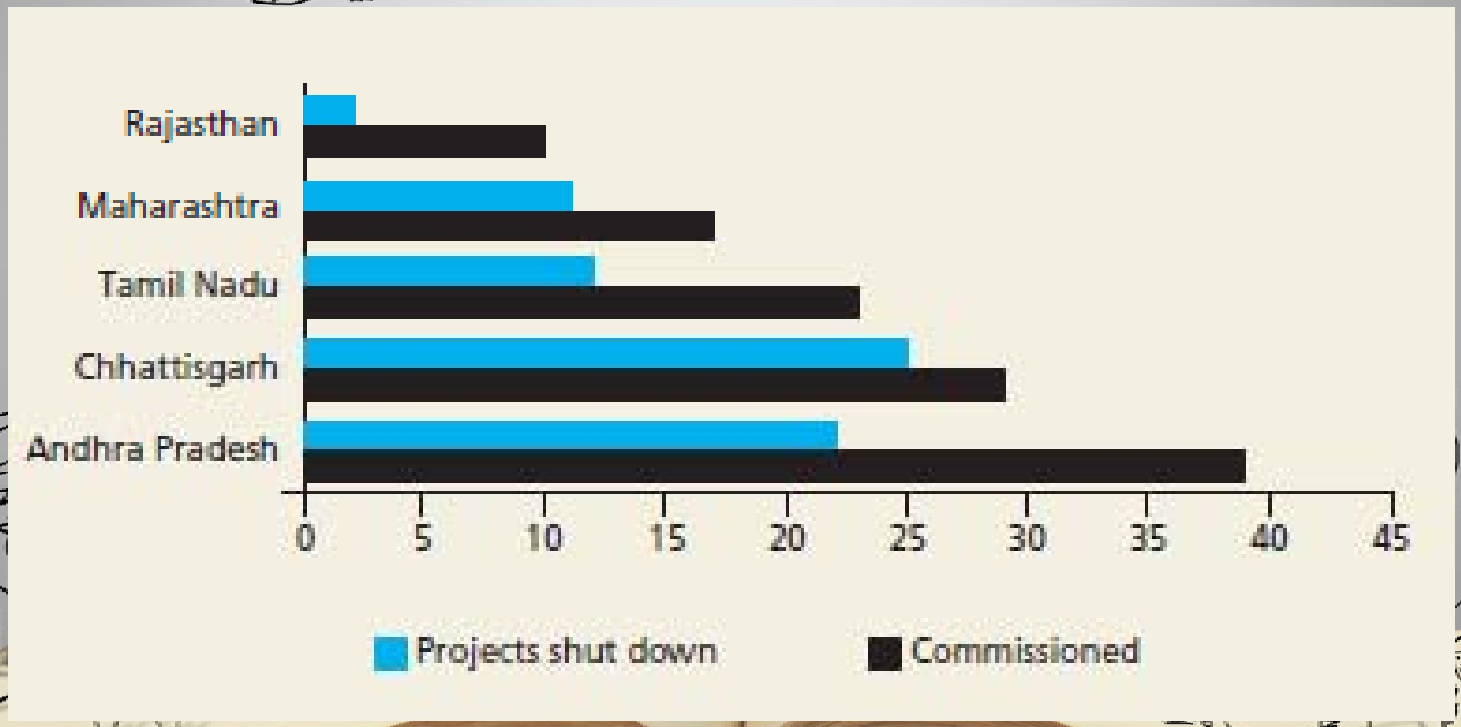
EXISTING REGULATIONS



- **No EIA and EC**
- **Ecological flows:** Himachal Pradesh is the only state to come up with norms for environmental flow that hydro power projects, including SHPs - **15 % of the average** of the three leanest months – **3% of the high flow**
- Projects within 10 km from any wildlife sanctuaries or national parks - **Assessment by the State Board for Wildlife and then on to the National Board for Wildlife – all cleared**
- **Forest Clearances** required. If the forest diversion is less than 5 ha, then it can be cleared at the state level.


BIOMASS POWER

POOR STATE OF BIOMASS PROJECTS



Problems in getting assured feedstock supply: rapid increases in prices, deteriorating quality and logistical issues related to regular supply of biomass.

