Design, Technology and Innovation
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Lecture-7
Challenges of Reaching a Million Users Part 3

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Various activities are involved towards doing this, especially setting assembly distribution centers, repair and maintenance centers, both involve identification set up, training as well as the actual operations. An entrepreneurship development also happened where we are doing entrepreneurship development training for those people who are involved in making the lamp, and can actually continue their livelihood using solar.

And being an IIT we were also strongly involved in continuing to be doing this documentation and research on all these aspects.

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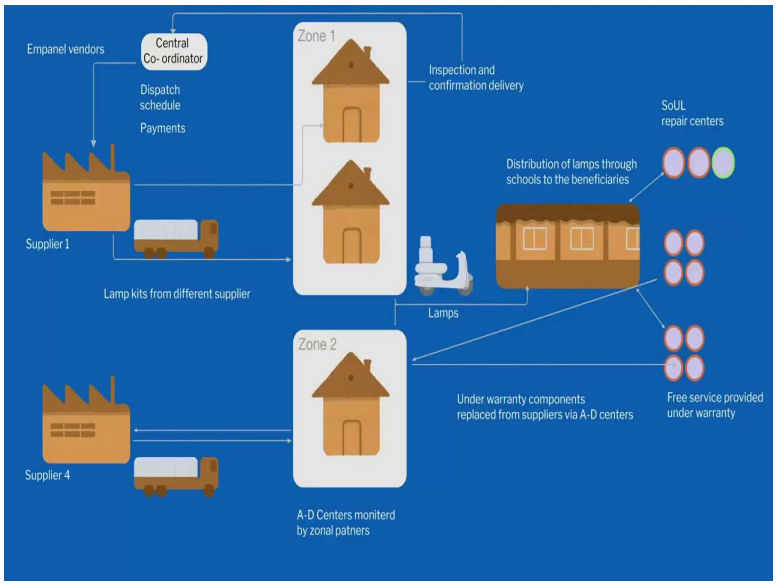

A quick idea of the operational flow we ended up creating is we have a central coordinator who we first empanel various vendors and based on the target population there, we decide how much quantities to send them. The quantities are directly told to the vendor and vendor supplies last mile up to that particular location which itself is quite an interesting task because the visibility is very low I am sure all of you have used, say, purchased through Flipkart and Amazon everything, right? Here you can really track what is happening.

Like, you know, whether it has reached warehouse, whether it has left the warehouse etc., but if you want to supply anything to some of these locations visibility will stop somewhere at Patna. You say reach Patna, left Patna and then you have got no news for next 7 days and then says 'Delivered'. It so you have no visibility in the last mile even though India is very well connected. People all have mobile phones still many of these locations where we need to go are very remote locations.

And as we told the quality is very important. Inspection confirmation of delivery happens, 100% is inspected and then once it is come from then the payments happen to the suppliers. These are some assembly and distribution centres are, so it is 1, 2, 3 blocks. 100% inspection of components happens. They actually make the lamps and sell it through schools to the end customers that are the school students, but of course school students are going to use it in their houses.

The people who had helped in setting up, running the assembly and distribution will now be empowered to set up repair centers, the solar lamp repair centers which provide free service under a warranty and during the warranty period. So, these represent a set up at the *Panchayat* level so the accessibility is more. You cannot go and repair the lamp at every school. But, and, again they cannot even come up to the block level or the district headquarters to repair the lamp so the repair centers are at the *Panchayat* level which has much more accessibility.

And all, what all components, bad components comes, it gets through the repair AD Center goes to suppliers for replacements.

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Additional training is provided for entrepreneurship development to all the people who are engaged in the repair and maintenance activities in the hope that at least some of them will succeed and become entrepreneurs. So, various process systems are ended up, setting up mainly in form of guidelines and training and manuals, then translated in the local language, then training videos etc. were set up. Then we established the processes, created flowcharts. Imagine we have to ensure that they have to assemble in the exact same way as they will do in an industrial setting.

We gave various record books did not show that indeed all the processes are followed and all the data is accurately recorded and there is a clear trace back and every lamp was coded so that given a lamp code you can actually trace it back to whom it was actually sold to and in fact we can even trace it to say, where it was made and which supplier actually made it up to that level we can actually trace it back all through the help of just simple record books.

Various softwares were also employed in the form of, so here we can get the information all back here and data entering is easy there but anyway get it here so we used scan utilities, we used apps, whatever technology was helpful for which our activity we used all sorts of things. Finally all coming together in our solar lamp SoULS website where you can get the latest information about the project.

