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Report on Technology Transfer of Solar Charkha in Khadi Sector

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The Report: The present report deals with the field trial project funded by the KVIC "Technology Transfer of Solar Charkha in Khadi Sector". The basic concept of this technology is to operate the manual NM Charkha used in khadi sector through solar energy in a viable way.

I. Background

1.1 Bapu and the Spinning Revolution:

"I have no doubt in my mind that the wheel can serve as the instrument of earning one's livelihood and, at the same time, enable the worker to render useful service to his neighbor. In order to ply the wheel intelligently, he should know all the processes that precede and succeed spinning" (H,17-3-1946, p. 42).

"Revival of the cottage industry, and not cottage industries, will remove the growing poverty. When once we have revived the one industry, all the other industries will follow…. I would make the spinning-wheel the foundation on which to build a sound village life. I would make the wheel the centre round which all other activities will revolve" (YI, 21-5-1925, pp. 176, 177).

The above statements of Mahatma Gandhi reflect not only his confidence on the spinning-wheel as an effective tool for eradication of poverty and unemployment in the country but also his confidence that the success of this decentralized cottage industry will enable all the others to follow. He also indicates the need for revival of existing systems. The KVIC has kept alive the production of khadi on the principles of Gandhiji, where it is essential that the spinning on charkha and weaving on handloom has to be performed manually.

1.2 The position of manual spinning in the new millennium:

Though the manual spinning operation on charkha was most appropriate during the freedom struggle movement, the situation is different today. During Gandhiji's time there were not many alternative job avenues and therefore the manual spinning on charkha was readily accepted by the masses particularly in rural India. However, the situation has drastically changed in the case of spinning and weaving. Mainly ladies are involved in spinning. Because of hard labor and poor wages the attraction of manual spinning on charkha is decreasing day by day with the result of decrease in employment in khadi sector. (as see in the table below):

Year	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**
Production (Rs in crores)	624	636	552	432	444	457	460	464	468	491	543

The invention of MGIRI's solar charkha has opened up a new approach to reverse this trend. With a number of job opportunities including NREGA providing employment to the rural masses the manual spinning on charkha is not able to continue its role as a source of employment. Hence an effective intervention like solarisation of charkha because the need of the hour since otherwise many lakhs charkhas will have to be abandoned besides leaving the dependants on them in the lurch.

1.3 Solar energy operated charkha as an alternative

"A scientific study of the spinning-wheel will lead on to Sociology. The spinning-wheel will not become a power for the liberation of India in our hands unless we have made a deep study of the various sciences related to it. It will then not only make India free, but point the way to the whole world". (H, 31-3-1946, p. 59)

It is very clear from the above statements of Gandhiji that he never objected to the introduction of new technology in the khadi sector. Announcement of the prize of Rs 1 lakh way back in 1929 for the development of improved charkha is a unique example of the importance given by him for technological innovations and scientific studies. His main objection was that technology which should not replace the human being and technology should not become a source of exploitation of the poor by the rich.

It is possible to eliminate altogether the hardship/drudgery involved in the manual operation of charkha and also increase the wage earning capacity by increasing its productivity by operating the charkha by means solar energy. Since charkhas are being mainly operated in rural areas and since rural areas have no assured electric supply only the use of solar energy could be thought of. The use of solar energy can usher in a new era of khadi spinning. The principle of conversion of solar light into electric energy is well established and solar panels of various capacities are now readily available. Since the

NMC charkha is a small machine, it is feasible to operate the charkha using solar energy. A commercially viable solar system for the operation of 8 spindle NMC charkha is now developed at MGIRI. The technology is now well proven through nationwide field trials and technology demonstration workshops.

To revive the large numbers of charkhas going out of operation in villages solar energy could be easily harnessed. For the operation of MGIRI Solar charkha we need only 30 watts motor and 60wp solar photovoltaic panel. A specifically designed solar charkha kit attachment has also been developed to operate the existing 8-10 spindle charkha which is normally used for manual operation in practice.

Mr. Patel former Governor, Reserve bank of India quoted that - Gandhiji was against capitalism if the means of production was concentrated in a few hands. ''He wanted everyone to own his means of production — a concept much wider than the current notion of empowerment through education and the like. He was against socialism as it concentrated all means of production in the hands of the state, which led to the enslavement of everyone. If everyone could have access to machinery, he was for it. Where large-scale production was inescapable as in the case of steel, he was for public ownership,'' he says.

''Decentralisation of production may not be easy. But something needs to be done to prevent the relentless march to urban slums. With today's technology and with rural electrification and technical training, it should be possible to carry jobs where people live and not vice versa,'' says Patel.

1.4 The aim of solarisation project:

- To bring a revolution in the khadi sector particularly through enhanced wage earnings of the spinners.
- To eliminate the drudgery of the spinner.
- To effect of an increase in the number of spinner- particularly through the 'cotton-to-garment' clusters in the cotton growing regions like Vidarbha.
- To provide lighting, fan and radio operating system with the use of solar panel in rural areas that have been deprived of such opportunities for ages.

II. Earlier Research Background:

The First Solar Motor: The earliest known record of the direct conversion of solar radiation into mechanical power belongs to Auguste Mouchout, a mathematics instructor at the Lyce de Tours. Mouchout began his solar work in 1860 after expressing grave concerns about his country's dependence on coal.

