A one day international seminar was organized on Sustainable Energy by Centre for Environment & Green Technologies and Indo-German Study Centre on 20th November, 2013 at GTU Chandkheda campus.

A Centre for Environmental and Green Technologies was set up on 22nd December 2010 designed to equip graduates with multi-disciplinary skills and knowledge in the area of environmental sustainability and green technology. The main focus of the centre is research and development in Green Technology involving important areas of Sustainable Development through collaboration across the disciplines and experts in the field of Environment and Green Technology. The thrust area for the centre are Green buildings, Sustainable Energy, water and waste water treatment, power generation and delivery and environmental bio technology. This centre is under the care of Wing Commander (Retd.) C. G. Pandya who is acting as Honorary Director and is supported by the experts.

Indo-German Study Centre was launched by GTU on 21st August, 2012. The centre was inaugurated by Dr. Nobert Gulerwald of German University – University of Applied Science and Technology, Business and Design. GTU has almost completed two collaboration of research projects with DHBW, Stuttgart, Germany under Indo-German Study Centre. Prof. Dr. Friedrich Augenstein, Head of Department, Business Administration, DHBW Stuttgart, Germany visited GTU on 21st February, 2013. The German students visited GTU under Students Exchange program in March, 2013. The students were from Bielefeld, Germany.
Following Dignitaries honored the dias:

1. Prof. Dr. Reinhard Dolechal, Guest of Honor
2. Shri Deepakbhai Gadhia, Keynote Speaker
3. Dr. Akshai Aggaraal, Honourable Vice Chancellor, GTU
4. Dr. G. P. Vadodaria, I/C Registrar and Controller of Examination, GTU
5. Prof. Dr. M. N. Patel, Director, GTU
6. Shri V. K. Desai
7. Shri Rajnikant Patel

The galaxy of the eminent speakers from various States and Countries were invited for sharing their knowledge and experience in the field of Sustainable Energy. The Speakers were:

1. Prof. Dr. Reinhard Dolechal, Professor of Innovation and Management at the Department of Electrical Engineering and Computer Science at Ostwest fallen – Lippe, University of Applied Sciences, Germany
2. Shri Deepakbhai Gadhia, MS Environmental Engineering (Berlin, Germany), Director, MSA Renewtech Foundation
3. Shri V. K. Desai, B.E. Mechanical, LLB, Founder of Tiny Tech Plants and Aadhunik Global Energy - Rajkot
4. Wing Commander (retd.) Shri C. G. Pandya, Honorary Director of Center for Environmental and Green Technologies
5. Shri Rajnikant Patel, P.E., MS in Mechanical Engineering – USA, MBA – USA, Advisor – Research and Consultancy Services Cell, GTU
6. Prof. Dr. K. N. Sheth, Dean – GTU, Director, SSES and Convener of the program
Inaugural Session:

At the outset, the program was inaugurated with *Deep pragatyam* and *Saraswati Vandna*.

**Prof. Dr. K. N. Sheth**, then heartily introduced and welcomed all the dignitaries by conveying his gratitude to them. He specially thanked Prof. Dr. Reinhard Dolechal, Shri Deepakbhai Gadhia and Shri V. K. Desai for their prompt and positive response to be the Speakers in this International seminar.

Dr. Sheth in his speech threw light on the aim of organizing this seminar on Sustainable Energy. He focused the Indian scenario for the utilization of energy. He stated following points in his speech:

- It is a fact that India made appreciable progress in the power sector during 11th plan period, i.e. 2007-12.
- The power sector ranks 6th among the leading sectors of Indian economy and has attracted $4.6 billion in Foreign Direct Investment (FDI) since 2000.
- India added 55000 MW generation capacities.
- Each Indian only consumes about 800 kwh of power energy every year (as compared to China’s 2631 kwh)
- Yet about 35% of households in India do not have access to electricity.