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So, *Chetan* introduced a 1 million solar lamp project. After we completed, when we presented the report to the ministry, soon they sanctioned a much larger project for about 7.5 million lamps.

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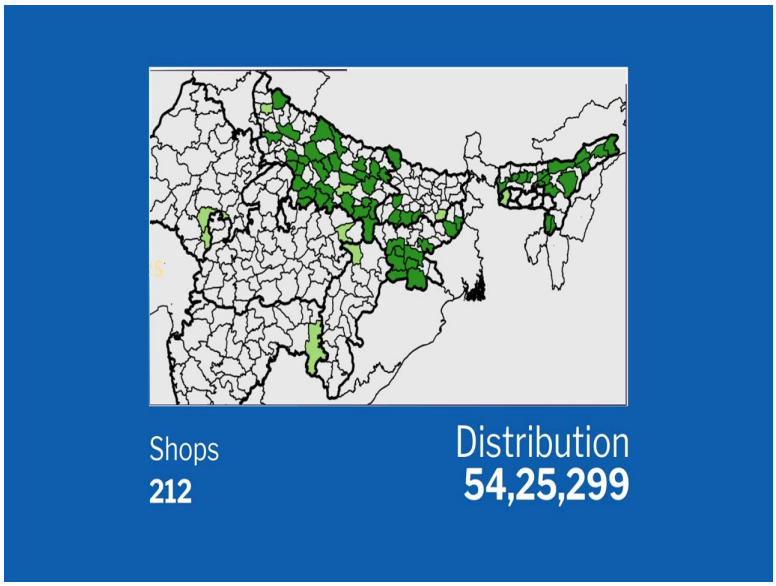

So, we are still involved in the central coordination of this pan India project, which is now the world's largest involving local communities. So, it is currently happening, right now the project in 9 States, 70 districts, 230 blocks. Nearly 7,500 people have been trained, 7,500 people trained and the current distribution stands at around 54 lakh lamps, and 212 people have actually moved from the R&M (repairs and maintenance) centers and set up their own shops where they are actually selling the solar products.

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Various interesting things happened when we gave the basic assembly and we just told them you know you have to assemble it. Everybody got the same training. But some of these centers actually thought for themselves and they told 'No, individually let us not make lamps, let us just form an assembly line. So let us, let us put two people doing only the first step, another two in the second step, another two in the third step and so on'.

So actually they created their own assembly line and then we took that best practices and shared it with others. So, the innovation doesn't stop just because we did not tell them. They are free to think and we gave them a sounding board to raise their ideas. So, we could get a lot of such interesting things coming out.

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Distribution was even more interesting because dialect changes every 50 kilometers. So we had projects in, the border between Gujarat, Madhya Pradesh and Rajasthan. There we teach in Hindi but finally the school kids learnt about the lamp on how to use the lamp in a, the language which is a mix of Gujarati as well as Rajasthani and some bits of Hindi also. So, it is extremely interesting how the same thing was actually conveyed last mile which is not possible if, even if, you know, we had trained really good people here and sent them there, the message would not have reached.

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Only because we included the local community, we were able to ensure that this happened. That happened just automatically because they are just used to that language they knew in their how to reach and they reached it.

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The repair and maintenance shops. As soon as they told that we can actually set up a center and then they could feel that they can earn some livelihood they took a lot of initiatives. They painted their phone number in various locations so people can actually call them and get the services.

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We are the central coordinators but various agencies has been involved. MNRE is the funding agency, to various field implementation partners, to vendors, to procurement partners.

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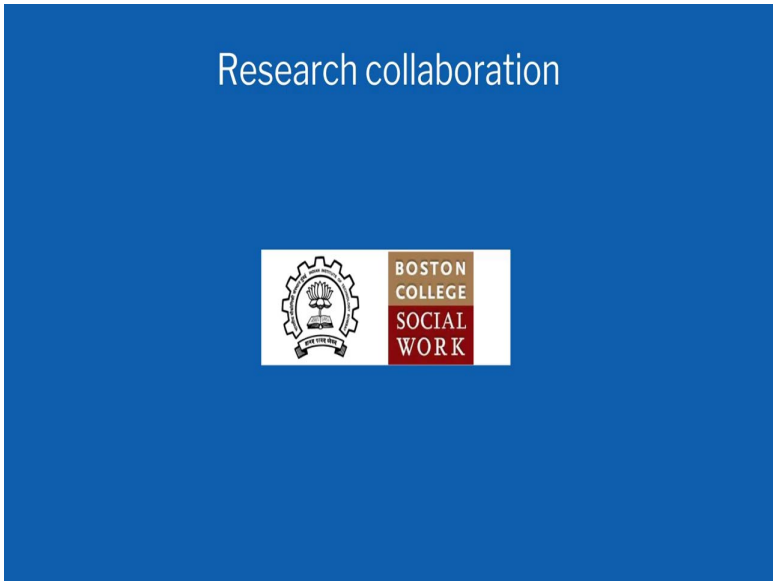