The First Commercial Venture: Boston resident Aubrey Eneas began his solar motor experimentation in 1892, formed the first solar power company (The Solar Motor Co.) in 1900, and continued his work until 1905. One of his first efforts resulted in a reflector much like Ericsson's early parabolic trough.

Solar charkha: For the past few years several attempts in bringing out a solar charkha were made by various institutions and research organizations. Some institutions in Gujarat and other places tried to operate a 2-spindle charkha on solar but could only succeed to operate it with more power giving an impression that the cost of photovoltaic panel will be prohibitive. One such feasible model was established in Uttaranchal in the context of a silk reeling unit. The Ministry of New and Renewable Energy had taken the initiative to develop Solar Powered Motorized cum Pedal Operated Spinning Machine or Solar Charkha (originally it is a reeling machine). This was approved by Central Silk Board (CSTRI) to produce fine yarn from silk and wool waste.

Unlike the traditional Spinning Machine, this Solar Charkha (reeling machine) is equipped with an electric motor powered by Solar Energy and battery bank capable of running the machine 5-6 hours a day.

More than 250 such Solar Charkhas have been installed and are running successfully in various parts of Uttaranchal. The project was however not taken to commercial level and its lateral expansion in the broader field of textile was not thought of.

(Ref:http://daskumars.com/yahoo_site_admin/assets/docs/solar_charkha_features.227190953.pdf)

III. Design details of MGIRI Solar Charkha

3.1 Design objectives

In designing the MGIRI's solar charka the following objectives were kept in mind:

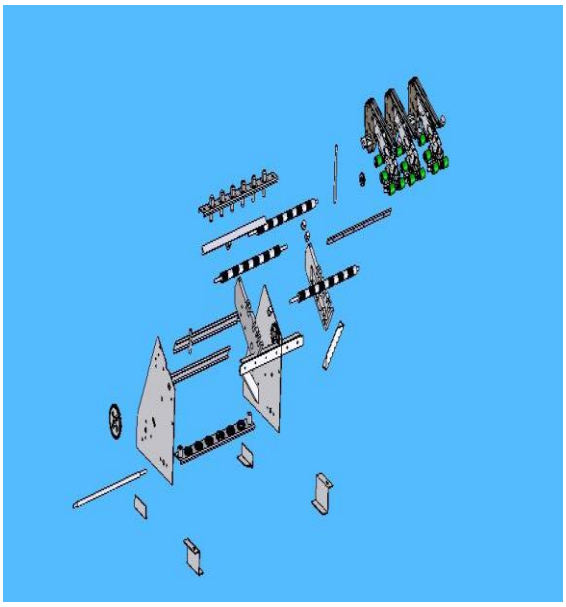
1. Cost effectiveness in providing the solar energy support to the charkha such that the investment for the system should be justifiable with the output.
2. Standardized technology for the operation of charkha on solar energy.

3. Assurance of significantly higher wages compared to manual spinning. For example Rs. 100 per charkha per 8 hr. and more wages by operating more charkha more spindle or over longer periods.
4. Enhancement of productivity
5. Improvement in yarn quality
6. Overall reduction in yarn price.

3.2 Details of solar powering of NM Charkha

Charkha:

These are 8-10 spindle manually operated New Model Charkha (NMC) presently used in khadi sector. A large number of such charkhas are available in hundred of khadi institutions –particularly the ones recognized as a part of the SFURTI program of KVIC.



A conventional yarn spinning device (charkha) operates by drawing a sliver from the feed roll and stretching it over one or more rollers. The rollers are usually set to operate at serially faster speeds.. The drawn sliver is then wound around a spool attached to a spindle. The spool revolves at a calibrated speed, facilitating further drawing of the sliver and twisting the same to form yarn.

The required power input in this device is at three places:

a) The operation of the rollers which draw the sliver,
b) The rotation of the spindle which twists and winds the sliver into usable yarn and
c) The CAM which bobs the spindle mounted bobbin up and down while winding the twisted yarn around it.

The power input is provided through the driver shaft. The driver shaft is connected by three independent gear tread systems to the roller shaft, the pulley system driving the spindles and the CAM. There can be one or more spindles, each with corresponding rollers operating in parallel in a given assembly. The power input required to operate the driver shaft is directly proportional to the number of spindles. In a hand operated charkha, the driver shaft is manually rotated by a handle attached to the driver shaft. The torque requirement on these conventional charkhas with 6 to 8 spindles is about 1.5 kg.

The manual charkha suffers two limitations, the manual operations limit the output possible from the machine since the torque requirement is about 1.5 kg for an assembly of 8-10 spindles and quality of the yarn obtained may be uneven due to reasons like human fatigue.

A motor was attached to one such hand spinning device (charkha) and it was found that the eight spindle charkha required not less than 50 watts. When the motor was connected to solar power source a panel of over 60-75 watts was required.

The power requirement for operating the charkha is brought down by attaching a specially designed D.C. motor. This leads to a lower wattage solar panel requirement and thereby to an lower affordable system cost.

The human fatigue could be certainly reduced by brining in the best possible bearing and other mechanism; but the torque needed for the functional requirements like drawing, twisting etc. cannot be done away with. Now when the increase of productivity is needed the functional torque requirements also Internationally accepted health convention do not permit the human being to be made to put in more than certain watts of power. Thus a vible means of motorization at some stage is necessary. In the mean time the effirt to reduce the torque need through best mechanical subsystem should also continue for obvious reason.

