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ROADMAP FOR GREENING AND STRENGTHENING HORTICULTURE IN MEGHALAYA THROUGH DRE INTEGRATION

FOCUS ON PINEAPPLE

February 2024

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Authors

Svati Bhogle, Tauseef Ahmed, Akanksha Chaurey and Rekha Krishnan - WEFT Research LLP
Vishal Toro - CLEAN

Knowledge Partner

WEFT Research LLP | www.weft.co.in

State Partner

Meghalaya State Rural Livelihoods Society (MSRLS) | https://msrls.nic.in/

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CLF	Cluster Level Federation
DRE	Decentralized Renewable Energy
FPO	Farmer Producer Organisation
FSSAI	Food Safety and Standards Authority of India
HMNEH	Horticulture Mission for North-Eastern Region and Himalayan States
LPG	Liquified Petroleum Gas
MBDA	Meghalaya Basin Development Authority
MNREDA	Meghalaya New and Renewable Energy Development Agency
MSRLS	Meghalaya State Rural Livelihoods Society
MT	Metric Tonne(s)
NABARD	National Bank for Agriculture and Rural Development
NAFED	National Agricultural Cooperative Marketing Federation of India
NECTAR	North-East Centre for Technology Application & Reach
NRLM	National Rural Livelihood Mission
ODOP	One District One Product
PM-FME	PM Formalization of Micro Food Processing Enterprises
PMKSY	Pradhan Mantri Kisan Sampada Yojana
PRIME	Promotion and Incubation of Market-driven Enterprises
RE	Renewable Energy
SFAC	Small Farmers Agribusiness Consortium
SHG	Self Help Group
TRIFED	Tribal Co-Operative Marketing Development Federation of India
USD	US Dollars
VDVK	Van Dhan Vikas Kendra
VO	Village Organization

Message from Hon. Minister, Power Department, Government of Meghalaya

A.T. MONDAL
MINISTER
Power, Taxation,
Community & Rural Development,
Meghalaya, Shillong.

सत्यमेव जयते

RILANG BUILDING
Main Secretariat, Room No. 307
Phone: (Off) 0364 2224283
PABX - 2201
Mobile No. 9612001812
email::er.atmondal@gmail.com

MESSAGE

My congratulations to Clean Energy Access Network (CLEAN) for coming out with a timely report 'Roadmap for Greening and Strengthening Horticulture in Meghalaya Through DRE Integration'

Meghalaya due to its unique topography and climatic conditions, is ideally suited for various types of horticulture crops including fruits, vegetables, and spices. The state is already making its mark in the production of crops like pineapple and turmeric. Decentralised Renewable Energy (DRE) based interventions possess immense potential in addressing the challenges in processing of horticulture produce. Access to DRE based processing technology at or near farm level would enable value addition, reduce post-harvest loss, and enhance rural incomes. DRE integration also opens the possibility for innovative financing including carbon finance.

DRE powered applications in pineapple, turmeric, and banana processing, as demonstrated in this roadmap document, opens new avenues for the producers. Especially, the implementation models suggested for value addition with integration of DRE, will help in boosting farmers' incomes through value addition while avoiding wastage.

Through detailed recommendations the report has shown a pathway to creating a sustainable horticulture-based livelihood for farming communities of Meghalaya. I wish all success to CLEAN and its partners for turning this roadmap from recommendation into reality with the backing of the State Government of Meghalaya and other relevant stakeholders.

(A.T. Mondal)

STATE COUNCIL OF SCIENCE, TECHNOLOGY & ENVIRONMENT MEGHALAYA

Phone & Fax No. : (0364) 2522077

E-Mail: stcouncil-megh@meghalaya.gov.in
stcouncilmegh@yahoo.com

(An Autonomous Body of the Government of Meghalaya for Promotion of Science & Technology)
Meghalaya State Housing Financing Cooperative Society Ltd., Nongrim Hills,
Behind Bethany Hospital, Shillong -793003

Congratulations to Clean Energy Access Network (CLEAN) for bringing out the document 'Roadmap for Greening and Strengthening Horticulture in Meghalaya through DRE Integration'.

The terrain and climatic conditions of Meghalaya are well suited for horticulture. The report focuses on the example of pineapple to highlight the economic and environmental potential of processing and marketing of horticultural produce in Meghalaya with the help of Decentralized Renewable Energy (DRE).

DRE powered processing units can be set up at different scales and different locations. These can provide easy and affordable access to processing and packaging particularly for small landholders. Market linkages can be created for the locally produced high quality products through existing schemes and support mechanisms. There is a tremendous potential for farmer producer companies as well as self-help groups in such a supply chain.

DRE is in itself carbon neutral and decentralization of the processing of horticultural produce also brings in an element of climate adaptation. In that sense this is also a roadmap for climate aligned rural development in the sensitive ecosystem of Meghalaya.

I offer my best wishes and support to CLEAN and its local partners in operationalizing this roadmap.

(Shri Gunanka D.B, IFS)
Member Secretary, SCSTE &
Joint Secretary, Planning Department Govt. of Meghalaya

HORTICULTURE IN MEGHALAYA - THE CONTEXT

1.1 Opportunity for Meghalaya to emerge as a frontrunner

Given its terrain and climatic conditions, Meghalaya is ideally suited for various types of horticulture crops including fruits, vegetables, spices, and plantation crops.

Horticulture accounts for over half of the cropped area in the state. Meghalaya is already making a mark in several horticulture crops like pineapple and turmeric.

Meghalaya produced 0.38 million MT of fruits, 0.52 million MT of vegetables and 0.072 million MT of spices during 2021-22 (Agricultural statistics, 2022, GoI). Fruits and vegetables comprise 89% of the horticulture in the state.

Meghalaya has limited infrastructure for storage, processing and access to markets. It is estimated that 30% of fruits and vegetables are lost due to absence of proper post harvest management.

Most of the production consumed within the state in fresh form. Only 10% or less of fruits are processed.

Processing will help in reducing perishability, preventing wastage, and adding value through new products.

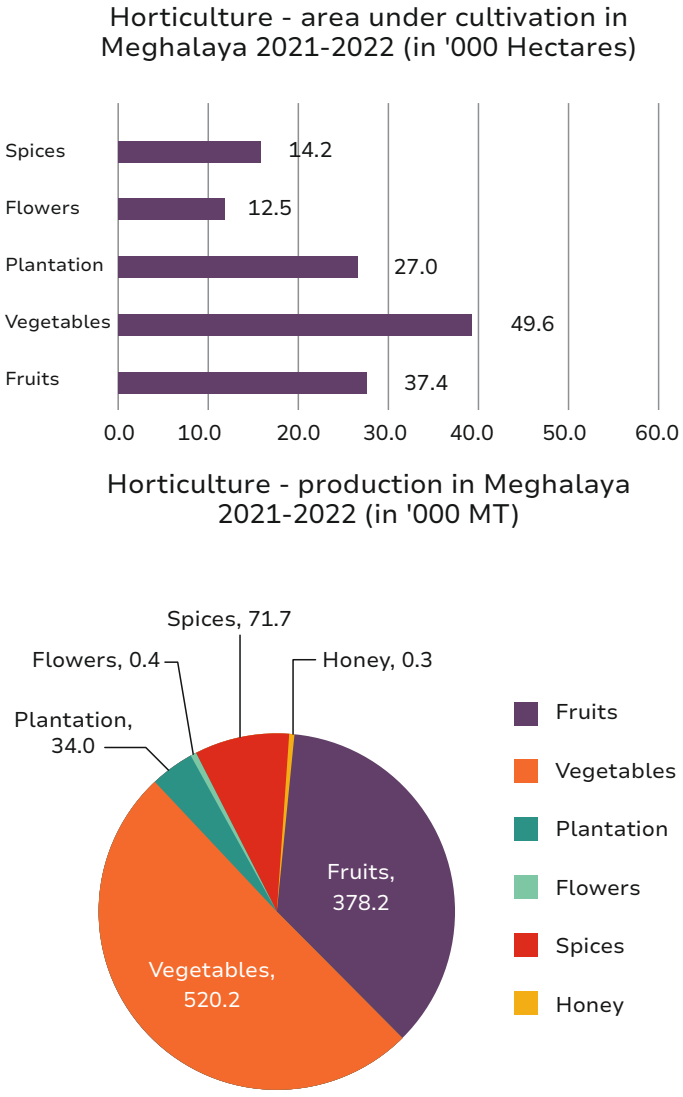


Figure 1: Area under cultivation and production of Horticulture crops in Meghalaya in 2021-22
Source: Agricultural statistics, 2022, GoI

Box 1: Pineapple example

- Value of pineapple can go up nearly 18 times – from INR 10 per kg of raw pineapple to INR 180 for per 100 gm of spicy dried pineapple (NAFED Bazaar)
- 30% of pineapple grown is spoilt and wasted - could be worth crores if stored and processed in a planned manner
- As per one of the estimates, INR 40,000 crore worth of fruits and vegetables are wasted in India every year (IBDLP, 2013)

1.2 What Meghalaya needs to invest in to tap this opportunity

To tap the vast opportunity in horticulture processing, the state will need to invest in

- Reliable cold storage to avoid spoilage
- Planned processing facilities to prepare products that have a market
- Conversion of waste (peel, core, leaves) to useful products and / or energy.