And for research here also collaborating with Boston College School of Social Work to understand the social impact of all these activities along with the Prof. *N.C. Nayarayanan* in CTARA (IIT, Bombay).

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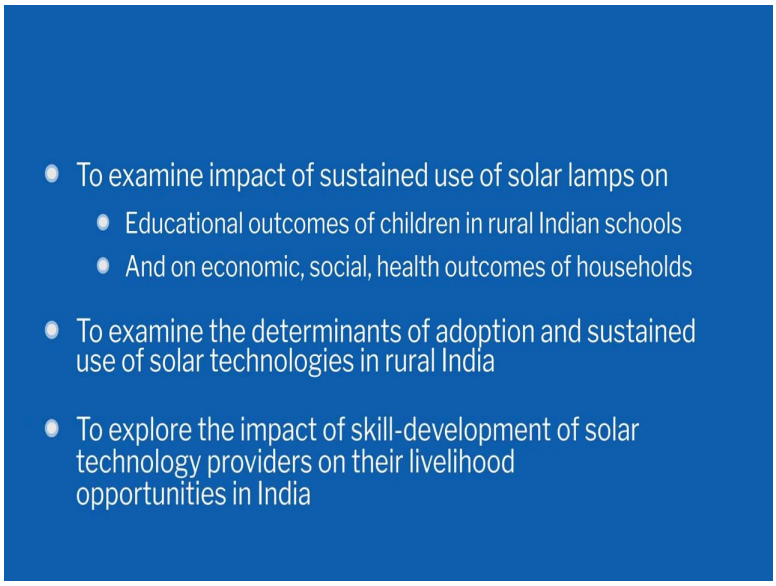

Where you are also trying to examine the impact of sustained use of lamps on the education outcomes of the children as well as the economic social health outcomes of the households and what determines the adoption of sustained use of technologies are broad questions. So, people whom we train, they are exploiting the impact of skill development on their livelihood opportunities in rural India.

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So, they are currently gathering this through both quantitative as well as qualitative approaches. That we are having surveys as well as focus group discussions and interviews. Okay, we have done the lamp distribution itself involving the local community where in research and evaluation just,

you know, questionnaires where they are very passive. Can we actually involve them in the research aspect also? So that is where the community-based research is coming in.

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We created the research process where we can involve the community. What we first do is we select people from the community, sat with them and actually discuss what is the actual problem that we want actually model.

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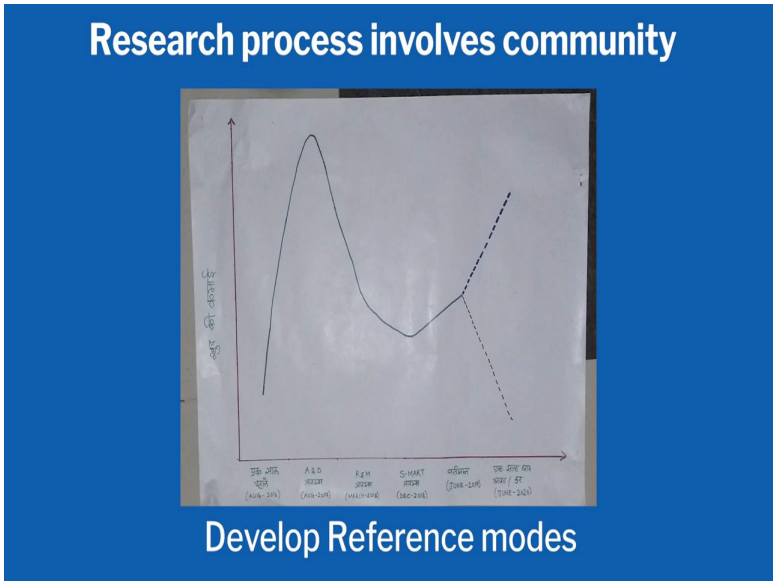

Worked with them. Identified what kind of issues or dynamics that is happening with the community. Identify key variables that they say will affect the problem.