*Report prepared by Prof. Dr. K. N. Sheth, Dean, GTU*
• The country could have added targeted 75000 MW generations in the 11th plan period but this could not be done because of fuel shortage and environmental clearances.
• Similarly India’s power sector which is expected to attract investment of Rs. 11 lacs crore during the 12th plan period is also reeling under crisis, and one of the reasons is power constraints.
• The renewable sources have therefore been a viable alternative to conventional fossil fuels. But the cost of renewable supply is a major challenge.
• The cost of solar power is almost 5 to 6 times that of the power produced from coal.
• The gas based on power plants is suffering from lack of available fuel supplies.
• Our present system is to impose load shedding but Indians resort to DG sets which are very expensive. The subsidized diesel is more than Rs.14 per unit.
• If we use coal it would be Rs. 3.50 per unit and if we use LNG it would be Rs. 7.00 per unit.
• We therefore need sustainable energy.
• We should produce power through cogeneration e.g. A sugar mill can generate power as a byproduct through bagasse, a residue of crushed sugarcane.
• We should concentrate on hydel power. There is a potential of about 1,55,000 MW of which only 40,000 MW has been tapped.
• Wind energy is almost zero carbon emission energy. Wind power potential is around 49,000 MW and we have tapped only 2.5 lakh kwh.

To address all such issues, Dr. Sheth stated that the Centre for Environment & Green Technologies and Indo-German Study Centre has therefore jointly organized One day International Seminar on “Sustainable Energy”. He reiterated that GTU is fortunate to have eminent experts who will share and interact with us on the subject of grave concern today.

**Dr. G. P. Vadodaria, Registrar, GTU**

stated that Sustainability is the capacity to endure. He wished that the International seminar on Sustainable Energy a great success as energy is not only the need for present generation but it is also the need for future generation. To cope up with the demand of energy, non-conventional sources must be taken into consideration by our country because the conventional sources are likely to reach to extinct soon. He had shown his happiness to welcome the renowned speakers from German and other places.
Prof. Dr. M. N. Patel, Director, GTU said that he was excited to see the speakers from all corners of India and abroad and he wished a success for the international seminar on sustainable energy. He congratulated Dr. K. N. Sheth for organizing such useful seminar specifically for the ME as well as PhD students who were present in the seminar.

At the outset, Honorable Vice Chancellor, Dr. Akshai Aggarwal Sir, GTU had raised a concern over the issue of energy security. Dr. Akshai Aggaral stated that India has to depend upon renewable energy sources like solar, wind, geo-thermal, bio-energy and hydro energy. The present energy scenario, given by Dr. Sheth clearly shows that there is energy deficit and almost 300 people in India are in darkness. He said, “Slowly and gradually we must avoid using fossil fuel.” Dr. Aggarwal further expressed his desire that all the buildings that we construct in India should be energy efficient. In other words, green building design concept must be taken into consideration.

Doing his address, he suggested to Dr. K. N. Sheth, Dean of GTU and Wing Commander (retd.) Shri C. G. Pandya, Honorary Director of Center for Environment and Green Technologies that the existing GTU building should now be modified as a green building as we have been continuously using enormous energy while regularly conducting seminars, symposium, conferences, etc. At the end, Dr. Akshai Aggarwal expressed his feelings of gratitude to the entire galaxy of renowned speakers on the subject.
In the beginning, Shri Deepakbhai Gadhia explained the fuel wood crisis of the world. He said how fragile the ecological environment is.

He said that women all over the world waste several hours per day in search and collection of fire wood. Whenever we imagine a rural woman she is either carrying wood or water and it is a global phenomenon. Due to fuel wood scarcity and since often they have to purchase the same many families avoid boiling water which is one of the major causes of diseases in developing nations.
He then introduced the Solar Box cooker - a Technology that is being promoted in India since last 50 years but it has not found much acceptance and there are approx only 650,000 such cookers in India. Of that only 50% may be in use and the major reason for resistance is that they are slow, can only boil and bake and not fry and make chapatis. Then, Shri Deepak Gadhia said that he brought technology from Germany of Sk 14 Parabolic Solar Concentrator for domestic cooking as it enabled quick cooking and also frying and making of chapties. The reason why Solar Concentrator can do what Solar Box cookers could do was that box cookers work on principle of trapping of heat where as Solar Concentrators work on concentration of sun rays which produce very high temperature of above 250 degree centigrade and the cooking vessel is kept in the focus of parabola. The cooking vessel has to be painted black so that it absorbs light and not reflect it back and thus increase the cooking time.
The problems that Shri Deepak Gadhia encountered repeatedly was that people who needed the Solar Cookers and would have used the same – could not afford it and the people who could afford it did not need it as they had easy supply of LPG gas and and other easier and cheaper (due to subsidy) means of cooking. The middle class women was resisting to use solar as it required them to go out in the sun and thus through Dr Dieter Seifert the developer of Sk 14 they got to know Physicist Wolfgang Scheffler whose technology enabled cooking in the comforts of kitchen.