1.3 Why is processing low in Meghalaya?

Following are the various factors that constrain and inhibit horticulture processing in the state

1. Poor grid supply in rural areas hinders the operation of electric machine
2. Consumption is largely in raw form; strengthening of market linkages for processed products needed
3. Limited access to modern post-harvest technologies and techniques; resulting also in low awareness about possibilities
4. Rural/tribal people not skilled or trained to adopt modern technologies
5. Lack of finance/ funds with rural/ tribal people to invest in modern equipment

- **Following policies/ schemes at central and state level are addressing the challenges #2, #3, #4, #5 (Details are provided later in the report)**
  - Van Dhan Vikas Yojana (VDVY)
  - PM Formalization of Micro Food Processing Enterprises (PM-FME)
  - Horticulture Mission for North-Eastern Region and Himalayan States (HMNEH)
  - Pradhan Mantri Kisan Sampada Yojana (PMKSY)
  - Van Dhan Vikas Yojana (VDVY) Fruit processing scheme of Meghalaya

- **DRE intervention would specifically address the challenge #1 and support in unlocking the potential. DRE integration will also help bring in exposure to state-of-the-art technologies.**
  DRE also opens the possibility for innovative financing including carbon finance

- **Access to DRE based processing technology, at farm level, would enable value addition, reduce post-harvest loss and enhance rural incomes**

Box 2: Grappling with electricity gaps: concerns from the ground

- **Population living in households with electricity in Meghalaya was 92% in 2019-20, with rural areas reporting 91% (Down to Earth, 2021)**
- **West Jaintia Hills district reported less than 80% access to electricity; West Khasi Hills and South-West Khasi Hills districts reported less than 90% (Down to Earth, 2021)**
- **Average hours of power supply in a day in rural areas of Meghalaya was 18.5 hours during September 2019 (Ministry of Power, 2019)**
- **Recently in May-June 2023, several parts of Meghalaya had faced power cuts of up to 10 hours daily because of decreasing water level at Umiam Lake (Outlook India, 2023)**
- **In 2022-23 the CLEAN team spoke to villagers in North and South-West Garo Hills districts including those living in villages close to the Bangladesh border. Findings from CLEAN's interactions point to persistent energy access gaps as follows:**
    - Despite apparently high levels of electrification in the state, grid power supply is poor with frequent voltage fluctuations and power cuts. The problem is exacerbated during the summer and rainy seasons, when power supply to the village is often cut off for several days. The government is setting up prepaid electricity meters at houses. The villagers find that the average electricity bill of ₹250-300/month is too high, especially given the poor supply
    - Agriculture is the main occupation, but there is no irrigation facility. Nearly all produce is sold in raw form to nearby areas. The team found only one rice processing facility which was powered by an oversized 10HP diesel generator. Getting diesel is a big challenge, given the condition of roads and difficult terrain. So, the facility is often shut
    - For cooking energy, though almost 80% of the households have LPG connection but refilling is an issue because they need to collect it from over 10 kms away. As a result, almost all the households consume firewood for cooking and for other thermal applications. They use conventional and inefficient cookstoves and average firewood consumption is 12kg/ day

Section 2

UNDERSTANDING THE ROLE OF DECENTRALIZED RENEWABLE ENERGY (DRE)

2.1 What is DRE?

- Small-scale generation and distribution – generation and consumption at the same point
- Form of energy supply: Electricity and thermal energy
- Any renewable source – solar, wind, hydro, biomass
- Can serve at different scales – household, community, farmer groups, small/ rural enterprise
- Positives: small, clean, sustainable, reliable, can create jobs, strengthen livelihoods – 12 DRE tech can impact 37 million livelihoods and create revenue of USD 48 billion in India (CEEW, 2023)
- Limited or no transmission and distribution loss with DRE
- Many market–ready technologies available
- Now attractive in areas where grid electricity is not there or is unreliable
- Costs coming down, carbon and other financing support can further make this attractive even when grid is reliable

2.2 How does DRE help?

- **Local value creation**
- **Reduces drudgery by minimizing or eliminating manual labour**
  - use of solar powered peeler or slicer eliminates manual cutting/ slicing
- **Increases shelf life of agriculture/ horticulture products through**
  - Cold storage
  - Boiling
  - Drying
- **Adds value, higher income**
  - Higher return for processed products
  - More productivity than manual processing – higher output with less work and over shorter time
  - Mechanization without dependence on unreliable grid or diesel genset

2.3 Are DRE solutions financially attractive?

A recent study of 12 DRE appliances by CEEW and CLEAN member insights indicate that:

- All DRE appliances are attractive when electricity is unreliable
- Solar dryer is always attractive irrespective of electricity situation
- Viability is best when products are used over the lifetime of around 10 years
- Higher usage days per year improves financial returns – processing of multi-crop would increase capacity utilization of technology considering the seasonal availability of horticulture crop

2.4 Types of DRE

DRE technologies can be broken down into two main types as following:

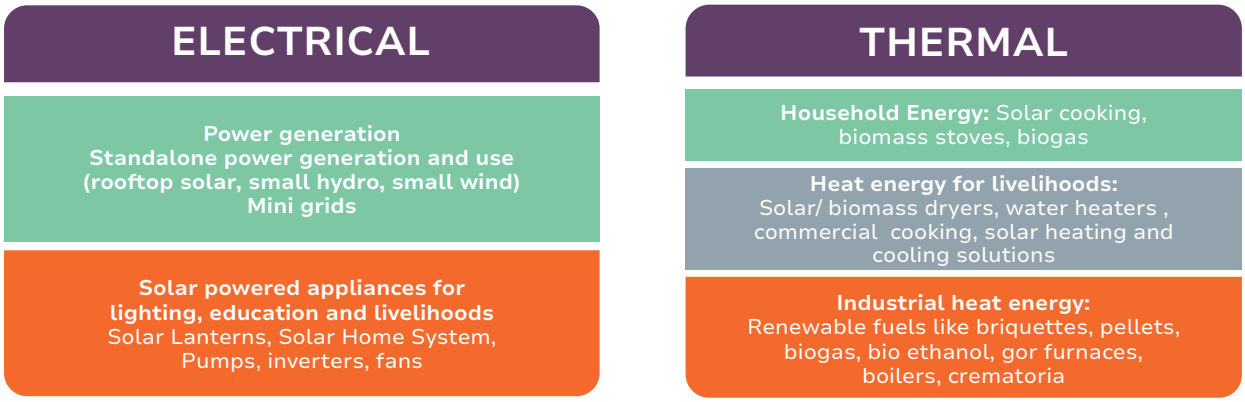


Figure 2: Types of DRE technologies available

There are many existing appliances that are or can be powered through DRE, which can help in agriculture mechanization, livelihood development, and horticulture processing. Some of these are:

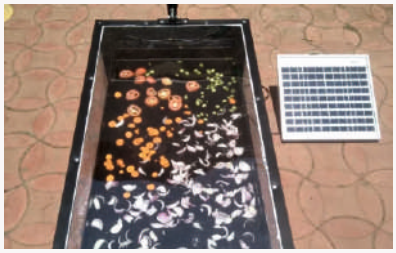
Solar insect trap

Solar sprayer

Solar milling machine

Solar Rice Huller

Solar cold storage



Solar dryer

Biomass dryer

Figure 3: Examples of various DRE technologies

2.5 DRE application in horticulture processing

DRE appliances can support numerous processes to prevent post harvest loss and enable preparation of value-added products from fruits, vegetables and spices.

The following figure illustrates the different processes in spices and fruits processing that can be supported through DRE appliances. Besides appliances, large scale multi-processing facilities can be powered by solar rooftop, small wind, small hydro and hybrid plant or RE-powered mini-grids

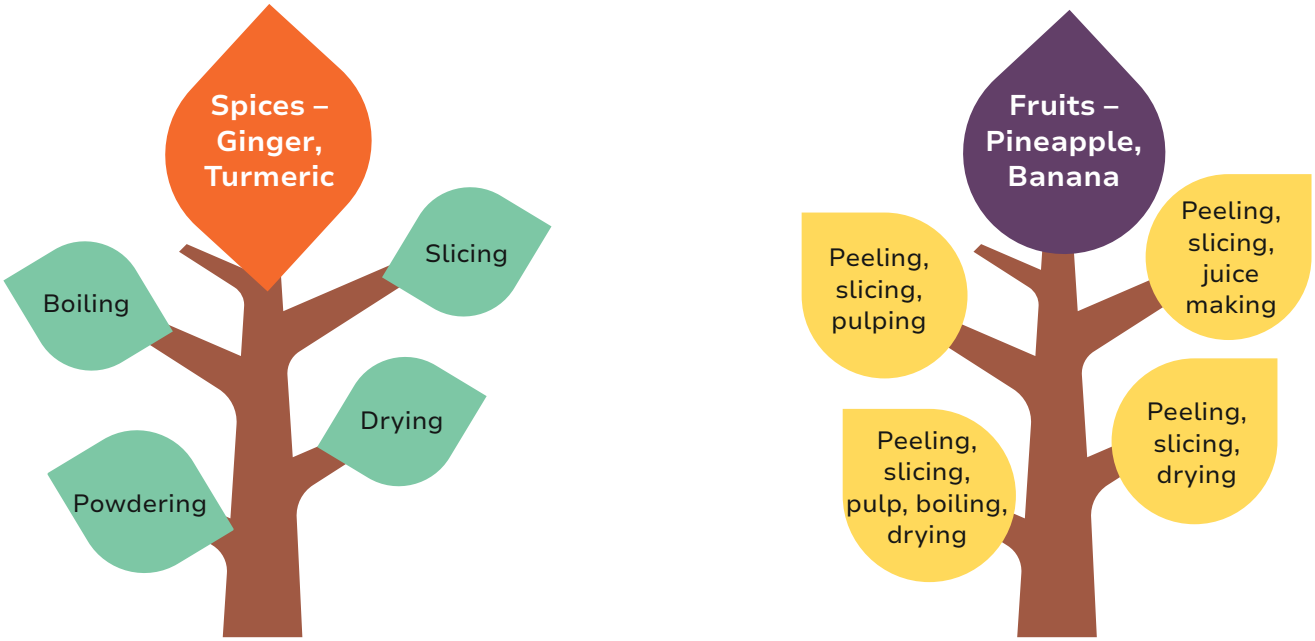


Figure 4: Different processes that can be supported through DRE in spices and fruits