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Work with them to actually build the model as what we call as a Causal Loop, that is a cause and effect mapping, the Causal Loop diagram or cause and effect model refinement and action plan was all discussed like what do you want to improve.

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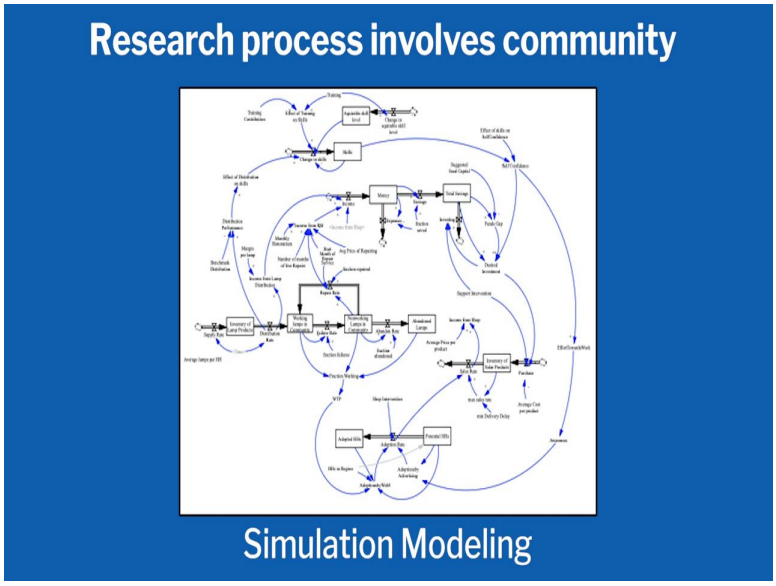

And actual working mathematical simulation models which accurately now represent the problem that they actually want to have. So we were able to bring in this aspect of localization into the research aspects also. Then why are we doing all these research and stuff, because research of course is essential so that we can actually transition to the next level where we have a lot of uncertainty. We want to provide energy access to the community by engaging with community institutions.

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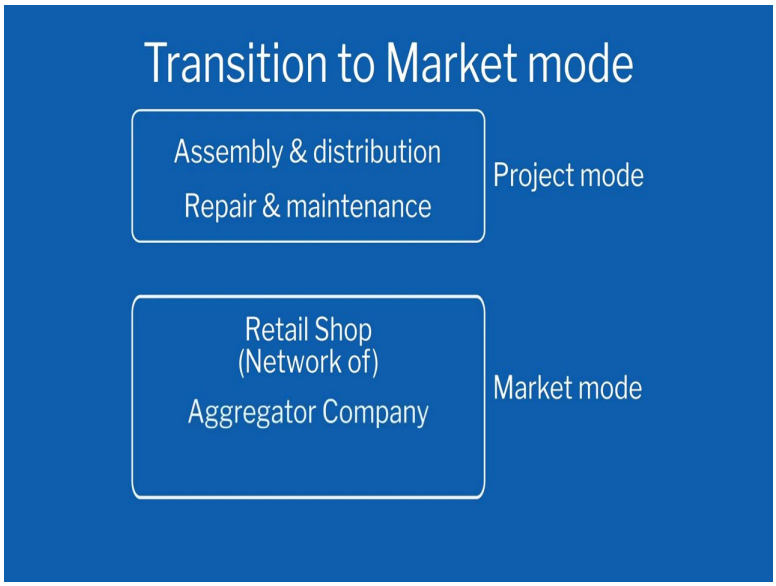

So, what do you mean by that till now we have been doing assembly, distribution, repair and maintenance which has been running in a Project mode. Large money was done, we could empanel vendors and then we could do it at a much larger and bulk scale. But now we want to transition to Market mode where the retail shops that we have set up or network of it, has to actually function as a retail shop and they should continue to earn their livelihood. At the same time the community must be able to get adequate energy access as per their needs.

So, this is just a network of retail shops or we need to transition to more aggregated companies who can now channelize, you know, so many 1000s of shops that can, 100s of shops that is going to be all over the country in every *Gram Panchayat*. How do we get there, get them together or can we actually even scale up to become a manufacturing company. To help answer all these things a core research component is necessary.

So that aspect again I think *Chetan* will be coming and talking to you about the last three aspects beyond the solar lamp, he is going to be talking about. To help with that transition we will have one more video.

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All right, getting an idea what are the various elements that are involved to implement a project which is going to millions of families. Right? Obvious question that has always been asked, you know, that 'Is the solar lamp is going to be enough?' You know. What is the solar limit? Ultimately it is a very tiny lamp which is not very powerful.