The technology consisted of flexible parabola that turned like sunflower and tracked the sun and reflected the sun-rays through a small opening in the north facing wall of the kitchen on the secondary reflector that was placed within the kitchen below the cooking vessel and the secondary reflector deflected the sun-rays on the bottom of the cooking vessels. Soon shri Deepak Gadhia realized that the cooker was too expensive for domestic cooking and thus positioned it to offer it for community cooking and was successful and have sold hundreds of such Community Solar Cooking System.

Shri Gadhia then showed in the next slide two Scheffler dishes of 10 sqr mtr each reflecting the rays on the secondary reflector in the kitchen. The system is installed at Rishi Valley Rural School in Madanapally near Bangalore.
In the next slide, Shri Gadhia stated that on receiving the inquiry to cook for 1200 people, he was forced to look for other solutions and with help of HTT GmbH of Germany developed Solar Steam Cooking System where instead of bring the sun rays in the kitchen the rays were concentrated on Receivers (heat exchangers) and the water in receivers was converted to each other with wire rope and it was connected to winch which had Dc motor and it ensured that the dishes tracked and faced the sun.

Shri Gadhia said that the success of Solar Steam cooking at Brahma Kumaris led to many more systems being installed in India. In the next slide, he showed the system supplied and installed at Tirupati Temple that cooks 30,000 meals per day. The system was installed in 2001.
He stated that the system at Tirupati consists of 106 dishes of 10 m² each which are placed on the terrace as 55 pairs and the steam is piped to kitchen 4 floors below. The challenge was to place the dish in such a way that the existing terrace could accommodate the same and all the load of the dish and wind load had to be transferred to columns and beams.

Shri Gadhia explained the system installed in Leh Ladakh for the Indian Army and which shows that Solar Systems work on radiation and not on heat and in spite of snow and the cookers work at -15° C.
Shri Deepkabhai Gadhia then explained the kitchen of Indian Army before the installation of Solar steam cooking system. He had shown the photograph of the system showing smoke and soot and indoor pollution due to use of conventional fuel.

He then explained the kitchen of Indian army after the solar steam cooking system was installed with back up boiler which is neat and hygienic kitchen.
In his address, Shri Gadhia said that few years back the first Solar Air-conditioning plant is installed at Muni Seva Ashram where he replaced the wood wired boiler and the steam for air-conditioning plant which is now supplied with Solar Steam. The Solar Air-conditioning system consists of 100 dishes of 12.5 m² and the capacity of the system is 100 Tone Refrigeration. The 400 kg/hr steam at 10 kg/cm² runs a 100 TR Vapor Absorption Chiller which generates chilled water and the chilled water is piped to hospital where the Air Handling Units (AHU) cool the air and ducts into the central air-conditioning plant.
He further showed a 50 m² Scheffler dish and the solar cremation chamber for Solar Crematorium being built at Muni Seva Ashram.

Shri Gadhia said that a Biogas plant at Muni Seva Ashram which converts bio-degradable material like cow-dung, kitchen waste, etc. by fermentation into biogas which is 55-65 % methane a combustible gas. The technology is of KVIC (Khadi and Village Industry Commission) and it is floating drum model.
He further explained in the next slide of his presentation that the slurry coming out of the biogas plant is converted to vermi-compost by adding it to soil and bio-mass and the earthworms convert the same into vermi-compost.

He stated that at Muni Seva Ashram the biogas technology got further fill-up as they took the technology to next level along with the vendor Excellent Renewable Energy Ltd., Valsad. They installed a Scrubbing System to remove the 20-25 % CO₂ in Biogas and thus after water scrubbing the methane content which was 55-65 % and CO₂ whose content was approx 20-25 % with removal of CO₂ the methane content in enriched/ upgraded biogas went up to 92-94 %, and this enriched Bio-CNG was compressed and bottled.