2.5.1 Solar powered horticulture processor

- Capable of processing pulp and juice
- Variants available in output capacities ranging from 40 litres per hour to 200 litres per hour (Motor capacity: 0.5 – 2 HP) (CEEW, 2022)
- Price range: INR 137,780 (40 litres/hour) to INR 408,390 (200 litres/ hour) (CEEW, 2023)
- About 600 systems installed in 18 states
- Price breakup for 40 litres/ hour variant:
  - Processor: INR 70,800
  - Solar PV unit– 375 Watt (inc. battery): INR 62,780
- Works on both grid power and solar power

Figure 5: Solar powered small horticulture processor
Source: CEEW/ Kissan Dharambir

2.5.2 Solar powered dryer

- Uses solar energy to dry and extend the shelf-life of otherwise perishable fruits, vegetables, flowers, etc.
- Variants available with capacities that can process inputs ranging from 5 kg to 500 kg per batch
- Price of solar dryer ranges from INR 8,925 (5 kg) to INR 1,70,100 (500 kg) (CEEW, 2023)
- Various manufacturers of solar dryers are available in the market
- Around 8,000 units installed across 26 states

Figure 6: Solar powered dryer
Source: Rudra Solar

2.5.3 Biomass powered dryer

- Capacity of biomass-based dryers ranges from 30 kg/ batch to 100 kg/ batch
- Since the fuel is biomass, the cost of fuel is low if it is collected locally
- Temperature within the dryer is controlled manually and can attain a maximum temperature of 100 °C
- Over 800 units installed mostly in Karnataka and Kerala

Figure 7: Biomass powered dryer
Source: CLEAN

2.5.4 Solar powered cold storage

- Energy-efficient, portable, and modular appliances that can help reduce food loss by storing perishable food commodities
- Enables farm level cold chain in locations with weak grid availability
- Variants available in storage capacities ranging from 2 MT to 10 MT
- Price of solar powered cold storage ranges from INR 7,67,200 (2 MT) to INR 24,64,000 (10 MT) (CEEW, 2023)
- Around 350 products installed across 12 states

Figure 8: Solar powered cold storage
Source: India Mart

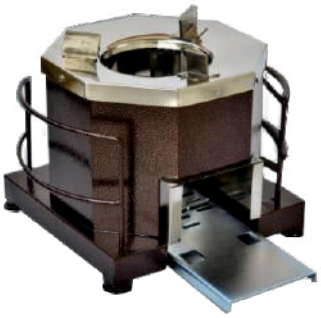
2.5.5 Biomass powered cold storage

- This type of cold storage works on the more environment-friendly system of vapour absorption for refrigeration, that is, it is powered by heat instead of mechanical compressor
- It uses the biogas directly as a source of heat or a heat transfer fluid heated by biogas in a separate biogas-burning system. The system does not require a compressor
- Capacity typically ranges up to 20 MT of storage; Capable of cooling down to 0°C
- A 15 Ton cold storage for on-farm usage consumes 100 kg/day of biomass

Figure 9: Biomass powered cold storage
Source: New Leaf

2.5.6 Improved biomass cookstoves

- This improved biomass stove emits less smoke, saves up to 50% of fuel, is portable and does not need continuous air blowing
- Fuel type used: Biomass (chopped wood, agro waste, pellets, etc.) and can be loaded in the front side of cookstove, thereby eliminating the need to chop
- Small cookstoves are available in natural as well as forced draft variants
- Large commercial stoves that can be used for blanching, frying, etc. in large scale are available in wood-fired natural draft and forced draft variants
- Cost of commercial large scale cook stoves may range from INR 35,000 to INR 70,000
- Over 6000 stoves are in operation



Agneeka ECo ND Cook stove

Figure 10: Biomass cook stoves
Source: Compendium 2020, CLEAN

2.5.7 Peeler/ slicer powered by solar

- Electric peeling or slicing machines are available in the market which are or can be operated by solar power
- Different variants of electric peeling/ slicing machines are pineapple peeler, apple peeler and slicer, vegetable/ potato peeler, vegetable slicer, among others
- Processing capacity depends on the type of fruit or vegetable and type of equipment used

Source: Pineapple peeling machine
Source: Astra Inc

Fruit/ vegetable slicer
Source: India mart

Figure 11: Examples of electrical peeler/ slicer

NOTE: Electric processing machines rather than DRE appliances can also be powered through rooftop solar plant or hydro/ wind/ biogas power plant or hybrid RE plant

DRE USE CASES IN HORTICULTURE: FOCUS ON PINEAPPLE

3.1 Why focus on pineapple: possibilities to add value with planned processing

- India is one of the top 10 pineapple producers in the world; North-east states produce about 50% of India's production. In India, pineapple is mostly consumed in fresh form, and only 10% is processed. Whereas globally, 90% of pineapple is consumed in processed form. Imported processed pineapple are also coming to India
- Pineapple is an important horticulture crop for Meghalaya. Around 139,000 MT of pineapple was produced in the state during the year 2021-22 (37% of Meghalaya's fruit production and 7.8% of India's total pineapple production) (Ministry of Agriculture, 2022)
- Pineapple from Meghalaya is popular: Brand Anaras has been developed under the One District One Product (ODOP) concept for dried spicy pineapple in Ri Bhoi district of Meghalaya and is being marketed by NAFED
- The post harvest loss has been estimated to be 30% (with on-farm loss accounting to 2%)

There are many possibilities to reduce wastage and improve value addition through preparation of following value-added products. Meghalaya can be the front-runner

Spicy dried pineapple (Source: Thukral foods)

Pineapple juice (Source: FreePiK)

Pineapple candy (Source: Flipkart)

Pineapple leaf fiber - used in making bags, mats, and other items (Source: Textile Engineering)

Canned pineapple (Source: Practical Self Reliance)

Pineapple waste peel and core- converted to biogas, products (Source: Research Tropica)

Figure 12: Examples of value-added products from pineapple

3.2 DRE use cases for selected value-added products of pineapple

Conversion of pineapple into different value-added products is a multi-stage process. The first few steps of sorting, removal of pips, seeds, other impurities, peeling, washing and the final steps of packing, storage etc. all have some commonality for most value-added products. Process flow charts, indicative DRE options, and techno-economics have been developed for spicy dried pineapple, pineapple juice, and pineapple candy.

3.2.1 Spicy dried pineapple

- Fresh pineapple has a moisture content of 90%
- Dried pineapple would have a moisture content of 6- 8%
- Yield of the spicy dried pineapple would be about 16% of the weight of the fresh pineapple
- 20 kg/ day of spicy dried pineapple can be prepared from 125 kg of freshly cut pineapple

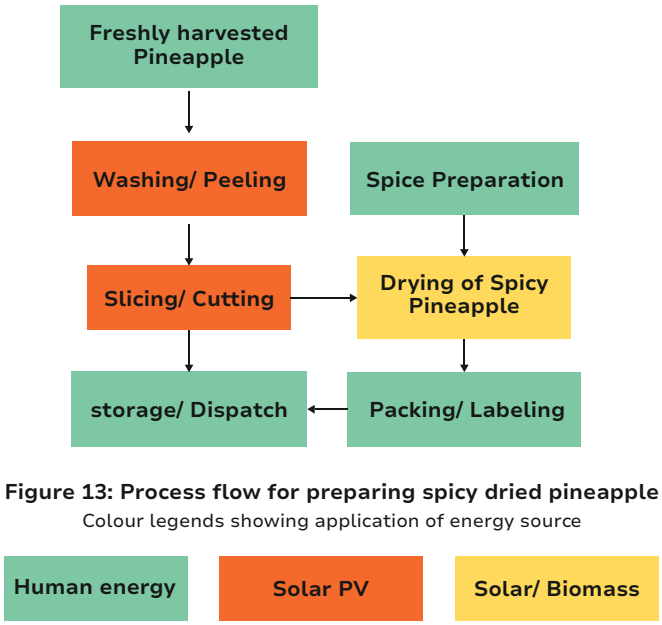


Figure 13: Process flow for preparing spicy dried pineapple
Colour legends showing application of energy source

Table 1: Indicative DRE options for preparing spicy dried pineapple

Process step requiring energy	Energy type	Estimated power requirement	DRE options
Peeling	Electrical	0.5 HP /0.37 kW	Solar powered peelers / Rooftop solar
Slicing / Cutting	Electrical	1 HP/ 0.746 kW	Rooftop solar/ Pico hydro
Drying	Thermal	Heat input 48000 KJ/ hour	Solar and / or biomass dryers

Techno economics for preparation of 20 kg per day of spicy dried pineapple from 125 kg of fresh pineapple has been developed and presented below in tables. The DRE interventions proposed for preparation of spicy dried pineapple are:

- Solar PV plant
- Solar dryer

Table 2: Techno-economic analysis for preparing spicy dried pineapple

	Cost of equipment
Pineapple peeling equipment	15,000
Washing tanks (2*5,000 litre capacity)	15,000
Stainless steel worktables (2 ft x 4 ft)	25,000
Pineapple cutting equipment (1 no, capacity: 150 kg/ hr, 1HP motor)	25,000
Solar dryer (50 kg tray area), (nos.= 3)	2,25,000
Packing sealing machines (2 nos. @Rs 2500 / piece)	5,000
LPG connection / large water heating stove	10,000
Solar PV (1.65 kW capacity)*	99,000
Total capital cost (does not include shed)	**4,19,000**
Labour cost 2 people full time	600
Cost of packing material / labels (100 gm pouches) at Rs 3 / pouch	600
Miscellaneous costs, utilities	500
Dispatch to wholesaler (transportation)	2,000
Daily interest on working capital loan - INR 73,500 @18% (250 days)	53
Losses during packing / slicing 5kg fresh pineapple	-100
Total daily expenditure for 20 kg of spicy dried pineapple	**3,653**
Income from sale of 20 kg of spicy dried pineapple @ Rs 300 / kg	**6,000**
Daily profit	**2,347**

***Size of Solar Plant to run a 1 hp (0.746 kW) motor of processing machine**

Considering induction motor draws large starting current, power factor (assumed as 0.85), inverter efficiency (assumed as 95%), and derating factor of solar panels (assumed as 0.75), the size of solar plant would be 1.65 kW.

