DRE for Livelihoods

Translating potential to action

Odisha roadmap



cKinetics
Accelerating Sustainability

About cKinetics

cKinetics is a mission driven Sustainability Insight, Innovation & Capital Advisory Firm. We work with businesses, investors, industry groups as well as thought leaders to continually generate market insight and catalyze change. cKinetics leverages thought processes for accelerating sustainable business and investing practices that include: (a) Closed loop systems, (b) Decentralized production and consumption, and (c) Resource conservation.

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Introduction

Productive Use of Renewable Energy- a promising lever to support livelihoods

There has been a growing push for coupling of DRE (Distributed Renewable Energy) solutions with global sustainable development goals pertaining to economic growth, good health and well-being and livelihoods. Interventions in this sphere have witnessed an increase over the past few years. These interventions collectively characterized as Productive Use of Renewable Energy (PURE) aim at enhancing income generation opportunities and productivity.

Productive use includes use-cases for Agriculture, Livestock and Non-farm enterprises-based activities each addressing key challenges in the rural economy. An overview of the different interventions in the sector is synthesized below.

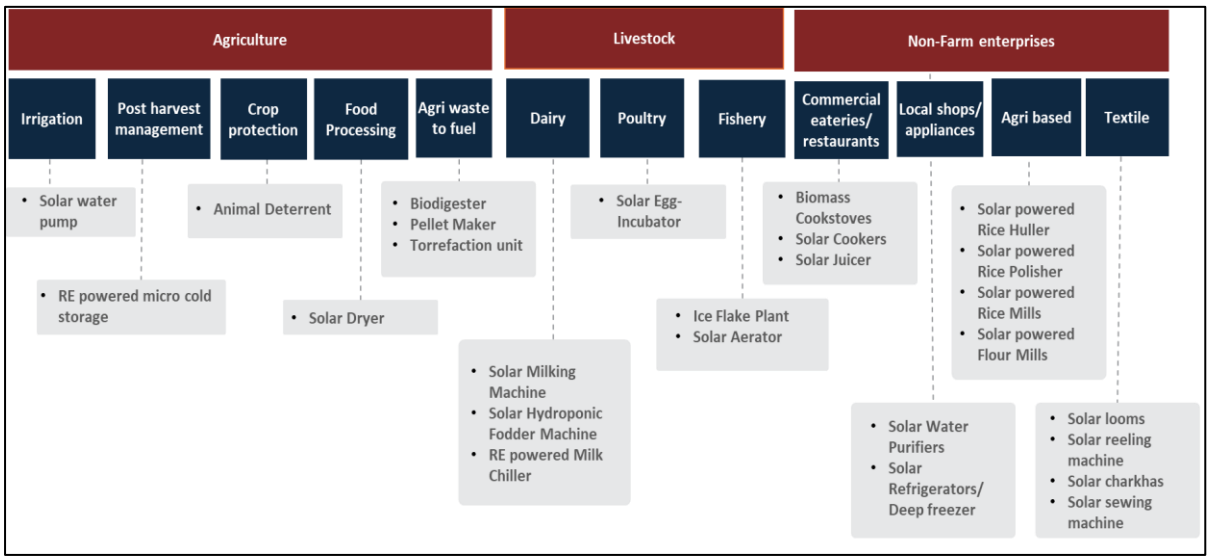


Figure 1: Segment classification and key DRE solutions catering to different livelihood areas

Even as more than 200 institutions (cutting across commercial and social enterprise space) are actively engaged in formulating and deploying DRE interventions for livelihoods, the product and customer development ecosystem for such DRE solutions is still evolving and not matured. Only a few solutions /segments are at commercial /near commercial scale.