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But, you know, when you look at the sustainable development goals say, when it actually talks about the complete affordable, reliable, modern energy solution. So, we used to talk about rural electrification but in the current context of what is happening in terms of the climate change,

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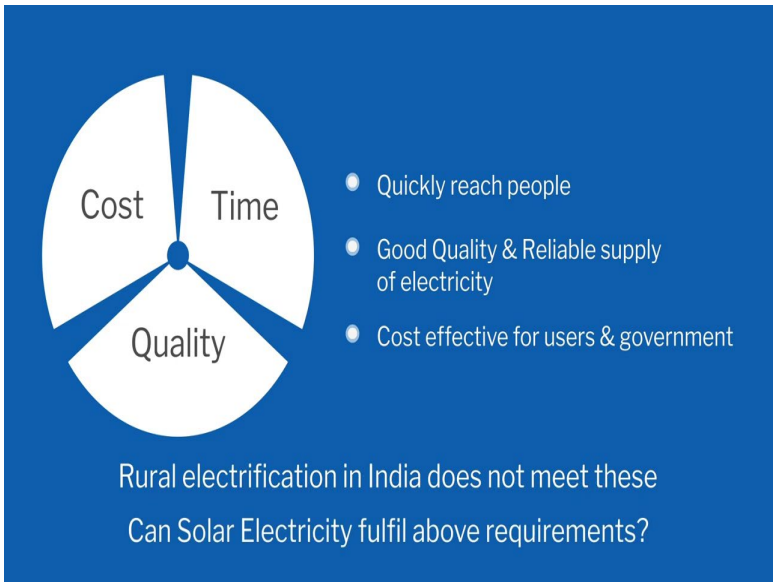

you know, you should talk about the complete overall electrification. So, we thought three things are required. You need to really quickly reach two people there's still 2.8 billion people who do not have access to clean cooking, something which is of good quality and it should also be affordable. So, these are the basic problems of every country in the world. We have been developing various kinds of solar products so as I said this technology is open-source hardware.

So this circuit actually can be utilized to power and make many other devices. For example, if you look at the flashlight that also has 1 watt of power, half watt of power. If you look at the various component home lighting systems, you know, that can also be in similar range so once we do this we can actually have many other products.

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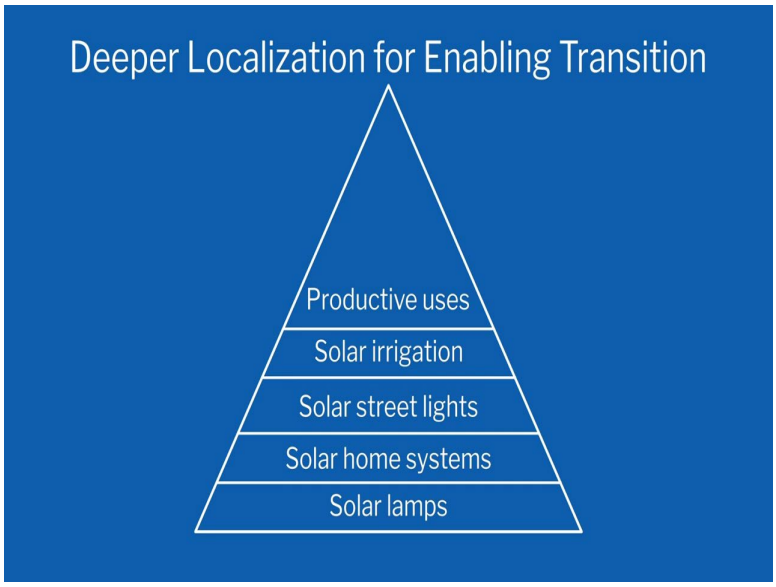

Only thing what you need to do is have a different body parts. You need to have a different battery, you need to have a different panel depending on the need. Then street light is a little bit higher power, you need 6 watt and 12 volt and 18 watt. So what we have done over a period of time we have, kind of, standardized various circuits which can actually take care of many products. So, we have released all of them. We designed it and released it in open source so that everybody can do that and we can do it further.

So, slowly building technology solutions, so that the knowledge of the technology or the availability of technology does not remain a bottleneck.