MNRE benchmark cost of grid connected solar power plant for NE states is INR 47,447/ kW, but a conservative value of INR 60,000/ kW has been used considering remote or rural locations of farmers in Meghalaya

3.2.2 Pineapple juice (ready to serve - RTS)

- A pineapple juice production line consists of washing tanks, peeler, slicer, pulper cum strainer, steam jacketed kettle, autoclave, cooling chamber, Brix meter and packing equipment
- Typically, 400 litres of pineapple juice is produced after processing 250 kg of freshly cut pineapple
- Similarly, 720 litres of pineapple juice is produced from 450 kg of freshly cut pineapple

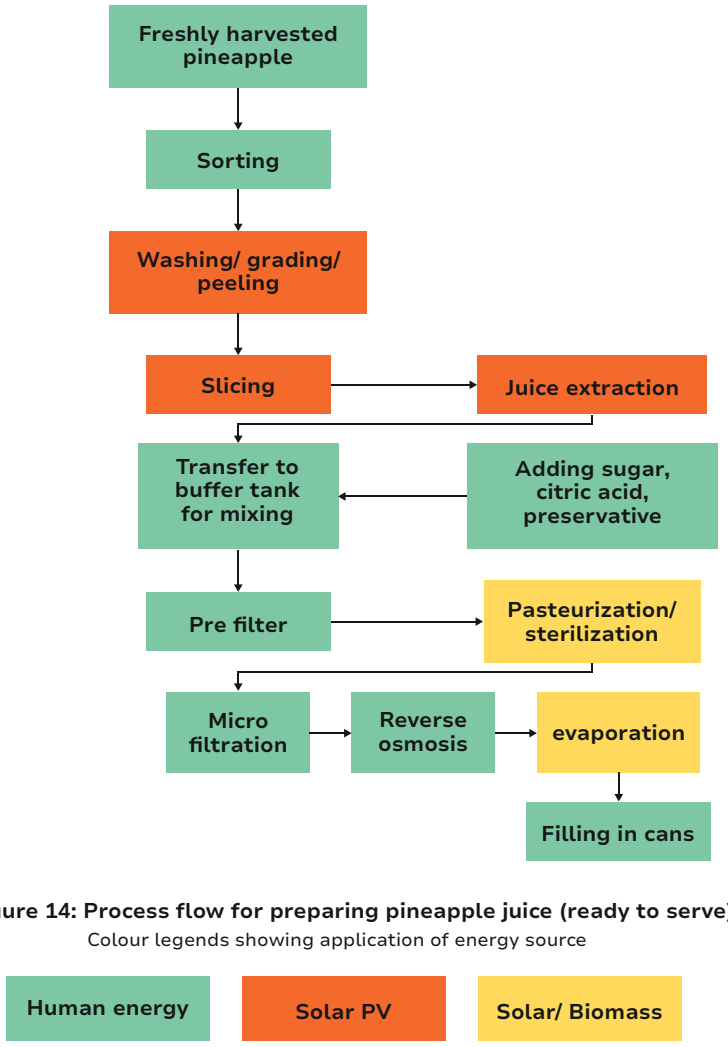


Figure 14: Process flow for preparing pineapple juice (ready to serve)
Colour legends showing application of energy source

Table 3: Indicative DRE options for preparing pineapple juice (ready to serve)

Daily profit	Energy type	Estimated power requirement	DRE options
Slicing / cutting, juice extraction, multiple	Electrical	6 kW (400 litres)/ 8 kW (720 litres)	Rooftop solar powered juice making production line
Pasteurization/ sterilization evaporation	Thermal		

Techno economics for preparation of 400 liters/ day of **pineapple juice** (Ready to Serve) from 250 kg pineapple/ day and 720 liters of pineapple juice from 450 kg pineapple/ day has been developed and presented below in tables. **Solar PV plant** of appropriate size has been proposed as DRE intervention for preparation of pineapple juice.

Table 4: Techno-economic analysis for preparing pineapple juice (ready to serve)

	Cost of equipment	
Equipment	**Semi automatic system for processing 250 kg pineapple/ day**	**Automatic system for processing 450 kg pineapple/ day**
Pineapple juice production line	20,00,000	50,00,000
Other miscellaneous equipment	2,00,000	2,00,000
Roof top solar (10 kW approximate)	6,00,000	
Rooftop solar (13 kW approximate)		7,80,000
Total capital cost (does not include shed)	**28,00,000**	**59,80,000**
Cost of pineapple @ Rs 30 / kg	7,500	13,500
Cost of sugar	360	648
Cost of water, heat energy	100	150
Cost of packaging @ Rs 5 / litre	2,000	3,600
Labour cost for 6 labour @ Rs 300 / day	1,800	1,800
Total daily expenditure	9,960	19,698
Income from pineapple juice @ INR 40/l	16,000	28,800
Profit / batch (per day)	**6,040**	**9,102**

3.2.3 Pineapple candy

- After adding sugar and drying, the yield of pineapple candy would be 80% by weight of the fresh pineapple
- 40 kg/day of pineapple candy can be prepared from 55 kg of freshly cut pineapple – considering a loss of 5 kg during slicing/ packing

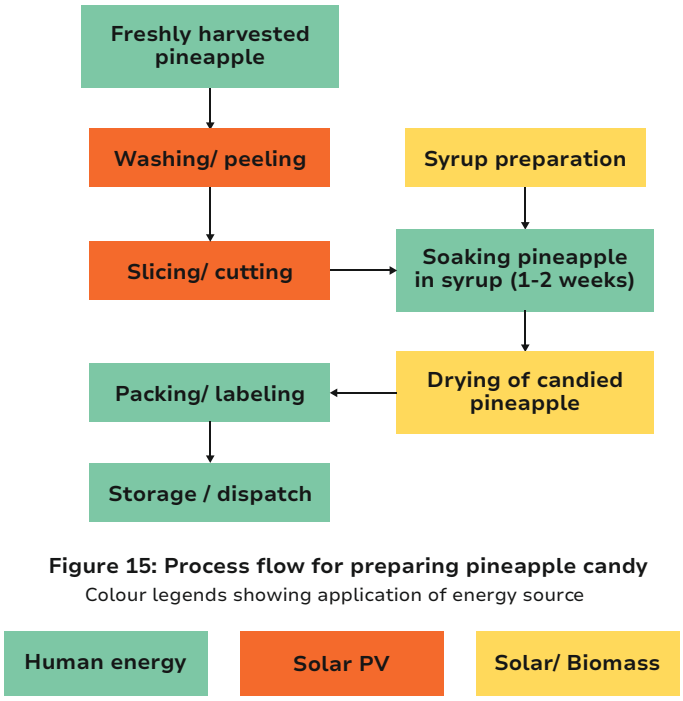


Figure 15: Process flow for preparing pineapple candy
Colour legends showing application of energy source

Table 5: Indicative DRE options for preparing pineapple candy

Process step requiring energy	Energy type	Estimated power requirement	DRE options
Peeling	Electrical	0.5 HP /0.37 kW	Solar powered peelers / Rooftop solar
Slicing / cutting	Electrical	1 HP/ 0.746 kW	Rooftop solar/ Pico hydro
Syrup preparation	Thermal	Heat input 73,000 KJ/hr	Improved biomass stoves and/or Solar water heater
Drying	Thermal	Heat input 24,000 KJ/ hour	Solar and / or biomass dryers

Techno economics for preparation of 40 kg per day of pineapple candy from 55 kg of freshly cut pineapple has been developed and presented below in tables. The DRE interventions proposed for preparation of pineapple candy are:

- Solar PV plant
- Solar dryer

Table 6: Techno-economic analysis for preparing pineapple candy

	Cost of equipment
Pineapple peeling equipment	15,000
washing tanks (2*5,000 litre capacity)	15,000
Candy soaking drums (15 drums * 200 litres) @ Rs 1000 / drum	15,000
Stainless steel worktables (2 ft x 4 ft)	25,000
Pineapple cutting equipment (1 no capacity 150 kg / hr, 1HP motor)	25,000
Solar dryer (50 kg tray area)	75,000
Packing sealing machines (2 nos @Rs 2500 / piece)	5,000
Initial cost of sugar (100 kg) @ Rs 45 / kg)	4,500
LPG connection / large water heating stove	10,000
Solar PV (1.65 kW)	99,000
Total capital cost (does not include shed)	**2,88,500**
Cost of peeled pineapple (55 kg) @ Rs 20 / kg	1,100
Cost of incremental sugar (10 kg)	450
Labour cost 1 person / day part time for 10 days + 2 people full time	500
Cost of packing material / labels (100 gms pouches at Rs 3 / pouch	1,500
Miscellaneous costs, utilities	500
Dispatch to wholesaler (transportation)	2,000
Daily interest on working capital loan of INR 1,64,500 @ 18% (250 days)	118
Losses during packing slicing 5 kg	-100
Total daily expenditure for production of 40 kg of pineapple candy	**6,068**
Income from 40 kg of candied pineapple (@Rs 300/ kg)	**12,000**
Daily profit	**5,931**

3.3 Summary

A summary of the techno economic assessments for pineapple value added products has been given in the table below.

The daily yield of value-added product have been considered as assumption for techno-economic assessment.

Practically, the daily production capacity would be based on an assessment of the available farm produce in the command area of the micro enterprise, compatibility of the capital expenditure with available schemes, loans, grants and the connected load required.