Several of the DRE livelihoods intervention areas represent significant potential, however a comprehensive strategy to trigger adoption at scale is needed. This requires a thorough mapping of the PURE segments to identify:

a) 'addressable /serviceable potential' of various technologies
b) specific elements to scale the growth of different applications /segments
c) segments poised for significant growth in the next 3-4 years and the exact models, policy triggers and catalytic interventions needed to ensure translation of potential into resilient market demand

Despite growing availability of PURE technologies tailored to rural livelihood needs, several constraints persist that limit uptake

Given the potential and evolving opportunity, over the years, several schemes for catalyzing adoption- from solar-powered agricultural equipment to textile machineries - have been implemented with varying levels of efficacy, however significant gaps in resource allocation, demand development, and scheme efficacy have been noted in several of these initiatives thus constraining growth of the sector. A synthesis of existing policies indicates a fragmented, though desirous, ecosystem taking shape. A few points in case are discussed below:

- The adoption of solar pumps is a prominent focus across the states, and the uptake is majorly supported by the KUSUM scheme, however states like Bihar still have to adopt the PM KUSUM where considerable demand for the solar pumps exists.
- Clear targets exist in some schemes and policies (e.g. PM KUSUM, Jharkhand state solar policy etc.), enabling measurable progress tracking. However, majority of the schemes/ policies lack explicit targets adversely impacting focused outlook for scale.
- Integration and convergence across schemes are observed only in rare cases thus underlining the need to streamline efforts and improve beneficiary reach and impact.
- Even as financing mechanisms directed at some of the PURE interventions have been set up under schemes like CGTMSE, MUDRA, AIF and others, the coverage remains low due to awareness gaps as also lack of adequate entrepreneurial capacity.

This Report provides an overview of the current landscape of PURE interventions and entails a comprehensive assessment of PURE interventions to identify 'addressable /serviceable potential' across key states in the country detailing out the underlying technology and business models as also financing solutions and specific policy recommendations to scale the growth of the sector.

A robust policy framework targeting a demand led segment build out key for enabling scale

The recommendations cover priority interventions as relevant for key states segments where policy and market development interventions can help catalyze scale-up.

Market readiness has been framed per serviceable market opportunity, ease of replication across the State and current market penetration level against respective potential while the enabling conditions have been assessed per the policy efficacy, supplier readiness/ adequacy of tech support and end user financing availability.

In particular, the report looks at ways to aggregate the rather distributed demand and ways to channelize capital at scale into these areas. The findings are being framed into specific recommendations for policymakers at state/national level encompassing the facets indicated below



Approach and Methodology

The report entails a holistic assessment of DRE based livelihood segments to identify 'addressable /serviceable potential', current sectoral and segment wise momentum as also specific elements to scale the growth of the sector.

The research entailed framing a bottom-up assessment of the DRE/ PURE potential for generating rural livelihoods across different kind of interventions and assessing the level of demand and supply preparedness to appropriately address the potential.

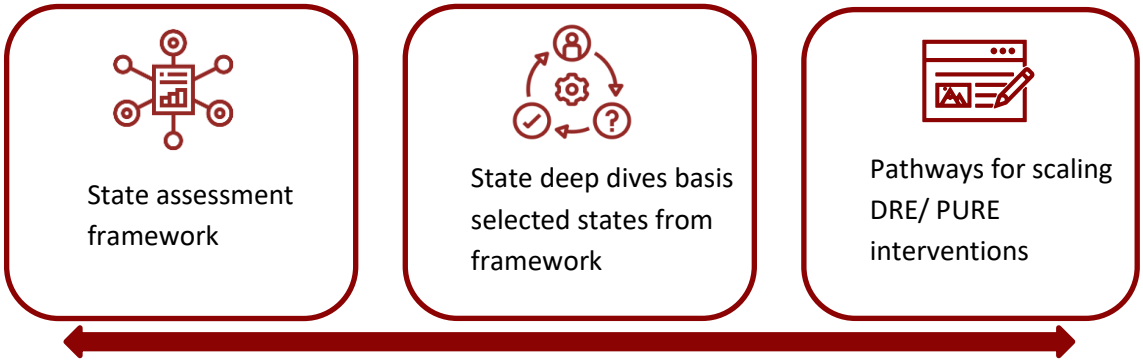


Figure 2: Methodology overview

The analysis synthesized the key factors influencing rural livelihoods leveraging DRE (i.e. PURE segment) to frame a perspective on policy efficacy for adequate replication and scale-up.

The analysis has helped identify geographies where the interventions have relatively ready market /retrofittable demand and assess the 'serviceable market opportunity' for select interventions and pathways for demand aggregation in these states.