He further explained about the Biogas digester, the scrubbing unit and the truck with bio-CNG bottle rack where 20 cylinders of 75liters were filled with bio-CNG and transported
to Ashram for cooking to replace LPG. Since now the Biogas after enrichment was equivalent to CNG a mini-truck of Ashram was converted to run on Bio-CNG and since last 4 years has been running successfully.

Shri Deepka Gadhia then talked about the Ultra Modern kitchen of Athithi Mandir of Muni Seva Ashram running on bottled Bio-CNG from Biogas plant. Food for approx 3000 people is cooked daily on same.
Shri Gadhia explained how he established Solar Dryer at Muni Seva Ashram to convert the perishable product a farmer grows into non-perishable product empowering the farmer to sit on his product till he gets better price.

Shri Deepakbhai Gadhia informed that at the NGO of Shri Gadhia, Solar Cooker project by Eco Center ICNEER was taken with Austrian School Children who collected funds for 200+ Sk 14 Solar Cookers for rural population and with that Smoke-free village and through Barli Women’s Institute 100’s of Solar cookers were supplied in rural India with income generation activities with a slogan, ‘pay from your profit and not from your pocket’. It was combo of Micro-finance and income generation program.

He showed in his next slide, Dr Shirin Gadhia training the tribal women to use Solar Cookers and use it as income generation too.

Report prepared by Prof. Dr. K. N. Sheth, Dean, GTU
He further said that Sk 14 Parabolic Solar cookers are being shared by a rural community for income generation which was a project taken with Jesuit Sisters.

Dr. Gadhia and Dr Shirin Gadhia with Mr. Bernward Geier who was for 18 years head of IFOAM- International Federation of Organic Agriculture Movement at Slow-food festival in Turin Italy where the solar cookers were demonstrated to be integrated in Slow Food Movement.

The visitor children after demo at Eco Center on Solar Cooking, they are quick to grasp importance of tress and its protection and Solar cooker as solution.

Shri. Gadhia further said about the first Smoke-free village in India (perhaps world’s) where villagers use Solar cookers as income generation tool and pay from profits they make on sales of solar processed foods.

Report prepared by Prof. Dr. K. N. Sheth, Dean, GTU
He then talked about an innovation found out by a village women using Solar cooker for ironing clothes showing that rural population is smart and will find many such uses of solar cookers for income generation and cooking is not the only way to use it.

Shri Deepakbhai Gadhia said that normally we see rural women carry fire-wood or water but by showing women carrying with them a Solar Cooker which comes as do-it-yourself-kit and after taking it to villages they assemble and use it for income generation by making and selling items like fried products, boiled water, baked products on the solar cookers.
Shri Deepak Gadhia then shared visit of Dr Abdul Kalam at the Ashram to know Biogas Bottle rack, how renewable energy is integrated in the social work and health and education work of Ashram.

Sri Gadhia ended his address by saying, “just like mobiles and soft drinks like Cola, Limca, Pepsi and Bottled water is available in deepest part of India why can’t sustainable technologies be spreaded and used by the rural population? We all need to work together to make it happen to Save Planet Earth.- Our OnlyHome.”
Prof. Dr. Reinhard Dolechal, Guest of Honor of the Seminar had spoken on, “Results of a User Study on Energy Consumption in India’s Mega Cities“. The overall aims of his investigation stated by him are as under:

1. To integrate the stakeholder’s mindset in knowledge sharing and decision making on energy-efficient buildings and living style.
2. To extend the awareness and the knowledge on energy-efficient building design.
3. Identification of awareness/needs/methods/approaches to improve the Indian energy scheme
4. Development of instruments for the promotion of sustainable consumption such as new material, comparative testing, and awareness campaigns; life-cycle assessment; and green public procurement
5. Involving businesses and corporate social responsibility for the promotion of energy efficiency and sustainable consumption
6. Identification of a stakeholder strategy for energy efficiency and sustainable consumption

He explained that he made studies into three parts:

Part: I User Priorities of home standards
Part: II User Environmental Knowledge
Part: III General User Attitude

He very scientifically presented the investigation made by him and discussed the analysis of his research in detail and concluded following matters:

1. The well educated middle class in India plays a significant role in the energy debate.
2. The awareness of energy saving is in this population segment wide-spread.
3. The knowledge level of energy saving is related with simple techniques.
4. Advanced Technologies of energy efficient building design are still unknown.
5. The demand and desire of comfortable and secure residential places is dominant.
6. Most of the respondents are willing to spend much more money for energy saving equipment and buildings.
7. A better public transport system has a higher priority than individual transport.
Shri Rajnikant Patel had focused in his address on, “Issues and Challenges in Sustainable Energy”. In his address, he gave brief idea on various sources of energy and discussed merits and demerits of each of following such sources of energy:

- Fossil Fuels—Coal, Gas and Oil
- Nuclear Power
- Renewable Energy Sources
- Solar Power—PV and thermal
- Hydro Power
- Wind Energy
- Bio mass Energy
- Geothermal Energy
- Tidal Power
- Hydrogen as Energy

There was an interesting discussion on components of Hydrogen economy and Hydrogen storage. The estimated levelized of new generation resources of 2016 as presented by him is as under:

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Capacity Factor (%)</th>
<th>U.S. Average Levelized Costs (2009 Simegawathour) for Plants Entering Service in 2016</th>
<th>Total System Levelized Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Coal</td>
<td>85</td>
<td>65.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Advanced Coal</td>
<td>85</td>
<td>74.8</td>
<td>7.9</td>
</tr>
<tr>
<td>Advanced Coal with CCS</td>
<td>85</td>
<td>9.2</td>
<td>9.2</td>
</tr>
<tr>
<td>Natural Gas-fired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional Combined Cycle</td>
<td>87</td>
<td>17.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Advanced Combined Cycle</td>
<td>87</td>
<td>17.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Advanced CC with CCS</td>
<td>87</td>
<td>34.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Conventional Combustion Turbine</td>
<td>30</td>
<td>45.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Advanced Combustion Turbine</td>
<td>30</td>
<td>31.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Advanced Nuclear</td>
<td>90</td>
<td>90.1</td>
<td>11.1</td>
</tr>
<tr>
<td>Wind</td>
<td>34</td>
<td>89.9</td>
<td>9.6</td>
</tr>
<tr>
<td>Wind – Offshore</td>
<td>34</td>
<td>209.3</td>
<td>28.1</td>
</tr>
<tr>
<td>Solar PV</td>
<td>25</td>
<td>194.6</td>
<td>12.1</td>
</tr>
<tr>
<td>Solar Thermal</td>
<td>18</td>
<td>259.4</td>
<td>46.6</td>
</tr>
<tr>
<td>Geothermal</td>
<td>92</td>
<td>79.3</td>
<td>11.9</td>
</tr>
<tr>
<td>Biomass</td>
<td>83</td>
<td>66.3</td>
<td>13.7</td>
</tr>
<tr>
<td>Hydro</td>
<td>52</td>
<td>74.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

1 Costs are expressed in terms of net AC power available to the grid for the installed capacity.

At the end, the renewable solar path to hydrogen – Futuristic Energy Scenario was explained by him as showed in the chart as under:

Wind Commander (retd.) Shri C. G. Pandya, had focused on wind power as an important area of renewable energy for new power generation. He said that the wind energy is kinetic energy associated with large masses of air.

He further said that, while wind energy had been used by human beings from time immemorable, the use of wind energy for electric power generation started mainly after the Gulf War. Rapid technological advances have today brought us to a stage from where planning for electric power generation as a clean power source is now gaining rapidly on a global basis.

Wind power is now one of the most important areas amongst Renewable Energy areas of new power generation needs. Both Solar and Wind are gaining grounds almost in all technology development fields all over the world. With the Smart Grid idea coming up
very fast, the planning of distributed power systems is being considered very essential for all existing and future power projects everywhere.