Table 7: Summary of techno-economic results for preparing pineapple value added products

Value added product	Yield per day	Capital cost (INR)	Daily expenditure (INR)	Daily income (INR)	Daily profit (INR)	DRE interventions
Spicy dried pineapple	20 kgs	4,19,000	3,653	6,000	2,347	1.65 kW solar PV Solar dryer
Pineapple juice (ready to serve)	400 litres	28,00,000	9,960	16,000	6,040	10 kW solar PV
	720 litres	59,80,000	19,698	28,800	9,102	13 kW solar PV
Pineapple candy	40 kg	2,88,500	6,068	12,000	5,931	1.65 kW solar PV Solar dryer

OTHER DRE USE CASES IN HORTICULTURE: TURMERIC AND BANANA

4.1 Use cases in Turmeric

- India is the largest producer of turmeric with 1124 thousand tonnes in the year 2020-21 (Agricultural statistics, 2022, GoI), contributing about 78% of the world's production (MOFPI).
- Turmeric is widely grown in all the districts of Meghalaya. According to 2015-16 data, the turmeric production in Meghalaya was 16 thousand tonnes (Mission Lakadong, 2018-2023).
- West Jaintia Hills district is home to one of the finest turmeric varieties in the world – the "Lakadong" variety as well as two other varieties - Laskein and Ladaw.
- Lakadong turmeric with curcumin content of more than 7% (almost 2% more than other varieties) and being chemically free, is very much sought after for use in cosmetic, pharmaceutical, and food industry.
- Meghalaya Basin Development Authority (MBDA) is implementing a Lakadong cluster farming project in West Jaintia Hills.
- In 2018, the Meghalaya government launched Mission Lakadong, that envisions a production target of 50,000 MT of turmeric per year by 2023 from 16,000 MT in 2018 (Mission Lakadong, 2018-2023).
  - Proposal to set up aggregation centres – integrated post-harvest management infrastructure
  - Support to eligible and well functioning processing units in terms of equipment and access to certification and quality testing facilities

Turmeric powder

Polished turmeric stick

Figure 16: Value addition opportunities in Turmeric

4.1.1 Turmeric powder and polished turmeric stick

- Yield of dried turmeric is 20% of the weight of the fresh turmeric
- Wastage during polishing is 8%
- 22 kg/ day of turmeric sticks and powder can be prepared from 122 kg of raw turmeric

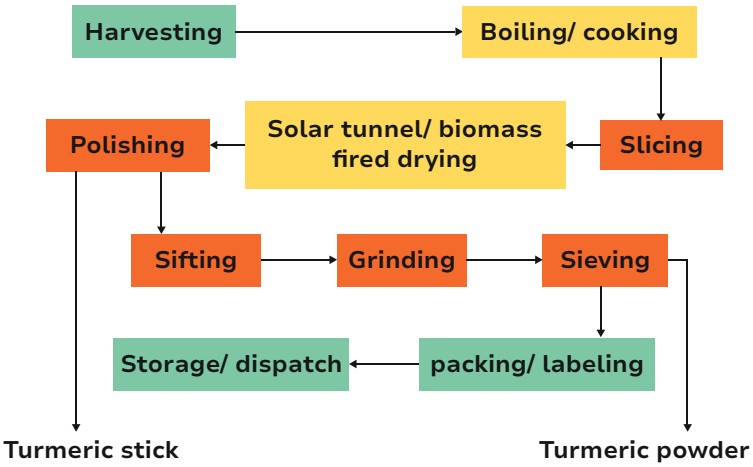


Figure 17: Process flow for preparing Turmeric powder and Polished turmeric stick

Table 8: Indicative DRE options for preparing turmeric powder and turmeric stick

	Process step requiring energy	Energy type	Estimated power	DRE options
DRE options for 22 kg/day of polished turmeric stick	Boiler (optional for some varieties)	Thermal	Heat input 73,000KJ/hr	Fuel efficient biomass stove
	Slicer	Electrical		Solar rooftop powered or solar powered slicer
	Dryer	Thermal	Heat input 48,000 KJ/ hr	Biomass/ solar dryer
	Polisher	Electrical	0.746 kW (1 HP)	Solar rooftop powered
	Sifter	Electrical	0.37 kW (0.5 HP)	Solar rooftop powered
	Grinder	Electrical	5.6 kW (7.5 HP)	Solar rooftop powered
	Seiver	Electrical		Solar rooftop powered

Techno economics for preparation of 22 kg per day of turmeric powder and polished turmeric stick from 122 kg of raw turmeric has been developed and presented below in tables.
The DRE interventions proposed for preparation of turmeric powder and turmeric stick are:

- Solar PV plant
- Solar dryer
- Biomass stove

Table 9: Techno-economic analysis for preparing turmeric powder and polished turmeric stick

	Cost of equipment	
Equipment	**Turmeric powder**	**Turmeric sticks**
Turmeric boiling stove	25,000	25,000
Stainless steel worktables (2ft x 4 ft)	25,000	25,000
Sifter	60,000	60,000
Solar dryer (50 kg tray area) *4	4,00,000	4,00,000
Turmeric polishing machine	1,50,000	1,50,000
Turmeric grinder	2,00,000	
Packing machines (2 nos @Rs 2500 / piece)	5,000	5,000
Weighing balance	6,000	6,000
Miscellaneous items	10,000	10,000
Solar PV (10 kW/ 1.65 kW)	6,00,000	99,000
Total capital cost	**14,81,000**	**7,80,000**
Fresh turmeric root 120 kg @ Rs 20 / kg	2,400	2,400
Labour cost 30 days, 2/ 3 people	900	600
Cost of packing material / labels	550	50
Miscellaneous costs (water, fuel)	500	500
Dispatch to wholesaler (transportation)	500	500
Daily interest on working capital loan	65	58
Losses during packing slicing	-100	-100
Total daily expenditure	**4,815**	**4,008**
Income from sale in Wholesale	3,300	3,960
Income from sale in Retail	6,600	4,400
Profit / batch (per day)	**1,785**	**392**

4.2 Use cases in Banana

- India is the largest producer of banana in the world, with an annual gross production of 29 million tons in 2019. This was almost 25% of the global banana production.
- Varieties like Jahaji, Chenichampa, Malbhog and indigenous varieties are commonly grown in Meghalaya. In 2021-22, 95,000 tons of banana of banana was produced in Meghalaya.
- Banana is a versatile fruit and several value-added products like banana chips, banana fig, banana powder and fruit bars can be prepared from raw and ripe bananas. Currently, only 10% of the banana grown is processed.
- Chips are major value-added product from banana. Chips are consumed round the year, most popular snack, and have high potential for marketability when compared to other value-added products like banana figs, banana powder

Banana chips

Banana figs

Banana powder

Figure 18: Value addition opportunities in Banana

4.2.1 Banana chips

- Variety of banana grown in Meghalaya is appropriate for conversion into chips
- 1 kg banana will yield 700 gms of sliced, peeled sun-dried banana
- Yield of banana chips from 100 kg raw banana is 65 kg

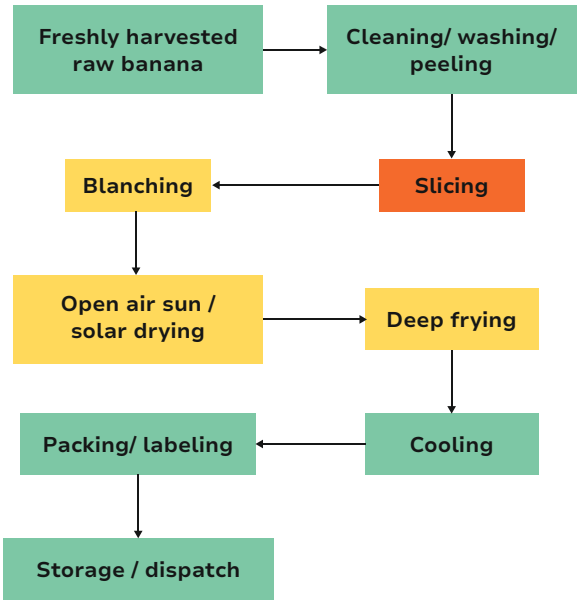


Figure 19: Process flow for preparing Banana chips

Table 10: Indicative DRE options for preparing banana chips

Process step requiring energy	Energy type	Estimated power requirement	DRE options
Banana slicer	Electrical	0.746 kW (1 HP)	Solar rooftop or solar powered slicers
Dryer	Thermal	Heat input: 48,000 KJ/ hr	Biomass/ solar dryer
Fryer	Thermal	Heat input: 1,46,000 KJ /hr	Fuel efficient biomass stove

Techno economics for preparation of 65 kg per day of banana chips from 100 kg of raw banana has been developed and presented below in tables. The DRE interventions proposed for preparation of banana chips are:

- Solar PV plant
- Solar dryer
- Biomass stove

Table 11: Techno-economic analysis for preparing banana chips

	Cost of equipment
Washing tanks (2*5000 litre capacity)	15,000
Stainless steel worktables (2 ft x 4 ft)	25,000
Banana slicing equipment (1 no capacity 10 kg / hr, 1HP motor)	30,000
Banana chips fryer 30 kg / hr biomass fired	50,000
Solar dryer (50 kg tray area) *2	1,50,000
Packing sealing machines (2 nos @Rs 2500 / piece)	5,000
Blanching stove biomass fired	10,000
Weighing balance	6,000
Miscellaneous items	10,000
Solar PV (1.65 kW)	99,000
Total capital cost (does not include shed)	**4,00,000**

Cost of banana 100 kg @ Rs 20 / kg	1,000
Cost of oil @10 kg / day	1,500
Labour cost 2 people / day full time @ Rs 300 / day	600
Cost of packing material / labels (100 gms pouches at Rs 3 / pouch	1,950
Miscellaneous costs, utilities	500
Dispatch to wholesaler (transportation)	2,000
Daily interest on working capital loan of Rs 92,500 @18 %/ annum	67
Losses during packing slicing	-100
Total daily expenditure for production of 65 kg banana chips	7,517
Income from sale of 65 kg banana chips	11,050
Daily profit	**3,533**

IMPLEMENTATION MODELS

Value addition in horticulture with integration of DRE can be organized in various ways. Individual farmers or groups of farmers may take up processing. Alternatively, farmers may choose to hand over their produce to a processing facility. In all cases, it is expected that farmers will see some increase in their income as there will be value addition and avoidance of wastage.