The pathways for scaling DRE/ PURE interventions have been developed leveraging a combination of secondary research as well as primary interviews covering state government departments/ agencies, private enterprises, NGOs, technology suppliers that are active in the Decentralized Renewable Energy (DRE) and/or Rural livelihoods space in India.

Methodology for identifying States of Relevance for Deep-dive

The purposive sampling method was adopted for shortlisting states for deep dive; and the indicators adopted for the same are illustrated below.



Figure 3: Purposive sampling indicators

The wide-set screening of all states and union territories covering economic, geographic, demographic, and renewable energy factors to shortlist 14-15 states for deep dive entailed assessing the different states and Union Territories (UTs) on the indicators as discussed below.

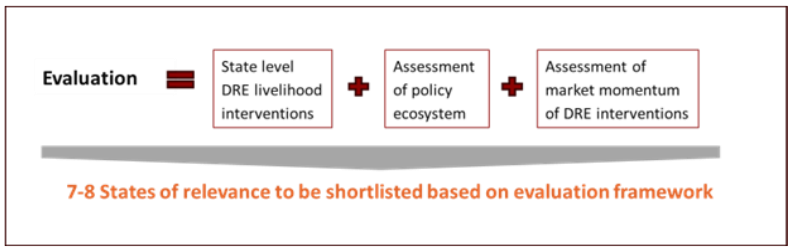


Figure 4: Assessment components of state evaluation framework

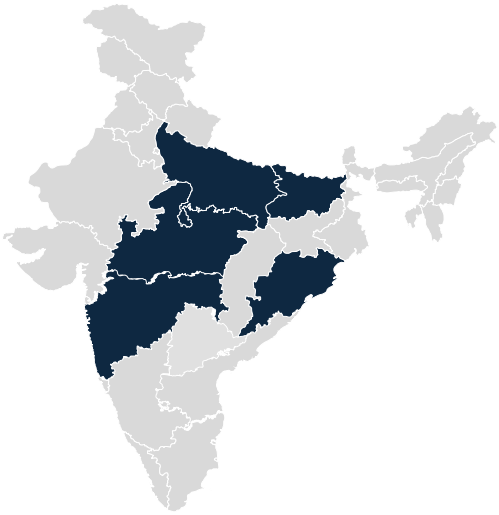
1. **Geographic Coverage:** States grouped based on climatic and ecological diversity. Each State/ UT categorized based on:
   a) Size (Small, Medium, Large)
   b) Geographic Location (North, South, East, West)
   c) Geoclimatic Zones (e.g., Warm and Humid Climate, Composite Climate, Hot-Dry, Cold climate, Temperate climate)
2. **Rural Population Density & Marginalized Communities:** Identified states with a high concentration of vulnerable populations.
3. **Rural Livelihood:** States with higher rural unemployment and potential for livelihood generation are considered.
4. **Renewable Energy Potential:** States with high solar irradiance and biomass availability were prioritized.

The synthesis is presented in Annexure 10.1. Based on the above considerations, 14 states /UTs were analyzed for their PURE potential and the enabling conditions for scale-up of priority interventions. **The assessment was undertaken on the basis of:**

a) Rural Livelihoods with energy as a core enabler
b) District wise potential viz. identified livelihood areas
c) Govt. schemes and targets related to the identified livelihoods
d) Focus of other catalysts and donors viz. the identified livelihoods in the corresponding rural areas
e) Current deployment of the concerned DRE interventions and overall market momentum /sentiment for the concerned DRE segment

The evaluation helped gauge the readiness and capability across different states viz. deploying DRE interventions and ability to truly enhance livelihoods at a ground level; leading to a **shortlist of 5 states for a deep dive per the elements discussed further along:**

1. Uttar Pradesh
2. Maharashtra
3. Odisha
4. Bihar
5. Madhya Pradesh



Approach for the state deep dive

State analysis factored in aspects of current economic development status, RE resource availability, livelihood potential in the concerned geography and presence /maturity of value chains that can effectively leverage these interventions. The analysis helped synthesize the potential of concerned PURE models in the State and spotlight:

- Overview of supply and demand factors, incl. distribution and service networks for key applications
- Potential to develop viable business case(s) for the end users
- Validation on alignment with the state priorities- mandates/policy support from states, schemes released by the state etc.