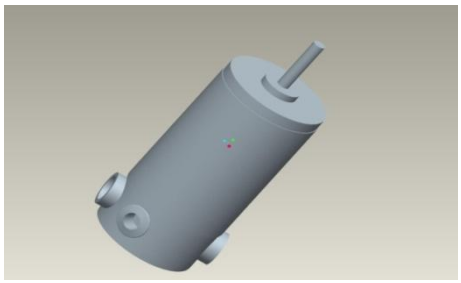
The present invention reduces the power requirement for a spinning device uniform supply of power from solar with a battery backup provided to the motor ensures the consistent quality of yarn.

The present invention maintains all the essential constructional features of the conventional charkha namely one or more feed roll pony from which a sliver is drawn and the series of rollers over which the sliver is stretched, such roller series operating at serially faster speeds. The drawn sliver is then wound around spindles spool attached correspondingly to one spindles. The spool revolves at a calibrated speed, facilitating drawing of the sliver and twisting the same to form yarn.
In the motorized version of this charkha, the torque requirement is further reduced by a motor connected to the pulley shaft instead of the driver shaft through a separate pulley system, with calibrated differences in diameter of the pulleys in this system, causing a negative gearing effect, thereby reducing the rpm with which the pulley shaft rotates. This increases the life of the yarn spinning device, as well as reduces the maintenance cost of the device. The reduced wattage motor can be powered by relatively inexpensive solar panels of 50 to 75 watts peak.
A motorized mechanism ensures an even power supply, which in turn ensures a better quality of yarn.

3.4 Solar kit to power the NM Charkha:
The solar kit to be fitted to the charkha comprises of two major subsystems. They are,

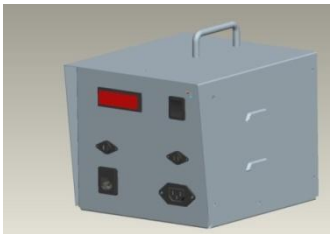
i. The motor

A specially designed 12 volt PMDC (permanent magnet direct current) motor and pulleys which can be directly mounted on the charkha. This motor requires about 30-35 watts of power to operate the charkha. The motor is fitted to the charkha's back channel with the help of two metal clamps. The driver pulley of the motor transmits power through a rubber belt to the driven pulley mounted on the spindle driving shaft. The ratio of the driver and the driven pulley is calibrated to get about 70-75 handle RPMs. The motor, pulley and clamps are designed for quick mounting on the existing charkha frame. The motor's main cord is fitted with the male part of the electrical socket at its end which fits into the female part of the socket of the control unit.



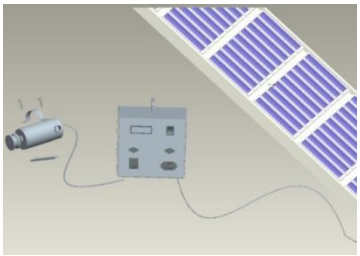
ii. The Control Unit

The control unit is a robust box made of steel with digital display, electrical sockets, switches and a handle. The charge controller and a battery is fitted in this properly ventilated box. A 12 volt 26 AH Exide battery is used in this system. The charge controller is specially designed to suit the ongoing process of operating the charkha as well as charging the battery. The charge controller has a current over charge, deep discharge and a cut-off protection circuit. The digital LCD display on the unit displays the solar in-voltage, battery voltage, charging status and load on/off status. The front panel also consists of a main switch for total on/off of the system, fuse, and sockets for various connections. The electrical sockets are for solar input, motor output and for additional accessories like lamps, fan, FM etc. The sockets are different for different connections such that one application socket does not fit in for other application, thus avoiding confusion.



iii. Solar panel:

The solar panel of 60/74 Wp are suitable for proper functioning of the system. The PV modules fitted to the system is from the reputed suppliers. The SPV panel are placed in the open and connected to the control unit through cables.



iv. Summary of specifications and other features

Specifications:
- 8-10 spindle NM charkha
- Solar PV module – 60 - 80 Wp
- Motor Drive - 12 V DC, 30 W
- Production capacity - 800 – 1000 gms /8hrs (40counts or more)
- Battery - 12 V, 26 Ah, SMF

Other features:
- Battery back-up available
- Fine quality yarn production
- Low yarn breakages
- Low fatigue
- Can also be operated manually
- User friendly system design

IV. Lab studies and Field trials

4.1 Objectives of Lab studies / Field trials

4.1.1 Lab trials

MGIRI has installed 18 solar charkhas in the institute and has been recording performance since May 2008. It has also been corroborating its results with the observations in other centres also in cities like Wardha, Indore, Surendranagar, Etah etc.
MGIRI's efforts were also to carry out test with a view to compare the yarns that come out of solar charkha with that of traditional NM Charkhas. It has also pursued a search for the best parameters achievable with the solar charkha.
The tables in 4.2 highlight some of the most important results.

4.1.2 Field trials on all India basis

a. Number of hours in a day that the solar charkha could be operated continuously.
b. Number of hanks prepared i.e productivity
c. Comparison of the operation of solar charkha with that of manual charkha
d. Standardizing the parameters for various stations in India.
e. Problems faced during the operation of solar charkha
f. Other observations.