Marketing of processed food products is complex as it involves Food Safety and Standards Authority of India (FSSAI) certification and other quality controls, and so it may be difficult at this stage, for individual farmers in the state, to take up processing and marketing of products on their own. The hub-and-spoke type of models, where farmers undertake minimal or some processing at their end and the rest of the processing is typically handled by organized groups or collectives of farmers or multi-processing facility, are more feasible at this stage.

Existing institutions like Self-Help Groups, Village Organization, Van Dhan Vikas Kendras are well-suited for taking up these activities (Box 3)

Box 3: DRE processing can be undertaken by existing collectives of farmers

Meghalaya State Rural Livelihoods Society (MSRLS) which operates at three levels of aggregation through SHGs, VOs and CLFs – is very suitable for hub-and-spoke model of DRE-powered horticulture processing.

A Van Dhan Vikas Kendra (VDVK) cluster constituting 15 tribal SHGs, each comprising 20 tribal farmers is well-suited for a hub-and-spoke model. VDVKs have been set up under the Tribal Co-Operative Marketing Development Federation of India Limited (TRIFED).

Farmer Producer organisations (FPOs) can also take the role of hubs working with their member-farmers as spokes.

Figure 20: Three levels of aggregation through SHG, VO, and CLF

5.1 Implementation model 1

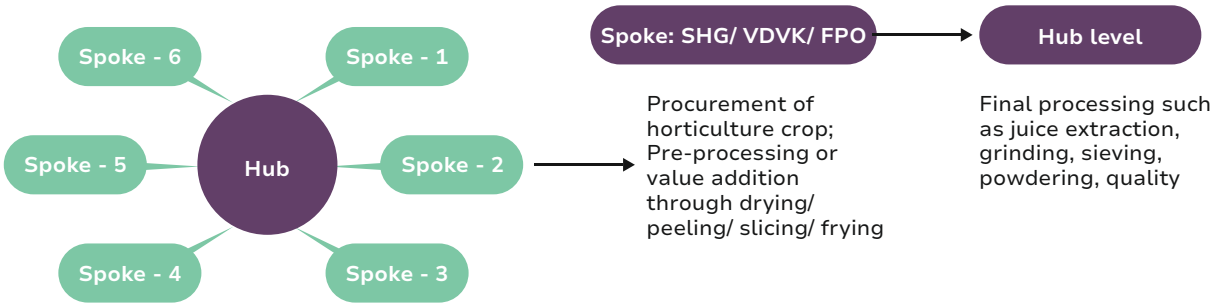


Figure 21: Schematic for implementation model 1

In this model, the spoke can take various activities to support the hub in final processing. The list of activities and possible DRE interventions are provided in table below. Further, as an example, techno-economics of supplying peeled pineapple to hub has been shown below.

Table 12: List of activities possible at spoke and hub levels under implementation model 1

Spoke Level		Hub Level	
Possible activities	**DRE intervention**	**Activities**	**DRE intervention**
1. Procurement of raw crop; pre-processing (washing, grading, & sorting); supply to Hub	None	Juice/ pulp extraction Grinding, sieving, powdering Quality testing and packaging	Solar horticulture processors for juice/ pulp extraction Solar PV plant for running electrical machines
2. Procurement of raw crop; pre-processing, peeling & slicing, drying, frying; supply to Hub	Solar powered peeler & slicer, Solar dryer, Biomass cookstoves		
3. Procurement of raw crop; pre-processing, peeling & slicing for juice preparation; supply to Hub	Solar powered peeler & slicer or None		

Table 13: Techno economics of peeled pineapple supplied to Hub* (No DRE intervention)

Pineapple cost @ Rs 20 / kg (from growers) for 110 kgs / day	2,200
Labour cost (for removal of tops, peeling and washing) @ Rs 5 / kg	550
Total daily expenditure for procurement and peeling of pineapple	**2,750**
Sale of 100 kg of peeled pineapple to production facility @Rs 30 kg	3,000
Sale of pineapple peel @ Rs 4 / kg	16
Total daily income	**3,016**
Daily profit by SHG	**266**

* In this case, spokes must be located within 100 m of the hub to avoid spoilage

Marketing and branding: The Hub may tie-up with bigger corporate company for selling of their processed products under the corporate's branding or the hub may partner with MSRLS/ National Agricultural Cooperative Marketing Federation of India (NAFED)/ TRIFED for FSSAI certification, branding and marketing

5.2 Implementation model 2

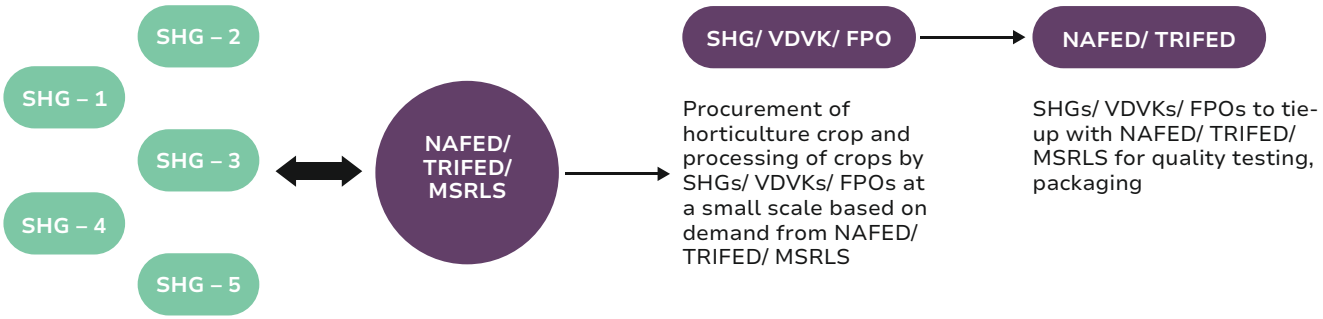


Figure 22: Schematic for implementation model 2

In this model, a SHG/ VO/ VDVK/ FPO may undertake both pre-processing and processing of value-added products up to the ready to market stage at a very small scale based on the demand from the partners. The DRE interventions that can support processing at individual SHG/ VO/ VDVK/ FPO according to the value-added product being processed are listed below in table.

Table 14: DRE interventions for different value-added products under implementation model 2

Value added product	DRE intervention	
	Option 1 Individual appliances	Option 2 Solar PV plant and others
Spicy dried pineapple	Solar powered peeler and slicer, Solar/ biomass dryer	Solar PV plant, Solar/ biomass dryer
Pineapple juice	Solar powered peeler and slicer, Solar horticulture processor	Solar PV plant
Pineapple candy		Solar PV plant, Solar/ biomass dryer
Turmeric powder	Solar powered peeler and slicer, Solar/ biomass dryer, Biomass stove	Solar PV plant, Solar/ biomass dryer, Biomass stove
Banana chips	Solar powered peeler and slicer, Solar/ biomass dryer, Biomass stove	Solar PV plant, Solar/ biomass dryer, Biomass stove

Marketing and branding: The individual SHG/ VO/ VDVK/ FPO may partner with NAFED/ TRIFED/ MSRLS for marketing of processed products. The demand for processing will come from these agencies. The agencies will provide facilities for quality testing, packaging, branding and selling of products

5.3 Implementation model 3

In this model, the multi-processing unit will carry out all pre-processing and value-addition activities. The unit will also include a cold storage unit, quality testing labs, packaging facilities. The unit will partner with farmers in nearby villages or district for supply of raw and fresh horticulture crop after being washed and graded. The unit may also be owned by a farmer co-operative.

The unit may be retrofitted with rooftop solar plant and/ or other DRE plant (pico hydro, biogas) to enable processing of different value-added products and thereby replacing DG sets in areas with no grid electricity or providing reliable electricity in areas with unreliable electricity

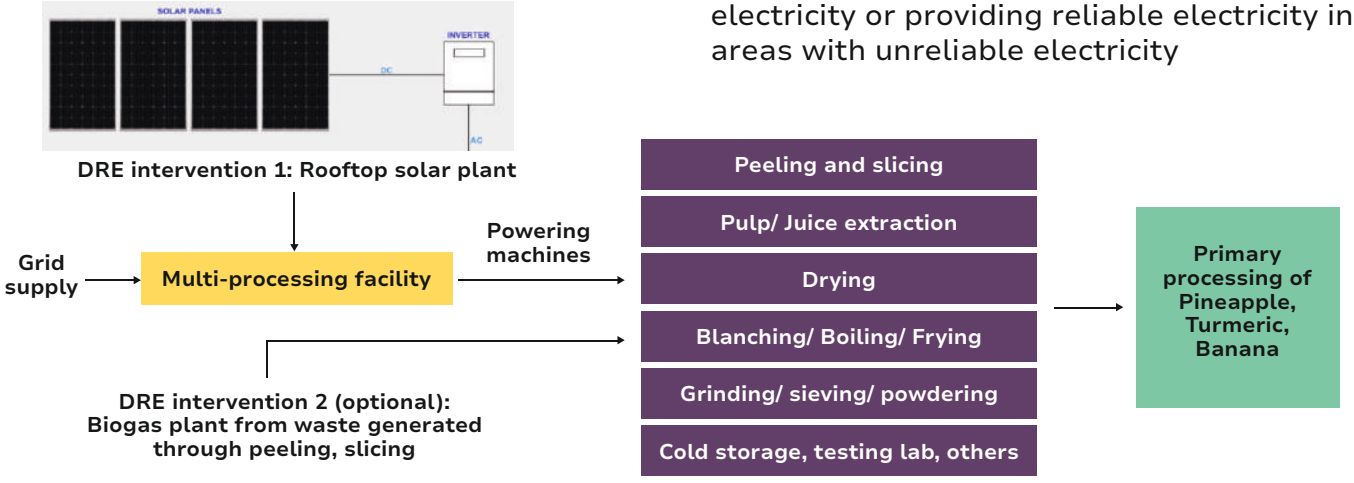


Figure 23: Schematic of DRE interventions under implementation model 3

Marketing and branding: The unit will have its own branding and will market the process products in wholesale/ retail outlets in the state or export to other states/ countries.