Shortlisting of intervention segments where enabling conditions and demand factors are fructifying

The analysis synthesized the key factors influencing PURE based appliances and systems to frame a perspective on policy efficacy for adequate replication and scale-up.

The selection criteria for DRE interventions across states were based on a set of supply-side and demand-side ecosystem indicators. The indicators are presented alongside.

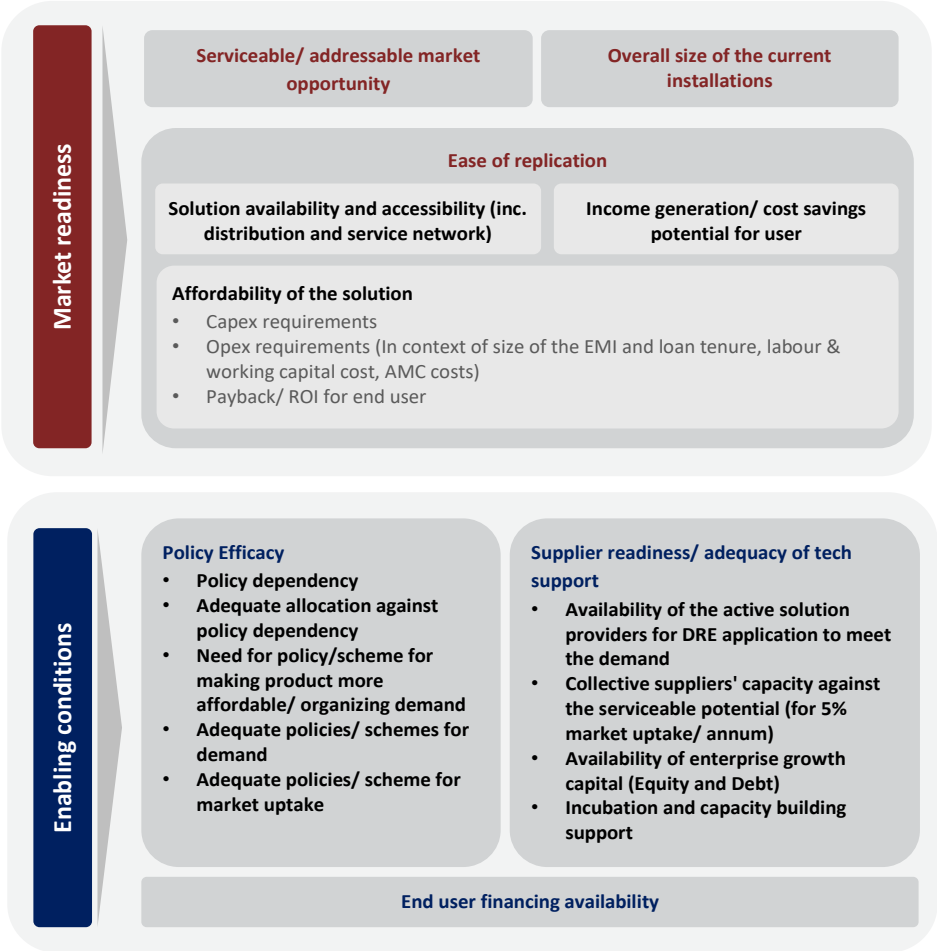


Figure 5: Parameters for DRE interventions assessment framework

Developing the state level recommendations for each key state

The process adopted for developing state level recommendations is presented below. The recommendations were crafted based on findings emerging from the research as also validated through interactions with concerned state government departments/ agencies, suppliers, program proponents etc.