4.2 Results of lab trials

The lab trials proved that

- yarn from a solar charkha are stronger compared to the manually operated charkha. In fact yarns of desired strength could be achieved by proper choice of the drive.
- yarn are more uniform compared to a manually operated. This is because of the incorporation of a battery which helps to give uniform power even in the variable climatic conditions.
- yarn are nearly free from knots. This is because of the absence of jolts and jerks in the charkha which are there when a human being cranks it throwing more or less a significant fraction of the body weight on it – thus resulting in fewer breakage of yarn, less down-time and greater productivity.

The following table indicates the test results carried out in MGIRI

Comparative report on Yarn produced by Solar Charkha Vs NMC Charkha

Aspect	Solar Charkha	NMC Charkha
Thin & Thick places/km	• Thin places /km= 254 • Thick places/km = 996	• Thin places /km=368 • Thick places/km=1156
Unevenness(%)	17.02	17.6
Breakages	Less	More
Strength of Yarn (CSP)	1830	1805

Also the results were confirmed by the tests conducted in The R.S.R Mohota Spg.& Wvg. Mills Ltd, Hinganghat, Maharashtra (See Annexure –II).

4.3 National level field trials

The KVIC funded a project for field trial of MGIRI's solar charkha in six SFURTI clusters across the country. The experiments were carried out during April-June 2010 and have proved that a spinner can earn more than Rs 100 in 8 hrs and more than Rs 150 in the case of silk reeling. If the battery is used to work during another 4 to 8 hrs the earning could be

increased by 50% to 100%. Further since one person can supervise 2 to 4 charkhas the earnings could be further multiplied depending on the investments in additional charkhas thus enabling the spinner to reach the expectations of the minimum wages act of the land.

- **Project: Technology Transfer of Solar Charkha In Khadi sector**
- **Principal Investigator: Deep Varma (PSO, E&I)**
- **Solar charkha installation in the following centers were completed in April itself:**

Sr. No.	Name of Cluster	Date of completion of Installation
1	Karakudi Khadi Cluster, Tamilnadu	**08-April-2010**
2	Khadi Cluster, Bassi, Rajasthan	**10-April-2010**
3	Raibareli Khadi Cluster, UP	**15-April-2010**
4	Surendranagar Khadi Cluster, Gujrat	**20-April-2010**
5	Berampur Jangipur Cotton Khadi Cluster, West Bengal	**23-April-2010**
6	Nagaland Khadi Cluster, Dimapur	**24-April-2010**

Solar Charkha at Karaikudi, TN

Solar Charkha at Bassi, Rajasthan and Raibarely U.P.

Solar charkha at Limbdi, Gujrat

Solar charkha at Murshidabad (W.B.)and Dimapur (Nagaland) Cluster

V. Data analysis

The stations conducting the field trial of MGIRI solar charkha were asked to collect data to finally fill up the following table:

Date	Solar Charkha Identification no.	Count of Yarn	Production (Hanks)	Total Time (Working hrs)

A feedback report on the performance of solar charkha was submitted to KVIC on June 2010 and it was found that there was huge variation in the outputs. The chief reason was that the set standards were not followed. (see annexure - I) In fact the charkhas that were employed where from many sources each are having different gear setting etc. thus creating large variations in torque requirement.

A rigorous retuning was carried out to minimize variations. Further a decision was taken by the KVIC (No.SFURTI/Solar Charkha/2011 dated 26th May 2010) to carry out a rigorous combined field trial monitoring of one week through a committee consisting of responsible officer from KVIC & MGIRI. Thus the daily data were recorded for further analysis.

The segment of the data from this controlled experiment is presented in tables – I, II, III, IV and V below.

The table related to Dimapur (Nagaland) is not presented here since the voluminous data in this station was free from problems right from the beginning. Further this station used the solar technology for the silk yarn spinning and since the rates of raw material and wages were incomparable to the case of cotton yarn spinning there is not presented below. However reports and data from Dimapur were sent to KVIC and as per the analysis and conclusion by the KVIC they had one of the best performances. It is reported that Dimapur attained the earning of Rs. 150/person per day whereas it was Rs 60-Rs70 per person per day before the introduction of solar charkha.

Table I Data recorded during the combined field trials
Solar Charkha Report of Paho Kahdi Cluster, Raibarely (U. P)

SN	Date and Solar Charkha		Hank (Count) Number	Production (Hank)	Total Time (Working hrs)
1	11/05/10	Solar Charkha- I	35	31	6:30 Hr.
		Solar Charkha – II	35	36	6:45 Hr.
		Solar Charkha- III	35	34	7:00 Hr.
		Solar Charkha IV	35	22	5:30 Hr.
2	12/05/10	Solar Charkha- I	35	39	7:00 Hr.
		Solar Charkha – II	35	41	8:00 Hr.
		Solar Charkha- III	35	47	8:00 Hr.

		Solar Charkha IV	35	43	8:00 Hr.
3	13/05/10	Solar Charkha- I	35	34	6:45Hr.
		Solar Charkha – II	35	37	7:35Hr.
		Solar Charkha- III	35	40	8:00Hr.
		Solar Charkha IV	35	36	7:15Hr.
4	14/05/10	Solar Charkha- I	35	34	7:00 Hr.
		Solar Charkha – II	35	34	7:00Hr.
		Solar Charkha- III	35	30	6:15Hr.
		Solar Charkha IV	35	32	6:30Hr.
5	16/05/10	Solar Charkha- I	35	41	8:00 Hr.
		Solar Charkha – II	35	35	6:40Hr.
		Solar Charkha- III	35	32	6:15Hr.
		Solar Charkha IV	35	33	6:25Hr.
6	17/05/10	Solar Charkha- I	35	33	7:00 Hr.
		Solar Charkha – II	35	33	6:35Hr.
		Solar Charkha- III	35	35	6:25Hr.
		Solar Charkha IV	35	34	6:35Hr.