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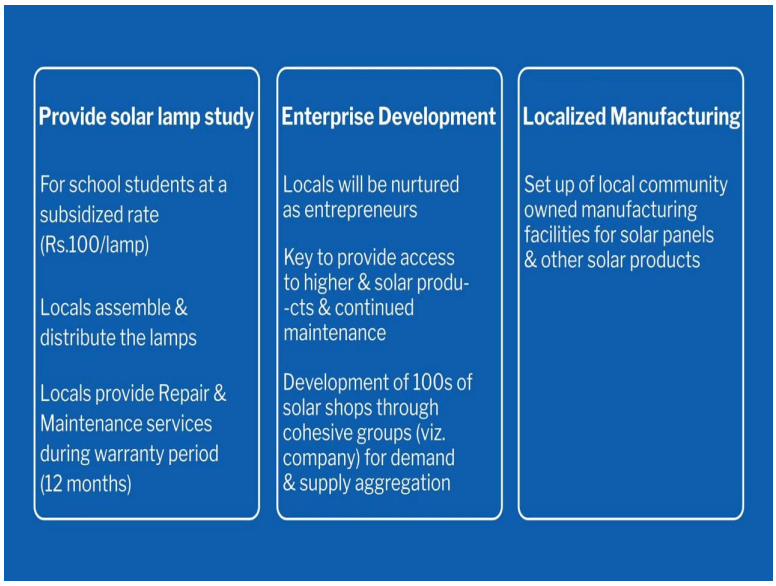

Whole idea was that if the solar shops are there and if they keep buying the material, you know, whether the panel and battery from outside and circuit from outside, the money from the local economy goes out of the economy. So, the idea was that why do not we locally manufacture it.

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For example, the sole panel making is a very simple technology. Only one complicated step that is involved is a kind of lamination. So, the solar panel making, using solar cell, is nothing but lamination. You must have seen the paper lamination right? Earlier we used to do, give your paper and get laminated as a plastic. Exactly the same thing.

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So, what we thought is why cannot we think of this as an ecosystem, you know, which is run by the local and is for the local, that if you are producing locally, the panels, if you are producing various components locally and this local products are actually useful for the problem solving for the local themselves and for their own need.

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Then what could be better than to create such an ecosystem. This year by the way we are celebrating the 150th birth anniversary of *Mahatma Gandhi* who always proposed that not the mass production but production by masses is required. You heard of this? Because mass production always results in a centralization. It always results in an accumulation of resources to one place.

And in fact that is exactly the problem if you look at the economic history of the world of last 150 years you will find that the world is becoming more and more unequal.

On the other hand if you do production by masses, then there will be a more equal distribution and therefore this solution that we have been building is exactly kind of production by masses and energy is really key. Especially now when the technology is improving and when the products are becoming very efficient.

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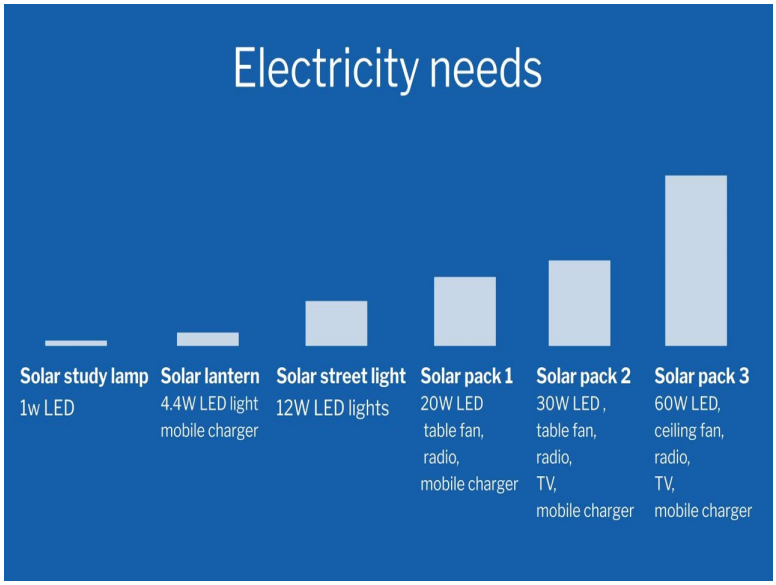

So for example if you have a house where there are lights and fans radio TV mobile charger all this thing in a house you can actually do all these devices if they are very efficient devices which are now available in just 16 units.

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So, what we have been also doing in our project is enable people to assemble this product and sell this product at the market mechanism.

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There are for example 200 shops that are running right now. All of them are on their own investment and they are selling products at the market rate.

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Not only that, we give them further training so they can do the entire electrification of the house. This is one of the projects that we did a small trial where we have asked people to surrender their electricity connection and go 100% on solar. So there are several houses that are of this nature. All, everything is done by the women.