He explained important aspects of Wind power like:

- **Wind energy siting**
  - Topology indicators
  - Terrain, obstacles, small hills, valleys
  - Geographical indicators
  - Sand dunes, satellite remote sensing data
  - Biological indicators
  - Bent trees
  - Social / Cultural indicators
  - Land use, crops, people, houses
  - Environmental indicators
  - Wind shear, roughness factor
  - Modeling techniques
  - Data interpretation, interpolation
  - Wind measurement
  - Anemometers, time periods, data logging
  - Wind rose generation
  - Wind direction and amplitude
  - Feasibility studies
  - Technical, Financial, Environmental
  - Starting up and monitoring of the project

- **Benefits and limitations**
  - Wind energy is free, fresh and for ever
  - Combats climate change*
  - Air pollution, water pollution
  - Provides energy security
  - Cuts fuel imports (thus reducing costs)
  - Wind farms are modular by design
  - Creates new jobs in bulk
  - Major Limitation: Power generation is not continuous.
  - *By 2020, 10 Billion tons of CO2 em’ns may be saved

- **Wind Turbines**
  - Types
    - Stand alone (Battery charging, WPWM)
    - Grid connected (Power generation)
  - Vertical Axis Type
  - Horizontal Axis Type
  - Major Manufacturers: (HAWT)
- Vestas (DK), G E (USA)
- Goldwind (China), Gamas (Spain), Enercon (Ger),
- Suzlon (Ind), Siemens (Ger), Mitsubishi (Japan)

**Wind Turbine Technology**
- Basic parts of a HAWT
- - Blades, Necelle, tower, M&C panel, foundation
- Power Equation and Power Curve
- Stall and pitch controlled machines
- Drive train
- - Main shaft, Gear Box, Gen, Yaw system
- Towers: Lattice or Tubular, 20m ht to 120m ht
- Blades: 2, 3, 4 or multi blade designs
- Life expectancy: 30 years in most cases

**Wind Farm Developments**
- Wind farms have to manage the entire establishment including:
- - Land, services, communication, local & external links, security of men and materials
- - Technical aspects include: Planning of the project. Micro siting, WTG O & M, Sub-station, training, stores and logistics
- Data collection, monitoring and, economic analysis and reporting of power output
- Emergency management especially in respect of cyclones and earthquakes

**Off-shore wind**
- Off-shore WF started only 20 yrs back
- - mainly in Europe, now in US too
- 50 GW global generation in Off-shore WFs
- 13 countries involved include
- - UK, Denmark, Netherland, Sweden, Germany
- Specific design features
- - Anti-corr mtls, sealed necelle, platfm, found’n
- Floating wind farms
- - Japan now plans huge FWFs of 1570 GW
- Major Manufacturers include
- - Siemens, RE Power, Vestas, Goldwind
- Emergency marine systems design
- Why not on Gujarat coast?

At the end, Shri C. G. Pandya stated that wind farm will be a part of Smart Grids globally. Many community WFs are likely to come up, off-shore wind will grow further,
Electric Vehicles will spread fast soon and all EV charging will be by Smart Grid. He expected that Wind Turbine materials and design will be more environment friendly and cheaper and Better lifestyle with clean energy is possible.

In the beginning, Shri V. K. Desai of Tiny Tech Plants, Rajkot who is a strong Gandhian had demonstrated how to make solar cooker within expenditure of Rs. 1,500. It was found to be simple and wonderful. All the participants were impressed by his ‘Swadeshi technique’.

Shri V. K. Desai had focused in his address on, “Creating happy India through swadeshi energy Industries”. His speech was found to be absolutely different from conventional thinking and was very interesting. Though apparently it looks difficult to be implemented but it is indeed possible to create sustainable energy through the use of solar energy at a reasonable cost.

Shri Veljibhai started saying that, “Do Not Be Fascinated By Europe & America”. He said so because the western societies are broken having no culture and character”. In the western social structure, everywhere distrust, jealousy, hatred, self centered thinking etc prevailed. In western countries, the sweet fruits like banana, mango, chickoo, papaya including sugarcane, Oilseeds, pulses, cotton, green Vegetables cannot grow there. Therefore, shri Veljibhai argues that western economic structure depends upon MNCs whereas India is a great nation because India has great culture & traditions, arts enriching
the life, religions, heritage, spiritualism, languages. Veljibhai quoted Gandhiji and said that “We have nothing to learn from the West. We have everything to teach to the West.”