*** Low quality Rowing

Table – II Solar Charkha Report of Limbdi Kahdi Cluster, Rajkot (Raj) I

Sr. No.	Date and Solar Charkha		Hank (Count) Number	Production (Hank)	Total Time (Working hrs)
1	10/06/10	Solar Charkha- I	40	27	5:45Hr.
		Solar Charkha – II	40	30	6:15Hr.
		Solar Charkha- III	40	17	4:15Hr.
		Solar Charkha IV	40	13	3:30Hr.
2	11/06/10	Solar Charkha- I	40	11	4:15Hr.
		Solar Charkha – II	40	22	4:45Hr
		Solar Charkha- III	40	18	4:15Hr.
		Solar Charkha IV	40	17	4:15Hr.
3	12/06/10	Solar Charkha- I	40	30	5:45Hr.
		Solar Charkha – II	40	28	6:15Hr.
		Solar Charkha- III	40	16	3:45Hr.
		Solar Charkha IV	40	18	5:00Hr.
4	14/05/10	Solar Charkha- I	40	17	5:00Hr.
		Solar Charkha – II	40	35	6:00Hr.
		Solar Charkha- III	40	22	6:30Hr.
		Solar Charkha IV	40	22	6:45Hr.
5	15/05/10	Solar Charkha- I, I, III, IV	No Production due to Rain		
6	16/06/10	Solar Charkha- I	40	13	3:00Hr.
		Solar Charkha – II	40	28	5:00Hr.
		Solar Charkha- III	40	21	5:00Hr.
		Solar Charkha IV	40	18	5:00Hr.
7	17/06/10	Solar Charkha- I, iI, III, IV	Hon. Minister Programme at Surendranagar (Raj.)		
8	18/06/10	Solar Charkha- I	40	30	6:30Hr.
		Solar Charkha – II	40	35	6:30Hr.
		Solar Charkha- III	40	30	6:30Hr.
		Solar Charkha IV	40	22	4:30Hr.
9	19/06/10	Solar Charkha- I	40	32	6:30Hr.
		Solar Charkha – II	40	34	6:30Hr.
		Solar Charkha- III	40	30	6:30Hr.
		Solar Charkha IV	40	22	4:30Hr.

*** Solar Charkha No. 3 and 4 are very poor in quality

Table – III Solar Charkha Report of Beharmpur Khadi Cluster, Murshidabad (WB)

Sr. No.	Date and Solar Charkha		Hank (Count) Number	Production (Hank)	Total Time (Working hrs)
1	21/06/10	Solar Charkha- I	70	30	6:30 Hr.

		Solar Charkha - II	70	30	6:35 Hr.
		Solar Charkha- III	70	33	7:30 Hr.
		Solar Charkha IV	70	34	7:30 Hr.
2	22/06/10	Solar Charkha- I	70	30	6:30 Hr.
		Solar Charkha - II	70	31	6:45 Hr.
		Solar Charkha- III	70	32	7:00 Hr.
		Solar Charkha IV	70	30	6:30 Hr.
3	23/06/10	Solar Charkha- I	70	26	6:00Hr.
		Solar Charkha - II	70	30	7:00Hr.
		Solar Charkha- III	70	30	7:00Hr.
		Solar Charkha IV	70	30	7:00Hr.
4	24/06/10	Solar Charkha- I	70	18	4:30 Hr.
		Solar Charkha - II	70	27	6:00Hr.
		Solar Charkha- III	70	30	6:30Hr.
		Solar Charkha IV	70	34	7:30Hr.
5	25/06/10	Solar Charkha- I	70	31	7:00 Hr.
		Solar Charkha - II	70	31	7:00Hr.
		Solar Charkha- III	70	29	7:00Hr.
		Solar Charkha IV	70	30	7:00Hr.
6	26/06/10	Solar Charkha- I	70	17*	4:00 Hr.
		Solar Charkha - II	70	07*	2:00Hr.
		Solar Charkha- III	70	07*	2:00Hr.
		Solar Charkha IV	70	18*	4:00Hr.

** Production less due to low working hours out of climatic conditions

Table – IV Solar Charkha Report of Karaikudi Khadi Cluster, Kandanur (TN)