BIOENERGY MISSION

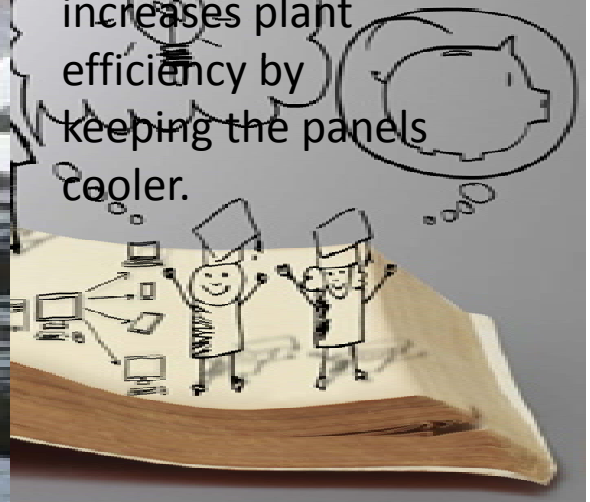
Biomass	Independent Power Producers	Tail End	Off-Grid	Cogeneration	Purified Gas	Thermal/ Cooking Purposes	Refrigeration	Total
Agro Resideue/ Waste	5,100	2,550	400	2,300	-	-	-	10,350
Plantations	3,800	1,150	175	700	-	-	-	5,825
Urban/ Industrial Waste	1,050	175	850	-	-	-	-	2,075
Waste from Dispersed Systems	-	-	145	-	130	122	100	497
Total	9,950	3,875	1,570	3,000	130	122	100	18,747

CHALLENGES

1. Rising Raw Material Prices
2. Reducing Government Subsidies
3. Environmental Issues

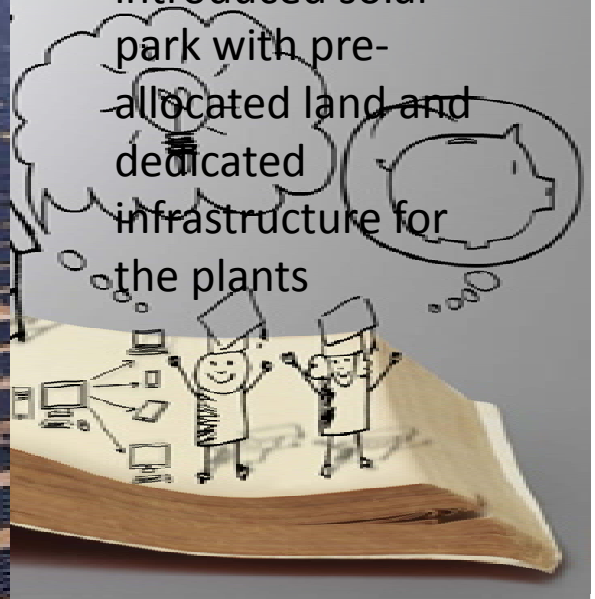
LESSON 1: INNOVATIVE LAND USES

Canal-top solar plants save water that have been evaporated from the canal and increases plant efficiency by keeping the panels cooler.



