**BUSINESS PROBLEM FORMULATION**

The Indian government wants to understand the effect of the energy deficit on the economy and citizenry and design a data-driven story to transition India to alternative sources of energy, namely renewables. They have hired you to look at split as whether renewables can be a sustainable source of energy and if it could fill the energy deficit

**Energy consumption in India**

* Overall energy self-sufficiency at 66% in 2017
* Focus on developing alternative sources of energy, particularly nuclear, solar, wind biomass energy
* Costlier import bills at energy companies due to higher imports
* Vulnerable to global supply disruptions and price volatility due to global events

**Step 1: Understanding**

* **‘Purpose-driven’ data: What am I looking at?**
* Consumption as of today
* Consumption Trends (History and Near Future)
* Production (Capacity and Output)
* Imports (Quantity and Cost)
* Vulnerability due to Global incidents
* Price volatility
* Cost of Renewable Sources – Installing and Maintenance
* **Define what matters: Why am I looking at it?**
* Minimize Imports
* Minimize Price volatility
* Adequate production through Renewable sources
* Address future needs
* Keep costs down for end users (both residential and commercial use)
* **Ask the right questions: Put the question horse before the data-collection cart**
* How can we improve renewable energy?
* How much it cost for renewable energy?
* How can we minimize imports?
* How much time it will take to get 100% sufficiency?
* **Understanding the complete journey: Map out…everything**
* **Where are we now?**
* Increase for Demand for energy over period of time creating a deficit of energy by 15% ( \***Assumption:** As of 2017, have 15% deficit (Generation = 85% of Consumption))
* Still 64% of electric generation is happening by thermal generation (Coal-57% Gas & others – 7%)
* The usage of Coal & Oil triggers higher imports.
* Imports are vulnerable to global supply disruptions and price volatility due to global events.
* Sustainable development in the field of power sector is critical for Indian Economy.
* The Energy generation is based on non renewable sources which can perish over time period.
* **Where do we want to go?**
* Improve the production from renewable energy sources to nullify the imports and deficit.
* **Impacts with Proposed solution:**
* Minimize the imports
* Minimize the Reserves
* Cost of Production
* Lower Transmission and Distribution cost
* Minimise the effect of global market crisis and price volataility
* Nullify the energy deficit by Improve the production from renewable energy sources

**Step 2: Synthesis**

* **Think really small and very big**
  + Identified the key driving factors that increase the consumption of electricity
    - Industrialization
    - Population
    - Urbanization
    - Agriculture
    - Average Household consumption
    - Electrification of rural areas
    - Weather
* **Embrace: Live on the Edge**
  + Among these driving factors identified population and Industrialization (GDP) has more impact over power consumption, and is predicted for period 2019-2022 based on the fact that as the population increases the consumption increases with the help of a linear equation
* **From outputs to Action**
* Promoting renewable energy for rural electrification and industrial applications
* Enhancing access of the rural poor to affordable and sustainable energy services
* Organizing global forum activities and providing strategic expert advice on renewable energy technologies and energy policy planning and institutional framework
* To fulfil the deficit ,the amount of proportion of converting the non renewable sources to renewable sources
* Enhancing access of the rural poor to affordable and sustainable energy services
* High potential for development across various renewable source
* Types of Renew Energy Sources
  + Nuclear
  + Solar
  + Wind
  + Biomass
* The final solution is to raise power generation capacity to 2,000 TW by installing a new renewable sources of capacity 900 TW.
* **Connect the dots:**

**Why Renewable energy for India**

* India has a large potential for energy generation by utilization of renewable energy source due to its geographical location advantage
* Rising Prices for Oil & Gases
* Ecological Hazards
* Ample Resources and Site available
* Abundant sunshine
* Avoid the high cost involved in transmission
* Avoid recurring fuel cost
* Boost the urban and rural economy
* Make available much needed energy for basic needs at door steps at affordable prices
* Unlike conventional thermal power generation from coal, they do not cause pollution and generate clean power

**Step 3: Hypothesis**

Our goal is to transform the present electricity generation from non renewable  to  alternative

sources of energy, namely renewables

1. *Who is the audience? Who are we translating this to?*
2. *How are we going to combine different components of visualization: generation and production, import cost*

**Audience**

1. ministry of power
2. various governmental departments (PM’s office),
3. ministry of agriculture,
4. Ministry of Environment & Forests (MoEF),
5. Ministry of Petroleum and Natural Gas,
6. Ministry of Mines)

**Visualizations**

1. Bar graph for energy consumption in India’s various states/Regions
2. Bar graph for energy generation across different states
3. Pie chart for various energy sources in electricity generation across states
4. Pie chart for coal imports
5. Bar graph for coal usage across various industries
6. Bar graph for production of Petrol across different ownership companies
7. Pie chart for oil type for the year 2015
8. Bar chart for petroleum imports and exports over period of time
9. Consumption of petroleum across states in 2016
10. Cost of all energy sources
11. Energy Consumption Vs GDP and Population
12. Potential sites for each Renewable energy\

Questions for Dhaval :

1. potential or installed capacity ? for generation (final)
2. NSDP constant ? because it include depreciation and inflation.(ass-4)
3. Do we need to take summarize region wise or state wise. if region wise suggest a way to summarize .(ass4)