SN	Date and Solar Charkha		Hank (Count) Number	Production (Hank)	Total Time (Working hrs)
1**	22/06/10	Solar Charkha- I	30	30	6:00 Hr.
		Solar Charkha - II	30	30	6:00 Hr.
		Solar Charkha- III	30	20	6:00 Hr.
		Solar Charkha IV	30	30	6:00 Hr.
		Solar Charkha - V	30	14	4:00Hr.
2**	23/06/10	Solar Charkha- I	30	26	4:50 Hr.
		Solar Charkha - II	30	30	4:50 Hr.
		Solar Charkha- III	30	25	5:00 Hr.
		Solar Charkha IV	30	30	4:50 Hr.
		Solar Charkha - V	30	Nil	Nil
3**	24/06/10	Solar Charkha- I	30	10	1:50Hr.
		Solar Charkha - II	30	35	5:45Hr.
		Solar Charkha- III	30	20	4:50Hr.
		Solar Charkha IV	30	35	6:00Hr.
		Solar Charkha - V	30	25	4:15Hr
4**	24/06/10	Solar Charkha- I	30	18	4:30 Hr.
		Solar Charkha - II	30	27	6:00Hr.
		Solar Charkha- III	30	30	6:30Hr.
		Solar Charkha IV	30	34	7:30Hr.
		Solar Charkha -V	30	25	4:15Hr
5	25/06/10	Solar Charkha- I	30	35	6:15 Hr
		Solar Charkha - II	30	35	5:45Hr.
		Solar Charkha- III	30	30	5:45Hr.
		Solar Charkha IV	30	39	6:30Hr.
		Solar Charkha -V	**30**	**39**	**6:20Hr**
6	26/06/10	Solar Charkha- I	30	31	5:45 Hr.
		Solar Charkha - II	30	30	5:20Hr.
		Solar Charkha- III	30	30	5:35Hr.
		Solar Charkha IV	30	35	5:25Hr.
		Solar Charkha -V	30	30	5:20Hr.

** Due to Cloudy weather & lesser working hours production is low

Table – V Solar Charkha Report of Bassi, Rajasthan

SN	Date and Solar Charkha		Hank (Count) Number	Production (Hank)	Total Time (Working hrs)
1	08/06/10	Solar Charkha- I	40	27	5:00 Hr.
		Solar Charkha - II	40	20	5:00 Hr.
		Solar Charkha- III	40	23	5:00 Hr.
		Solar Charkha IV	40	31	7:00 Hr.
2	09/06/10	Solar Charkha- I	40	35	7.00 Hr.
		Solar Charkha - II	40	32	7.00 Hr.
		Solar Charkha- III	40	36	7.00 Hr.
		Solar Charkha IV	40	36	7.00 Hr.
3	10/06/10	Solar Charkha- I	40	35	7.00 Hr.
		Solar Charkha - II	40	33	7.00 Hr.
		Solar Charkha- III	40	32	7.00 Hr.
		Solar Charkha IV	40	35	7.00 Hr.
4	11/06/10	Solar Charkha- I	40	35	7.00 Hr.
		Solar Charkha - II	40	35	7:00Hr.
		Solar Charkha- III	40	38	8.00Hr.
		Solar Charkha IV	40	43	8.00Hr.
5	12/06/10	Solar Charkha- I	40	35	7.00 Hr.
		Solar Charkha - II	40	36	7.00 Hr.
		Solar Charkha- III	40	31	7.00 Hr.
		Solar Charkha IV	40	36	7.00 Hr.
6	14/06/10	Solar Charkha- I	40	40	7.00 Hr.
		Solar Charkha - II	40	36	7.00 Hr.
		Solar Charkha- III	40	42	7.00 Hr.
		Solar Charkha IV	40	28	5.30 Hr.

VI. Conclusions

Interim results of field trials:

Hanks produced / 8 hrs on MGIRI's solar charkha as per reports from SFURTI clusters

Khadi cluster	Count	Ave production of hanks		Hanks / 8hrs	Wages / day in Rs
		per day	of hrs		
Paho, Raibereli (UP)	35	35	6.84	41	107
Limbidi, Rajkot (GJ)	40	23	5.01	37	103
Behrampur, Murshidabad (WB)	70	27	6.00	36	107
Kandanur,Karaikudi (TN)	30	28	5.07	44	132
Banskho, Bassi (RJ)	40	35	6.60	42	124
Dimapur, Nagaland (Muga Silk)	45	21	6.00	28	153

A review of the interim results took place in KVIC, Mumbai on 8-9 July 2010 in which Commission members, relevant khadi institutions, manufacturers of khadi implements and representatives from MGIRI participated. It is clear from the above results that the spinner can earn more than 100 Rs./day per solar charkha.

The KVIC, during this two day convention confirmed the interest of KVIC institutions, manufacturers and Khadi Mission members in the solar charkha project.

The Chairperson of KVIC also announced to the press that the field trials have proved that **MGIRI solar charkha is technically and economically viable** for the spinner and weavers.

KVIC institutions, Commission members, manufactures, respectively, in the Mumbai meet on 8-9 July 2010.

Warm reception from the artisans, Khadi institutions, Khadi Mission and state governments:

There was exceptionally high response from the artisans and khadi enthusiasts in a dozen national level exhibitions and *karigar sammelans.*

President of India watches the Solar Charkha at Amravati during a visit on 7-1-2010. Mr Deep Varma (Designer of Solar Charkha) is explaining the system.

Solar Charkha in Khadi Utsav-2010 at Allahabad attracted large crowds.

The reaction from khadi mission is clear from the encouragement/ guidance they gave when the solar charkha was demonstrated in their annual meeting at Wardha on 17- 07- 2008. Further, the Khadi Mission in their March 2010 meeting at Wardha took a historic decision that the yarn from the solar charkha should be linked to the handlooms so that the later could be liberated from the government system of 'hank yarn obligation' which places the weavers at the mercy of spinning mills.
It didn't take much time for the state governments to understand that the above development has enormous implications to energy management, rural development, social welfare, textile and many other contexts and that spinning could emerge as a decentralized 'home industry' following the case of weaving. The fact that the Chief Minister of Karnataka chose solar charka as a major symbol on the occasion of October 2, 2009 is an indication of the above. Similarly the interest of the Tamilnadu Government to work out a solar alternative to the energy starved spinning mills is an interesting example.