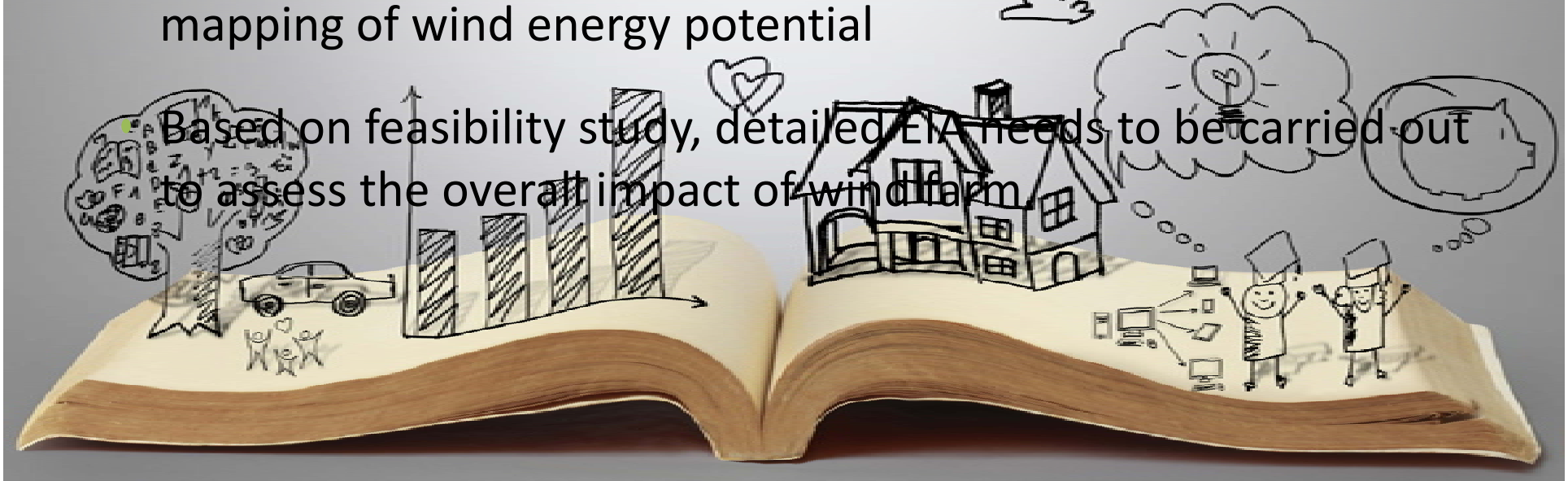
LESSON 1: INNOVATIVE LAND USES

Government has introduced solar park with pre-allocated land and dedicated infrastructure for the plants



LESSON 2: ENVIRONMENT MANAGEMENT

- Zonation of wind resources should be carried out on priority basis.
- Identification of potential area followed by district level mapping of wind energy potential
- Based on feasibility study, detailed EIA needs to be carried out to assess the overall impact of windfarm

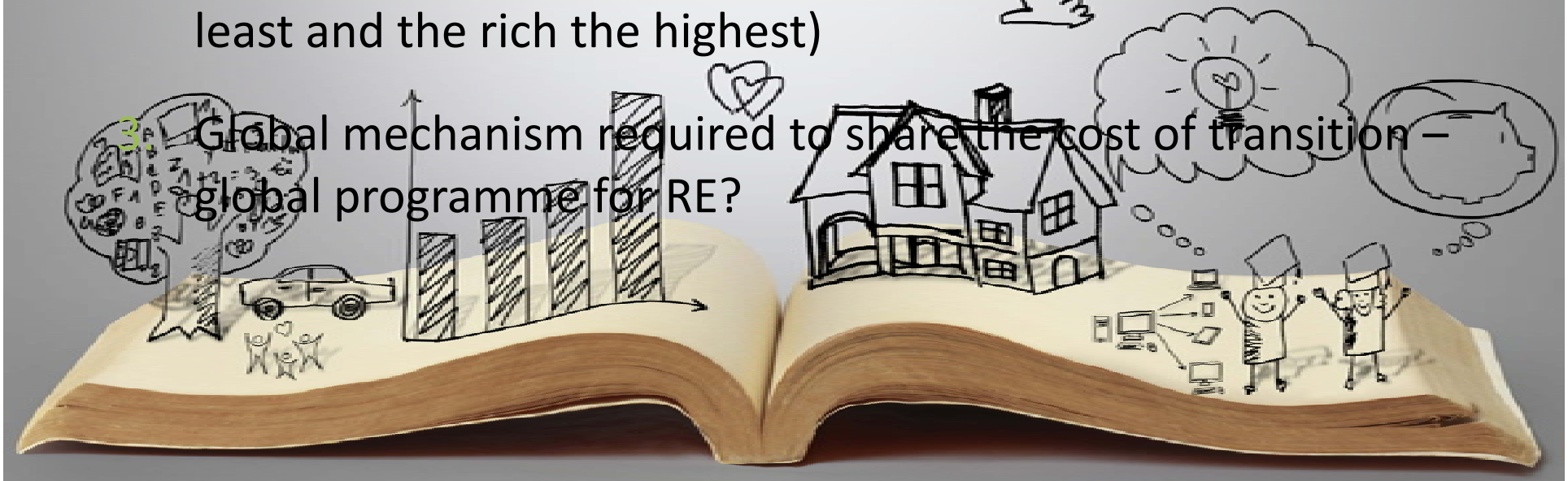


LESSON 3: PLAN AHEAD

- Plan for 24X7 electricity taking in to account RE targets
- Plan for the grid (we already have grid problems in evacuating wind power)
- Plan for the energy market