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So, this is one of the unique factories established in Dungarpur, Rajasthan, which is owned by women and operated by them. And this is a 2 megawatt module manufacturing plant, so whatever module that I showed here, they make similar kinds of modules. And not only that they can make a 5 watt module, 10 watt module, 20 watt module, so whatever are the needs of the local area they can manufacture it and supply it.

So that is how empowering it can be. The CEO of this factory is *Rukmani Devi* and *Rukmani Devi* is only 8th passed. And couple of weeks ago when I, when I visited the *Dungarpur* and I was asking **(FL: 17:08) "***Rukmini Ji kaisa chal raha hai factory?*" (Translation: Rukmani ma'am, how is the factory working?). You know what she replied?

(FL Start Time: 17:10) " *Sir acha chal raha hai. Abhi* dollar *ke* rate *thode badh gaye hai toh hamara* raw material *ka 75* paise *bad gaya hai* per watt *ka, toh hamara* panel *itna 1 rupaya mehenga ho gaya*" (Translation: Sir the work is going fine. Now the dollar rate has increased a little so our raw material is costing us 75 paise more per watt, so our panel has become 1 rupee costlier.) **(FL End Time: 17:18)**

That is what the empowerment. So that is what this localization of this technology that it can bring. So, this is the example how *Dungarpur* in this particular place has really evolved from a very simple,

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so, this very woman started with the solar lamp program. They set up the repair centers then they started some solar shops and now they are actually running the model manufacturing factory.

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And this was such an involvement for everyone within the district also, that this project was also nominated and also won the Prime Minister's Innovation Awards by the district under this project. The next and the ultimate idea I think we are working on is what I call is Energy Suraj.

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Like *Gram Swaraj*, you heard of *Gram Swaraj*? What was the idea of *Gram Swaraj*? You know? Production by masses. That every community be self-sufficient in fulfilling their own needs, that is *Gram Swaraj*. Right? Can we not do the same thing with the energy now. And if you can do that it becomes Energy Swaraj.

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What is required: why do not we locally manufacturing, why we locally service and why we locally use, locally finance. Everything if you can do that. In a lot of institutions that we have been working in our project the State Rural Livelihood Mission actually have a very good established the local financing mechanism so, that is already there. IIT Bombay anyway working on the technological solution, making it open source, that is possible. And of course there are local consumers. So,

when we do this we can create a complete ecosystem. And this model by the way is not only valid for rural areas but it is also valid for urban areas.

Basically what I am trying to show you is it is indeed possible that we do that completely energy self-sufficiency locally.

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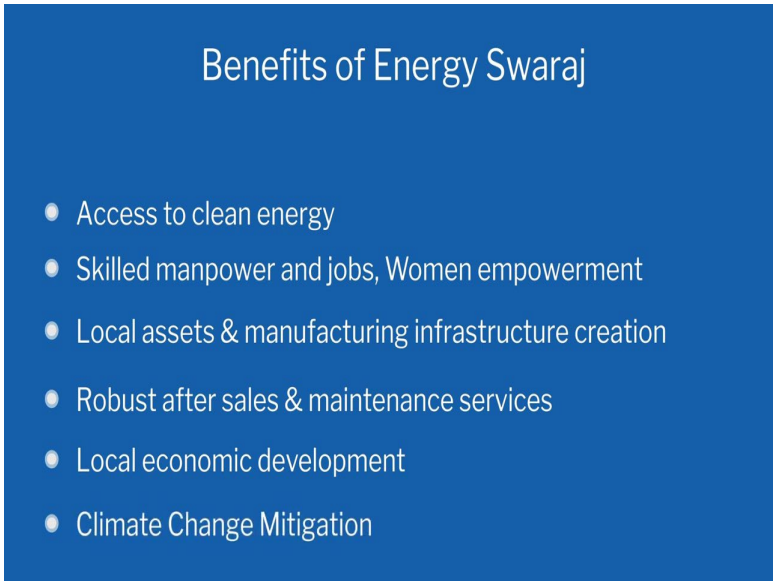

And if you can do that I believe that the advantages are really enormous and job creation is one of the major problems of any young growing country, so a lot of jobs can be created because by nature decentralization of anything requires more men, by nature. It will create a skilled manpower, you know, Skill India, then Make in India, local assets in the economy once the local manufacturing units are set up the economy becomes stronger.

The robust after sales and services and maintenance because people are local, the local economic development climate change mitigation, lot of benefits I can see happening from here. And not only that it will also result in a shift from the Program mode that we have been doing so far to the Market mode.