Chief Minister of Karnataka Shri B S Yadyurappaji inaugurated the Solar Charkha at Gandhi Bhavan, Bangalore on the auspicious occasion of 2nd Oct 2009, Gandhi Jayanti.

A note about the working of MGIRI solar charkha in all parts of India during all the seasons:

A question may be raised that although the solar charkhas were found to perform uniformly well in all the six stations spread across the country only because the trial was conducted during April-June which are summer months; and that the performance could vastly differ had the trial been conducted during the winter.

The above observation/criticism is well founded; and its implication to the solar technology project could also be easily explained if one takes a systemic point of view. In fact the solar energy is an input and in the cases where relation between input and output are linear the experiments need not be conducted for all the ranges of input.

In fact the solar insolation (average energy received from sun's rays during a particular day) for various locations of India have been measured and documented by the scientists and the relevant charts are available in the website of MNRE for every month. A perusal of this chart indicate that indeed there are two zones of India – namely Kashmir and a pocket of North-east where the insolation drops by almost 40% during a few months of the year. From this data a systems approach helps us to conclude that the solar charkha could be used to get the same output in these zones even during low insolation period provided we are willing to invest a proportionately higher area of photo voltaic panel. There will be a few other issues like the effect of cloud, snow fall etc. But these questions will also encountered in other areas as well. Certainly a few days in a year are lost in every economic activity due to exigencies like flood, cyclone etc.

Annexure -I

Report on the documentation and field problems rectification

In the recently completed Solar Charkha installations at various Khadi institutions SFURTI clusters, variation in the yarn production of the Solar Charkha's was noted in the feedback report. Every institute is given a feedback report format to be filled on daily basis. For the purpose of documentation and to indentify the problem of the variation in the yarn production, an urgent visit to every cluster was planned. It was decided to complete the visit program within a week's time. Persons visiting at these places were,

- Deep Varma (PI) and Sachin Raut (SSO, E&I) to Paho, Raibarelly U.P; Bassi, Rajasthan; Murshidabad, West Bengal, Dimapur, Ngaland.
- Dr. T. Karunakaran (Director, MGIRI) to Limbdi, Gujrat.
- Mr. Ravikumar Kandasamy (Deputy Director, E&I) to Karaikudi Tamilnadu.

1) Raibarelly (Paho) U.P.

Deep Varma (PI) and Sachin Raut (SSO, E&I)

Highlights:

Starting time: 9:30AM
Lunch time: 1:00 to 1:30 PM
Stop time: 5 PM
Effective average working period: @ 7 hours
Hank number: 35-40 count
Maximum production achieved in a day: 44 hanks

Reported problems:

- Large variation in yarn production, like in one Solar Charkha with a maximum production of 44 hanks/day and the other with a minimum production of 20 hanks/day.
- Some Solar Charkha production was declining day by day.
- One Solar Charkha stops in the evening.

Problems Identified:

- The Solar Charkha with minimum production had a very high pressure of Top Arms.
- The Motor was jammed with the roving and yarn tightly wound in between the shaft pulley and the bearing.
- Shafts, Bushes etc. were blocked by threads and filaments.
- Gearing was not proper.
- Some new Charkhas had alignment problems.
- The Solar PV panels are placed on the terrace of the CFC and the boundary wall and pillars are of more than 6 feet high, hence sun light falling on the SPV was restricted during morning and evening time. A design of fabrication structure for the mounting of SPV panel was given to them during the installation phase and was suggested to implement as early as possible.
- The Solar Charkha was consuming more than double the wattage and running at half the speeds because of the above stated problems. Hence, the production of some Solar Charkha was deteriorating day by day.
- One SPV panel was getting in early shadow of the pillar and the Solar Control Unit attached to it, was used for other purposes also, hence the unit was stopping during evening time.
- The spinners keep their own Charkha very neat and clean but not the Solar Charkha, as they think that they are not responsible for these Charkha's. One single Master has to take care of the all Charkhas in that area.

Action Taken:

- Overhauling of the Solar Charkha was fully conducted including cleaning, oiling of parts, optimizing top arm pressures etc.
- Proper gearing set fitting and proper alignment of the Solar Charkha was done.
- SPV panel stand of 7 feet height was fabricated. The panels were mounted on the stand and then fitted on the terrace.
- All the above stated problems where conveyed to the people concerned there and were instructed to take actions accordingly.

Result:

- The production came back to normal as it was at the initial stage (ie. 35 – 40 hanks/day/Solar Charkha).
- People understood the importance of the project and agreed to take due care of the system.

2) Bassi (Banskho) Rajasthan:

Deep Varma (PI) and Sachin Raut (SSO, E&I)

Highlights:
Starting time: 9:30 AM
Lunch time: 12:00 to 1:00 PM
Stop time: 5 PM
Effective average working period: 7 hours
Hank number: 35-40 count
Solar Charkhas are in good condition and proper care is taken.

Reported problems:
- Some Solar Charkha speed was declining in the evening time in between days.
- The Solar Charkha production is consistent but a little less as compared to other clusters.

Problems Identified:
- The Solar PV panels are placed on the tin roof of the CFC and the cluster is located at a foot hill. The hill is on the western side adjacent to this cluster hence, the sun light falling on the SPV is restricted during evening time.
- Two motors were consuming a little more wattage.
- Gearing of the Charkha are not as required.