5.4 Summary of implementation models

A summary of three implementation models discussed in previous slides are presented below

Table 15: Summary of proposed DRE implementation models

Implementation model	Entities involved	Activities performed	DRE intervention
Implementation model 1	Spoke (SHG/ VO/ VDVK)	• Procurement and pre-processing (washing & grading) OR • Value addition activities such as peeling & slicing, drying, frying	Solar powered peeler and slicer/ Solar dryer/ Biomass stoves
	Hub	• Final processing such as juice extraction, grinding, sieving, powdering, quality testing, packaging	Rooftop solar plant and/ or solar horticulture processors
Implementation model 2	SHG/ VO/ VDVK/ FPO	• Procurement and pre-processing (washing & grading) • Processing of value-added product at a small scale	Individual DRE appliances such as solar horticulture processor, solar/ biomass dryer, biomass stove, etc. OR Rooftop solar plant, solar dryer, biomass stove
Implementation model 3	Farmers	• Processing of value-added product at large scale, quality testing, packaging	None
	Multi-processing unit	• Cold storage facility	Rooftop solar plant, Biogas plant or other

Section 6

MOVING AHEAD -CREATING AN ECOSYSTEM TO FACILITATE DRE-INTEGRATED HORTICULTURE VALUE ADDITION

The earlier sections clearly shows that horticulture processing can play a major role in strengthening Meghalaya's economy and enhancing farmers' income. DRE integration can facilitate and strengthen this process. However, to ensure that DRE-powered horticulture processing is adopted on a wide scale in the state, there is a need to systematically catalyse and support it through:

- Technology customization and after sales services to ensure sustainability and reliability
- Skill development and capacity-building for operating the systems effectively
- Collaborative working among departments/ institutions in the state
- Policy measures to incentivize and organize DRE integration
- Access to end-user financing to increase adoption

Note: Another critical aspect of horticulture processing is the evaluation and creation of market for processed products. The team has found that market for horticulture products exists within Meghalaya and in other states. Spicy dried pineapple from Meghalaya under Anaras brand are being marketed and sold through NAFED website. Dried/ spicy dried pineapple/ pineapple juice products are already being sold on e-commerce platform such as Amazon. Canned pineapple is also imported from Philippines and Thailand in India which have price advantage against domestic canned pineapple. There is also export potential for these products. Various institutions in the state and at the central level are already supporting demand creation and market linkages for horticulture products. Market linkages and demand creation are not a subject of DRE ecosystem. Therefore, this has not been included as part of the recommendations

6.1 Technology customization and after sales services

- Assessment of the potential of deployment of DRE appliances across horticulture industry and across different regions to map the needs of beneficiaries with appropriate fit to DRE applications
- Customization of technology (capacities, design, processes) to suit the local processing requirements
- An assessment of comparative benefits of DRE options (DRE appliance vs solar PV plant vs biogas plant vs micro, pico hydro) considering availability of different renewable resources at the location
- To ensure reliability of electricity supply in the long run, maintenance and repair of DRE appliances must be provided by the vendors for the first 5 years. Vendors should also provide guarantees on DRE appliances and train local youth for simple problem-solving
- DRE appliances should be utilized for other purposes or for processing alternative fruit/ vegetables to increase their capacity utilization since it affects viability of the technology

6.2 Skill development and capacity building

- DRE technology is a new concept for rural people in Meghalaya and there is very little know-how. State government departments under their existing

programmes may take up awareness campaigns on importance of processing and how DRE can help

- Trained workforce within the state will be required for installation and maintenance. Partnership with technical institutes to develop and impart technical training to rural/ tribal people on DRE technology and its usage
- Technology providers to build the capacity of potential users and buyers on basic troubleshooting of the equipment to boost adoption of DRE technologies

6.3 Collaborative working among departments/ institutions

Various departments/ institutions are implementing schemes/ programs that support horticulture processing directly or indirectly. Co-ordination and collaboration among these departments/ institutions to include DRE applications in their programmes and to extend support to DRE based horticulture processing in the state will be essential. Policy support, financing and institutional arrangements must connect across at least three areas: farmer, processing, and renewable energy.
A mapping of departments and institutions in terms of their significance and role has been done in the following diagram and discussed further in table.

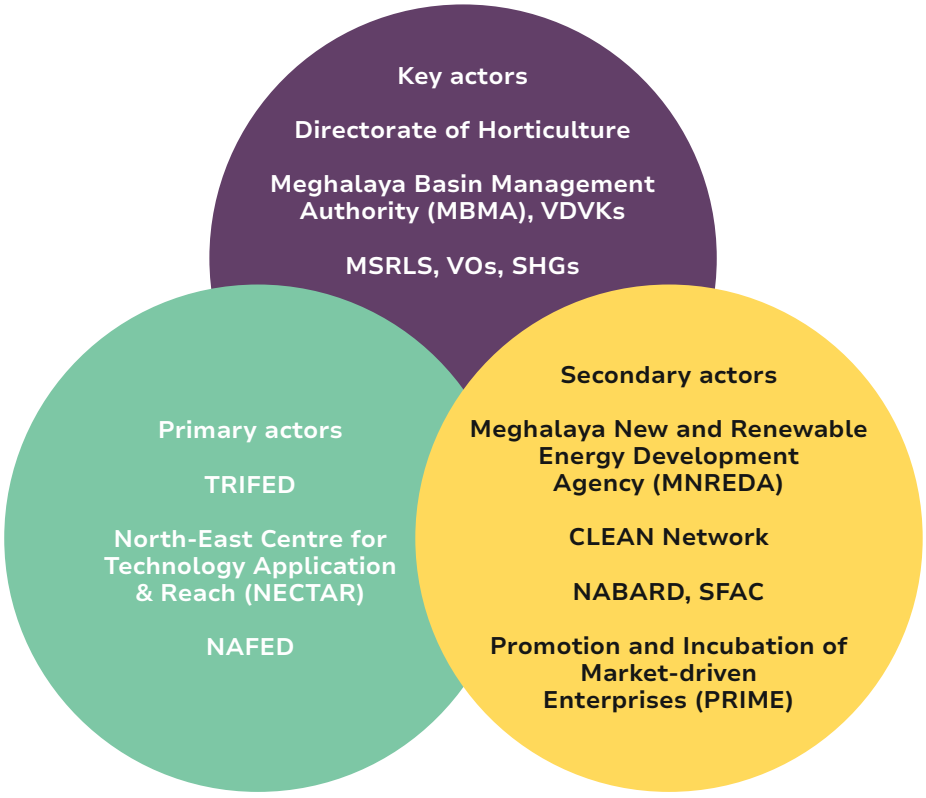


Figure 24: Mapping of relevant departments and institutions in Meghalaya

Table 16: Role and significance of relevant departments and institutions in Meghalaya

Name of the institution	Role and significance in strengthening horticulture
Directorate of horticulture	It is the nodal department of the state government to implement farmer-oriented schemes of the State and Centre and implementing the Fruit processing centre scheme for promoting processing of fruits and vegetables in the state
MBMA	MBMA is the implementing agency for Van Dhan Vikas Yojana(VDVY) in Meghalaya. The fund for equipment purchase under VDVY scheme is allocated and released by MBMA
MSLRS	It is the nodal agency for implementing NRLM in Meghalaya. MSRLS is also the mentoring agency for PMFME and VDVK scheme
TRIFED	A National Cooperative Body under the Ministry of Tribal Affairs, GoI. It is implementing Van Dhan Vikas Yojana through state nodal department and developing markets for tribal products
NECTAR	It is an autonomous society, under Department of Science & Technology, GoI. It is implementing Technology Outreach and Services Scheme which supports implementation of technologies including clean energy technologies having potential for social and economic growth
NAFED	It is a registered body having agricultural farmers as its main members. Its objective is to promote co-operative marketing of agricultural produce to benefit the farmers
MNREDA	It is the nodal agency of MNRE for implementing renewable energy policies and programs in Meghalaya
CLEAN	CLEAN is an industry body for DRE sector in India and has a network of 200+ members comprising developers, financiers, consultants. It develops and influences policies for DRE sector, bridges access to finance and assist members in accessing markets and build capacity
NABARD	It is supporting establishment of farmer producer organizations through loan linked grant support
SFAC	It is providing venture capital to agribusiness projects by way of soft loan and promoting and supporting viable FPOs
PRIME Meghalaya	State government program for incubation and promotion of enterprises in the state. It has supported various food processing enterprises like Rynsan (Savourit), Dalade Foods, among others

6.4 Policy measures for incentivizing and organizing DRE integration

Relevant policies and schemes at the state and the central level have been identified that can be used for incentivizing and supporting DRE integration in horticulture processing in the state. The following table discusses the various state level and central level policies separately and provides recommendations under each.