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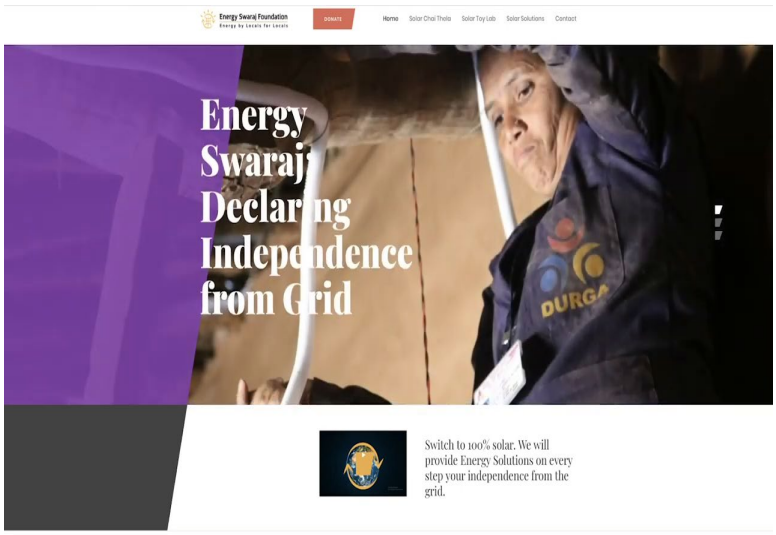

So, just to give a glimpse of it I have been, I have undertaken what is called Gandhi Global Solar Yatra to go around the world, talk to people and say, 'Look guys, climate change is a really, really serious threat'. It is very scary and solar energy solutions are actually viable today and without subsidies without grants we can do that. We have been showing how we can reach to millions and millions of families. So, if you go around and whether you go to South Asia, you go to Africa, you go to Latin America, everywhere you can find that such a model can do a great deal of benefit for the various economies.

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Some of the examples how the solar lamps is now reaching to millions and millions of people not only in India but outside also.

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So, what we have done is last year, we organized a student solar ambassador workshop where we have trained more than one lakh thirty two thousand students all over the country on a single day. It was a Guinness World Record. So this was in our Gymkhana ground here. So more than 5,700 students got together and they learned to make their own solar lamp. They all took a pledge of non-violence to the environment.

And it was a Guinness world record this year in 2019 this event is now taking place all over the world with more than 1 million students on a single day going to learn to make their own solar lamp. So, that is how, as I said, is starting with the solar lamp where we have done lot of innovation in various levels at the technology level, at the operations level, at the financing model and the more important is working with the community.

So, now we are kind of creating a base on or whatever learning and experience creating as an Energy Swaraj as a movement. I believe that the governments around the world cannot actually solve the problem of climate change, because the government's are elected for a short term 4 years or 5 years. The climate change or the sustainability requires thinking of 50 years and 500 years and it is only general public that has to become aware broadly and start taking and generating our own energy needs.

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And if we can do that we have formed a foundation called Energy Swaraj Foundation. We are going to start inviting people to surrender your electricity connection. So, if anybody is interested to surrender your connection you are most welcome, you can join it. At home we have stopped using the refrigerator, washing machine, microwave, AC, geyser, we do not use any of it. So, for me it is very easy to surrender.

So one of the basic principle or the formula of sustainability is what *Gandhi* ji told, you know, that 'There is enough in the world for everybody's need, but not anyone's greed'. You heard of this? And it is very clear that whatever modern lifestyle that we are living, it is impossible for the planet earth to sustain, impossible. You cannot do it for everyone. And therefore until unless you are just limited to your needs there is no way you can sustain.

And therefore even if it is energy, even if I have a magic wand and convert all the solar, all the energy needs of the world into solar, the climate change will still not stop. So, the first principle is to become a disciplined user, and once you become a disciplined user, it is very easy to surrender your connection and go 100% with the solar. So, with this on behalf of *Chandran* and would like to thank you again, and one of the things that the lamp has done is; we have found out from various anecdotes and also research that the number of deaths due to the snakebite has come down wherever our lamp is gone.

Because in the low mode it can run for overnight you know 12 to 15 hours. What people will do is they will switch on and sit and sleep and whenever they wake up they do not have to, you know, walk on the snakes, you know. So, they can figure out where to sit and avoid it, so that has been a, you know, surprisingly for us also has been a kind of contribution that this lamp has resulted in a reduction of the number of deaths, alright. Thank you.