According to Gandhiji, we should decentralize:

- Power Houses to Farm or Village size power plants.
- Rice Mills to family size rice hullers.
- Oil Mills to village size tiny oil mills and Ghanis.
- Textile Mills to family size home industry.
- Cement Plants to village size family industries.
- Abolish Sugar Factories & promote only farm size Jaggery Units.
- Giant thermal power houses have installed capacity of 1,80,000 MW.
- Proposed Huge Nuclear Power Plants can kill India anytime.
- They exploit Rs.5 lakh crores from people annually.
- Mass scale scandals in coal mining.
- Mass scale displacement and eviction of people from their homes and villages.
- Half of India (i.e. 80% rural homes) have no power connection in their homes.
- So entire system is cruel, unjust, exploitative, wasteful, polluting and working in favor of handful of billionaires.

But Mahatma Gandhiji said, “We must learn how to use steam and electricity appropriately.” Shri Veljibhai, therefore, stressed on Tiny Thermal Power plant like:

- Steam Engine 20 HP.
- Water Tube Boiler 150 Sq.Ft heating surface.
- Alternator 10 KW.
- Scope in India- 3 crores.
- Scope in the World- 8 crores.
- Fuel- Any biomass or wood.
Then, he said that all these tiny power plants can be converted into solar power plant simply by adding Solar Concentrators.

He then discussed about the solar concentrator made by him with following salient features:

- Cheapest in the world. Cost US$140/sq.mt which is 40% of market price.
- Tracking is manual. But only one person can manage tracking of 5 such concentrators.
- Clever electronic engineers can devise tracking system.
- Every person is free to copy my solar concentrator.
- Huge scope of 3 crores of Concentrators for SOLAR REVOLUTION in India.
- Concentrator is so much simple that village blacksmiths, carpenters, welders and clever technicians can fabricate it.

He also explained other Rice mill industry, Oil expeller and Oil ghani made by him.

During the discussion he stated that Jaggery is better compare with sugar and the interesting aspects of sugar vs. jaggery are as under:

- 1 ton of sugarcane produces 100 kg of sugar OR 140 kg of Gur, i.e. 40% more production in Jaggery.
- Sugarcane crop in India is 35 crores tones annually.
- Sugar factory requires 50 times more capital than jaggery units of same production capacity.
• Jaggery units provide 40 times more employment than sugar factories for same capacity.
• Jaggery is full of nutrients & beneficial to body.
• Sugar is white poison with 59 kinds of dangerous side effects.
• It creates diabetes and stimulates heart attack.
• Half of the world still eats Jaggery.
• Sugar industry exploits Rs.1,00,000 crores from the people.

He, therefore, suggested that we should use jaggery for creating power due to following reasons:

• 30,000 jaggery units are working in India crushing 10 crore tones of sugarcane.
• 1 lakh jaggery units can work in India to crush 35 crore tones of sugarcane to produce 5 crore tons of jaggery.
• Then India can provide Jaggery to 4 billion people in 150 countries.
• 10 HP motor or diesel engine drives sugarcane crusher to crush 20 tons of sugarcane per day.
• Huge quantity of heat is wasted in a chimney of furnace.
• Waste heat can produce steam which will drive sugarcane crusher. So all jaggery units can be power independent.
• Mono Tube Boiler placed in a chimney or Furnace Boiler will be enough to produce free of cost power.
• Huge scope for Engineers to make boilers, steam engines, sugarcane crushers, boiling pans etc.

He suggested decentralized cotton spinning mills, cement plant, domestic biogas plant, solar cooker and wing mills. He very confidently described the huge scope for engineers as under:

• 10 crores of Domestic Solar Cookers.
• 25 lakh of Small Community Cookers.
• 2 crores Large Solar Concentrators.
• 1 crore Wind Turbines upto 500 W.
• 20 lakh Wind Turbines upto 5 KW.
• 2 crores of Steam Engines upto 20 HP.
• 3 lakh Oil Expellers.
• 3 lakh Rice Hullers.
• 6 lakh Tiny Cement Plants Equipments.
• 5 lakh Tiny Ice Plants.
• 3 lakh Village Soap Plants.
• 1 crore Simple Electric Bikes.
• Earning 1 crore Rupees for 1 lakh Engineers.
In next session, following had presented the papers:

1. Evacuated Tube Solar Cooker by Kirankumar R. Patel, Ankit D. Ramoliya
2. Producing Green Energy through Renewable Energy Resources in Hybrid Resources in Hybrid Power System by Rohan B. Patel
4. Developing an Energy Self Sustainable Sewage Treatment Facility by Brijesh N. Sheth, Dr. K. N. Sheth