Action Taken:
- Rearrangement of working time schedule is suggested such that the lunch time can be illuminated and the spinners can stop work one hour early in the evening.
- Motors were changed as a precautionary measure.

Result:
- The production has enhanced and expected to be much better after altering the gearing ratio.

3) Mushidabad, West Bengal:
Deep Varma (PI) and Sachin Raut (SSO, E&I)

Highlights:
Starting time: 9:30AM
Lunch time: 12:00 to 1:00 PM
Stop time: 5:00 PM
Effective average working period: less than 7 hours
Hank number: 70 count

Reported problems:
- Variation in yarn production, like in one Solar Charkha with a maximum production of 31-32 hanks/day and the other with a minimum production of 20 hanks/day.

Problems Identified:
- Gearing set in this Charkha is different from that used in lower count hanks.
- The Charkha with high production of hanks was having altogether a different gearing set as compared to Charkha's with lower hank production.
- Know-how about these Charkhas was lacking.
- The Solar PV panels were placed on the terrace of the CFC. But the panels were placed in the fabricated guarding wires, this obstructs the sunlight falling on the panels.

Action Taken:
- Gearing ratios were corrected with reference to higher producing Charkha.
- They are told to remove the SPV panels from the fabricated frame and to place them over this frame.
- All the above stated problems where conveyed to the people concerned.

Result:
- The average hank production of each Solar Charkha is now similar (ie. 31 – 33 hanks/day/Solar Charkha).

4) Rajkot (Limbdi), Gujrat:
Dr. T. Karunakaran (Director MGIRI)

Highlights:
Starting time: 9:00 AM
Lunch time: 12:00 to 2:00 PM
Stop time: 5 PM
Effective average working period: less than 6 hours

Hank number: 35-40 count

Reported problems:
- The daily Solar Charkha production is consistent but lesser as compared to other clusters.

Problems Identified:
- Working time is lesser.
- Gearing of the Charkha are not as required.
- Spinners operating more than one Solar Charkha and are inexperienced.

Action Taken:
- Rearrangement of working time schedule is suggested such that the lunch time can be reduced which also is the peak period of Sunlight.
- Gearing ratio change and induction of compatible spinners is suggested.

Result:
- The hank production has enhanced after the gearing change.
- The other results are still awaited.

5) Karaikudi, Tamilnadu:
Ravikumar Kandasamy (Deputy Director E&I, MGIRI)

Highlights:
Starting time: 9:00 AM
Lunch time: 12:00 to 1:00 PM
Stop time: 5 PM
Effective average working period: less than 7 hours
Hank number: 35-40 count

Reported problems:
- The daily Solar Charkha production is consistent but lesser as compared to other clusters.
- One Solar Charkha is not working from soon after installation.

Problems Identified:
- Gearing of the Charkha are not as required.
- The fuse was blown out in one unit.
- Technical staff is not available on regular basis.
- The Charkas maintenance is poor.

Action Taken:
- The stopped control unit is changed.
- Gearing ratio change and proper maintenance of the system was suggested.

Result:
- The hank production has enhanced after the gearing change.
- The other results are still awaited.

6) Dimapur, Ngaland:

Highlights:
Starting time: 9:00 AM
Lunch time: 12:00 to 1:00 PM
Stop time: 5 PM
Effective average working period: less than 7 hours
Mooga Silk production unit
Production of silk from Solar Charkha is 500 – 600 grams/day that is almost double than hand spinning

Reported problems:
The daily Solar Charkha production is consistent and not much problem is reported.

ANNEXURE II

The Rai Saheb Rekhchand Mohota Spg. & Wvg. Mills Ltd.
Corporate Office : Post Box. No. 1, Hinganghat, Dist. Wardha, Maharashtra - 442 301
Ph. : 07153-244282, 244545 Fax : 244753 Gram - MOHTAMILL E-mail info@rsmm.com

ISO 9001 - 2008 CERTIFIED QUALITY SYSTEM

QUALITY CERTIFICATE

Sample Result of 20s K (100%) Cotton

Solar Charkha Yarn & Yarn from manual operation

Supplier : M/S Mahatma Gandhi Institute for Rural Industrialisation Wardha

Date of Receipt : 31.08.2010

Standards Dept. Date of Testing : 31.08.2010

Sr.No.	Properties	Results			
	Product	20s K			
	Blend %	100% Cotton			
	Count & Test Parameter	**Solar Charkha Yarn**		**Yarn from Manual Operation**	
	Teeth (Gear)	**20 Teeth**	**18 Teeth**	**20 Teeth**	**18 Teeth**
1	Avg. Count	20.67s	20.39s	20.78s	20.66s
2	Avg. Test in Lbs.	106.64	113.73	110.28	106.66
3	C.S.P.	2204	2319	2292	2204
	Uster & Imperfection Value				
6	Yarn U %	16.11	17.78	16.3	17.97
7	Thin Places / Km	328	799	406	825
8	Thick Places / Km	770	872	675	934
9	Neps / Km	964	1099	921	1290
10	Total / Km	2062	2770	2002	3049
	Twist Results				
11	T.P.I.	18.22	21.03	17.41	18.68
12	ASTM Grade	C	D	C	C

Manager Q C G.M.(Tech.) C.E.O.