Table 17: State policies and schemes for promotion of horticulture processing or DRE

Policy/ scheme	Features	Recommendations
Fruit processing centre scheme (Directorate of Horticulture, Meghalaya)	• Supports manufacturing of quality processed fruit products such as squashes, jams, jellies, canned fruits and juices under the trade name “Meg” fruit products • Disseminate technical knowhow to youth entrepreneurs, farmers and housewives through practical demonstration on the importance of fruit preservation.	Supports manufacturing of quality processed fruit products such as squashes, jams, jellies, canned fruits and juices under the trade name “Meg” fruit products
CM Solar Mission, Government of Meghalaya	• Government of Meghalaya has recently approved CM Solar Mission With a commitment to fostering green and clean energy transformation • Subsidy in the range of 50-70% to be available along with back-end bank financing • Beneficiaries: individual households, public institutions, and commercial entities • A large sum of fund has been earmarked for supporting livelihood activities through solar	The guidelines of CM Solar Mission should clearly specify support to horticulture processing under types of livelihood activities that will be supported and should have provision recommending inclusion of O&M up to 5 years by the developers within government tenders for solar installations

PM Formalisation of Micro Food Processing Enterprises (PM-FME)	• Financial, technical and business support for upgradation of existing food processing units; 2 lakh micro FPIs to be supported with an outlay of INR 10,000 cr. over a period of 5 years from 2020-21
	  • Credit linked grant at 35% of the project cost with maximum up to INR 10 lakh
	  • Additional grant support to SHGs at INR 40,000 per SHG member towards working capital and purchase of small tools
		Seed capital @INR 40,000 per member of SHG may be extended to purchase of small DRE based appliances. Existing training and handholding support may also be provided on DRE technologies

Horticulture Mission for North-Eastern Region and Himalayan States (HMNEH) - Mission for Integrated Development of Horticulture (MIDH) scheme	• Assistance up to 50% of the eligible project cost with a ceiling of • Target beneficiaries: Farmers, SHGs, FPOs, Machine manufacturers • Cold storages upto 5000 MT capacity and minimal processing units are supported	Scheme should extend to DRE powered cold storages and should include small DRE appliances under primary/ minimal processing units
Van Dhan Vikas Yojana	• Involves setting-up tribal community owned VDVKs in forested tribal districts • 100% Central Government Funded with INR 15 lakhs for each 300 member VDVK Cluster • 39 VDVK cluster has been set up in Meghalaya so far in 7 districts	DRE appliances for horticulture processing should be eligible and listed under the list of equipment supported by the scheme of INR 15 Lakh per VDVK Centre

Pradhan Mantri Kisan Sampada Yojana	Creation/ Expansion of Food Processing/ Preservation Capacities (Unit scheme) • Creation of processing and preservation capacities, modernization/ expansion of existing FPIs • Grants-in-aid at 35% of the eligible project cost in general areas and at 50% of the eligible project cost in the North-Eastern and Himalayan States	The sub scheme on 'Infrastructure for agro-processing' that supports infrastructure including electricity supply/ power back-up in cluster approach should include DRE technologies for supporting VDVK centres which essentially works as a cluster scheme
	Infrastructure for Agro-processing Clusters • Grants-in-aid @ 35% of eligible project cost in general areas and @50% of eligible project cost in the North East States/ Himalayan States to a maximum of INR 10 Crore - for development of modern infrastructure including electricity supply, power back-up, for cluster based FPIs	
	Creation of Backward and Forward Linkages • To provide effective backward and forward integration for the processed food industry • Grants-in-aid @ 35% of eligible project cost in general areas and @50% for North-East States, Himalayan States to a maximum of INR 5 crore per project	

6.5 Access to end-user financing

The techno-economics of DRE use cases show in some cases the payback is quick, even within a season. Though the upfront cost of DRE equipment are often very high. Farmers are not economically affluent to bear these costs and thus easy end-user financing plays a major role in adoption of DRE appliances and scale of the sector. In some cases, subsidy support may be needed and can be integrated in existing state policies supporting livelihood.

The following financing schemes from NABARD, SFAC can be leveraged to integrate DRE in the scheme and provide easy finance to users. MSRLS can also leverage their existing institutional setup to provide financial support for the women self-help group members.

Table 19: Available financing schemes for integrating DRE/ horticulture processing

Financing schemes	Features
Producers' Organisation Development Fund (PODF) - NABARD	• Credit support, capacity building, and market linkage support • Grant amount capped at 20% of the loan amount; Initial corpus of INR 50 crore • POs can directly avail credit facility from the lending institutions
Venture Capital Assistance - SFAC (Department of Agriculture and Cooperation, Government of Indi)a	• Support of 26 per cent (40% in North-Eastern and Himalayan States) of promotor's equity or INR 0.5 crore • To catalyze private investment in setting up agribusiness; strengthen backward linkages; training and exposure visits

Section 7

WAY FORWARD

It is evident that there is tremendous need and opportunity for horticulture processing exist in Meghalaya. As per MBDA estimate, nearly INR 40,000 crore worth of fruits and vegetables are wasted each year in India. Similarly, in Meghalaya, the amount of pineapple that is wasted could be worth crores if stored and processed in a planned manner.

- Horticulture processing can play a major role in strengthening Meghalaya's economy and enhancing farmers' income
- Poor grid supply in rural areas of Meghalaya hinders the operation of electric processing machine
- DRE can help in unlocking this potential. Several DRE solutions that are affordable and scalable are available in the market
- Use cases of DRE-powered processing show healthy returns and, in some cases, payback is quick, even within a season

To ensure that DRE-powered horticulture processing is adopted on a wide scale in the state, there is a need to catalyse and support it step-by-step through:

- Awareness creation about importance of processing and how DRE can help
- Facilitating Institutional arrangements and business models
- Explicit policy support for DRE in various schemes; policy convergence through inter-departmental collaboration (horticulture, food processing, MSME, RE)
- Access to end-user financing for systems
- DRE integration- customize technology, optimize capacity utilization, maintain
- Livelihoods around DRE-powered processing and DRE itself
- Support with marketing of processed products
- Monitoring, learning, evaluation, sharing

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List of participants of roundtable consultation organised on August 01, 2023 at Shillong

Participants of Roundtable Consultation
'Decentralised Renewable Energy for Horticulture in Meghalaya'
August 01, 2023 at Hotel Courtyard by Marriott, Shillong, Meghalaya

Sl No	Name	Organization
1	Mrinal Krishna Choudhury	Consultant (CLEAN)
2	Aiban Swer	Soil and Water Conservation, Meghalaya
3	Nayana Hazarika	AIC SELCO
4	Mousumi Hazarika	AIC SELCO
5	Besii Hriggio	Samunnati Foundation
6	Ricky Renth	Bethany Society
7	PK Marbamang	Bethany Society
8	SG Christopher	Animal Husbandry and Veterinary Department, Meghalaya
9	P Sahoo	NABARD
10	Badahun Phawta	Directorate of Dairy Development, Meghalaya
11	Randorph S Diengdar	Sammunati Foundation
12	Nangsan Khwaqwis	Directorate of Soil and Water, Meghalaya
13	Banteilang S Mannar	SELCO Foundation
14	Rkhestar Wahlang	SELCO Foundation
15	looluti Niang	MSRLS
16	Androny K Lyngkhoi	Directorate of Food Processing, Meghalaya
17	Pavithra Sinha	Shakti Sustainable Energy Foundation
18	Jeff Rani	PRIME
19	Frankie Ryanthiang	PRIME

20	MD Shadap	Directorate of Food Processing, Meghalaya
21	Linnai Margaret	MOSONIE Socio Economic Foundation
22	Ringbila Pungding	MOSONIE Socio Economic Foundation
23	Fastar Khorsurai	SELCO Foundation
24	Wungsheng Keishing	SELCO Foundation
25	Dipti Nair	MSRLS
26	B Plaeu	MSRLS
27	SF Lyngdoh	MSRLS
28	Fidelia Kharbargaon	MSRLS
29	Babiangmon Lapang	Village Organization
30	Helina Mohr	Village Organization
31	Simanta Das	NECTAR
32	Silkel M Sangma	Dairy Development, Meghalaya
33	Stacy May Shallam	SN Society
34	Kilfohlang Suting	SN Society
35	Cherrylana Waifah	SN Society
36	Liti D C Sohtun	Agriculture Department, Meghalaya
37	Minha	PRIME
38	Fazle Muztaba	Envo Renewable Energy
39	Hridayananda Goswami	Purna Enterprise
40	B Mukhim	Horticulture Department, Meghalaya
41	Rekha Krishnan	WEFT
42	Vishal Toro	CLEAN
43	Tauseef Ahmad	Consultant (Renewable Energy)
44	Bishal Choudhury	CLEAN

Images of roundtable consultation organised on August 01, 2023 at Shillong

About the organizations

CLEAN

Clean Energy Access Network (CLEAN) is a non-profit organization, committed to support, unify and grow Decentralised Renewable Energy (DRE) enterprises in India. Its primary focus is on rural and underprivileged communities where reliable, affordable and clean energy plays a unique role in accelerating social, environmental and economic development. CLEAN, through its 200+ members, contributes to developing and influencing policies for the DRE sector, bridging access to finance for DRE enterprises, facilitating technology innovations, and assisting its members in accessing markets and building capacity. Its overarching mission is to mainstream DRE systems in the overall energy framework of India.

For more information, visit: www.thecleannetwork.org

WEFT

Water-Energy-Food Transitions (WEFT) Research is a development advisory focused on evidence-based policy advocacy and business models analysis. WEFT's mission is to facilitate transitions to a more sustainable and inclusive world; towards circular economy and resource democracy. Comprising a group of experienced professionals from diverse practices; WEFT's work pillars include energy transitions analysis, efficient and equitable livelihoods and climate-compatible habitats.

For more information, visit: https://weft.co.in/

CLEAN
771, Office No. 3, Mayur Apartment, Bhandarkar Road, Pune - 411004
P: +91-7683047824 E: support@thecleannetwork.org

CLEAN website: https://thecleannetwork.org/
https://www.instagram.com/cleanenergyaccessnetwork/
https://www.youtube.com/@clean-networkfordreenterpr6603/featured
https://www.linkedin.com/company/clean--clean-energy-access-network/
https://twitter.com/thecleannetwork
IREAP: https://ireap.thecleannetwork.org/