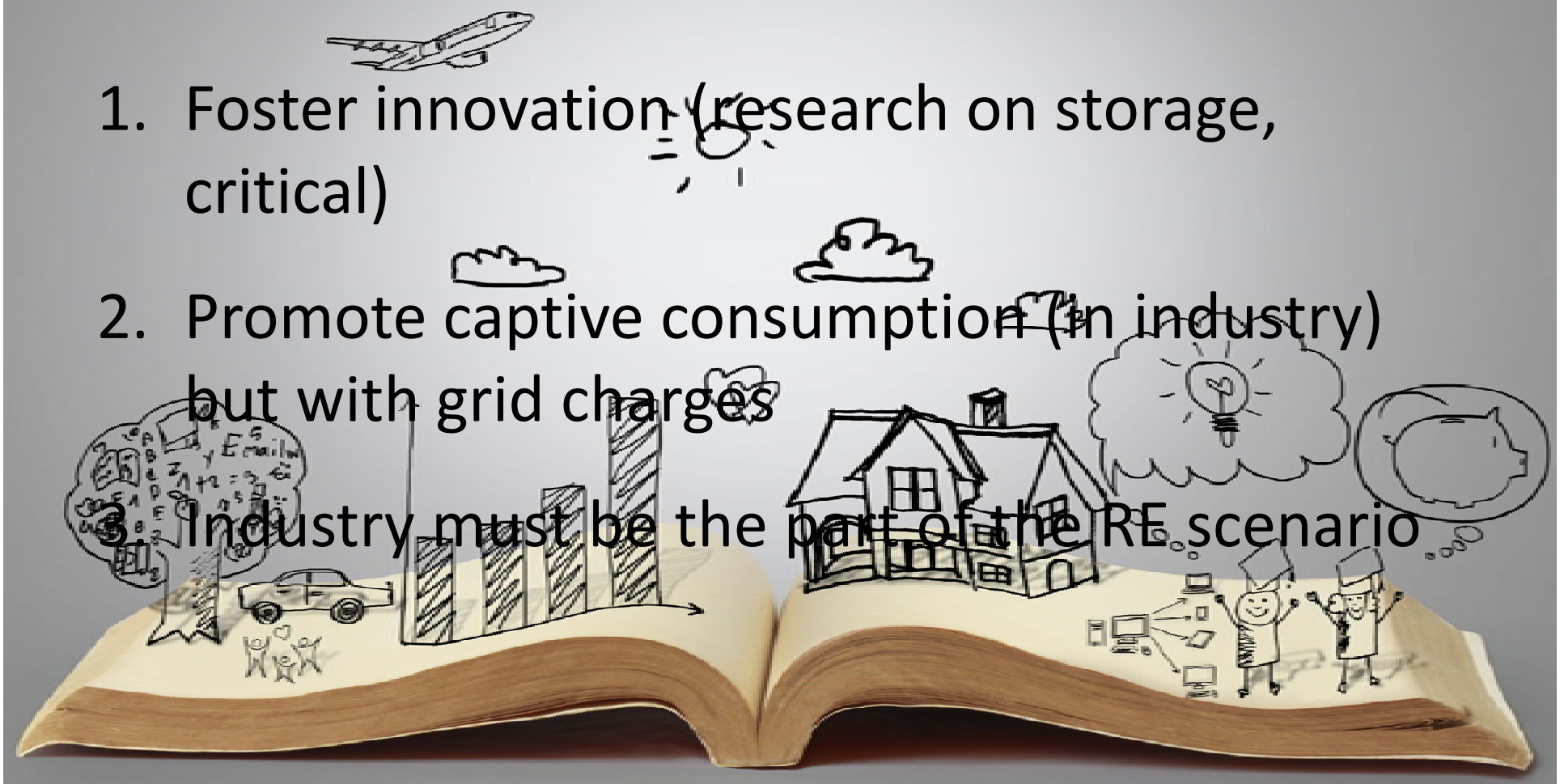
LESSON 4: ARRANGING FINANCE

1. Find the least cost option suitable to your country
2. Tax on electricity consumption – but at a lower level than Germany; applicable to all in a graded manner (poor the least and the rich the highest)
3. Global mechanism required to share the cost of transition – global programme for RE?



LESSON 5: OTHERS

1. Foster innovation (research on storage, critical)
2. Promote captive consumption (in industry) but with grid charges
3. Industry must be the part of the RE scenario



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