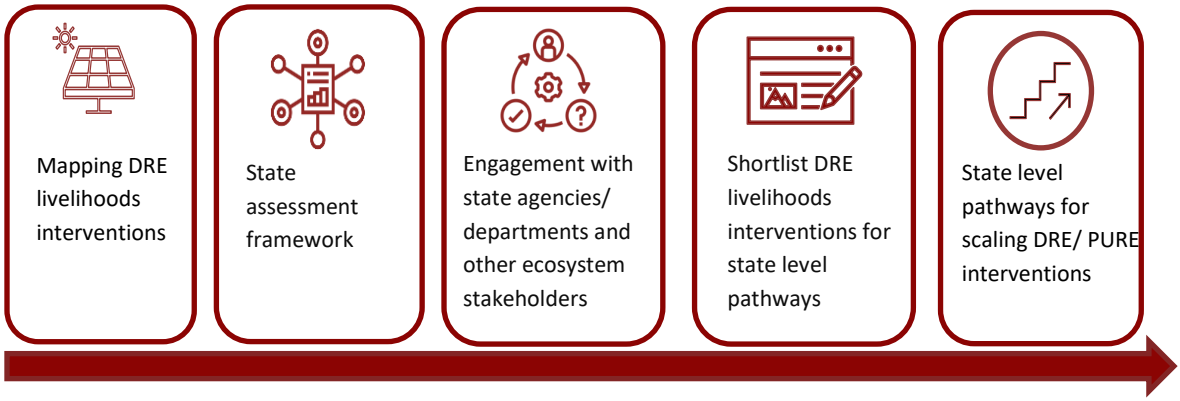


Figure 6: Process followed to develop state level pathways

Building Momentum: Odisha's emerging landscape for DRE livelihoods

Odisha, located in eastern India, spans 155,707 sq. km and has a largely rural population of over 34 million (2024). The state's economy is primarily agrarian, with a majority of its people dependent on agriculture and allied sectors for their livelihoods.

Despite this strong agricultural base, Odisha faces persistent challenges in agrarian development. Low levels of farm mechanization, frequent post-harvest losses, and unreliable electricity supply continue to limit productivity and income for smallholder farmers. These structural gaps hinder value addition, reduce market access, and make rural livelihoods vulnerable to external shocks.

At the same time, Odisha holds significant potential for DRE solutions that support agricultural livelihoods. With an average solar irradiance of 4.77 kWh/m²/day, the state is well-suited for solar-powered applications. The DRE ecosystem in Odisha is beginning to take shape, with interventions through government programs and philanthropic initiatives, though the market remains in an early stage. Given the scale of agrarian need and the state's renewable energy potential, Odisha presents a strong opportunity for deploying scalable, livelihood-focused DRE technologies that can drive long-term rural prosperity.

Potential opportunities along with the prioritized use cases in Odisha

Several of the DRE livelihoods intervention areas analyzed for the State of Odisha, represent significant potential- analysis of the serviceable/ addressable opportunity over the next 5-6 years indicates a prospective market of nearly USD 550+ mn.

However, there is a lack of clarity on the segments poised for significant growth in the next 3-4 years and the exact models, policy triggers and catalytic interventions needed to ensure the translation of the potential into actual sectoral size. In this context, a comprehensive approach for scaling up interventions which present the most opportunity in the near to mid-term and have relevance across large parts of the state has been identified.

The agriculture value chain covers the largest share of the total serviceable market with USD 250 mn in opportunities for DRE interventions with RE powered micro cold storage, Agri waste to biofuels and Solar dryer interventions being the lead segments. **The growing market potential for non-farm enterprises (USD 220 mn) signifies the increasing diversification of rural economies beyond traditional agriculture.**

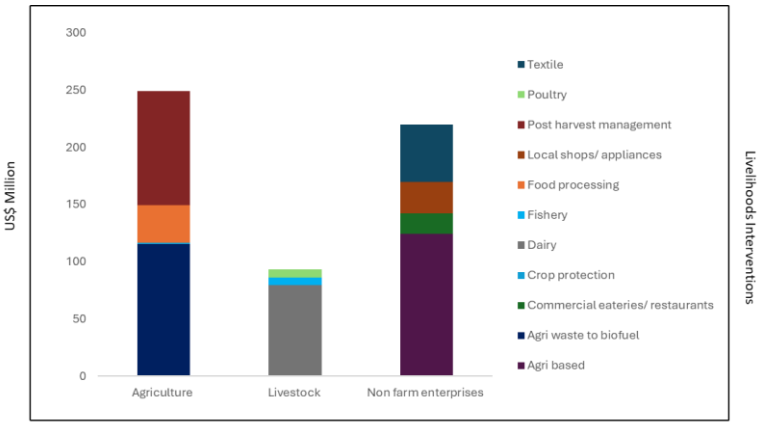
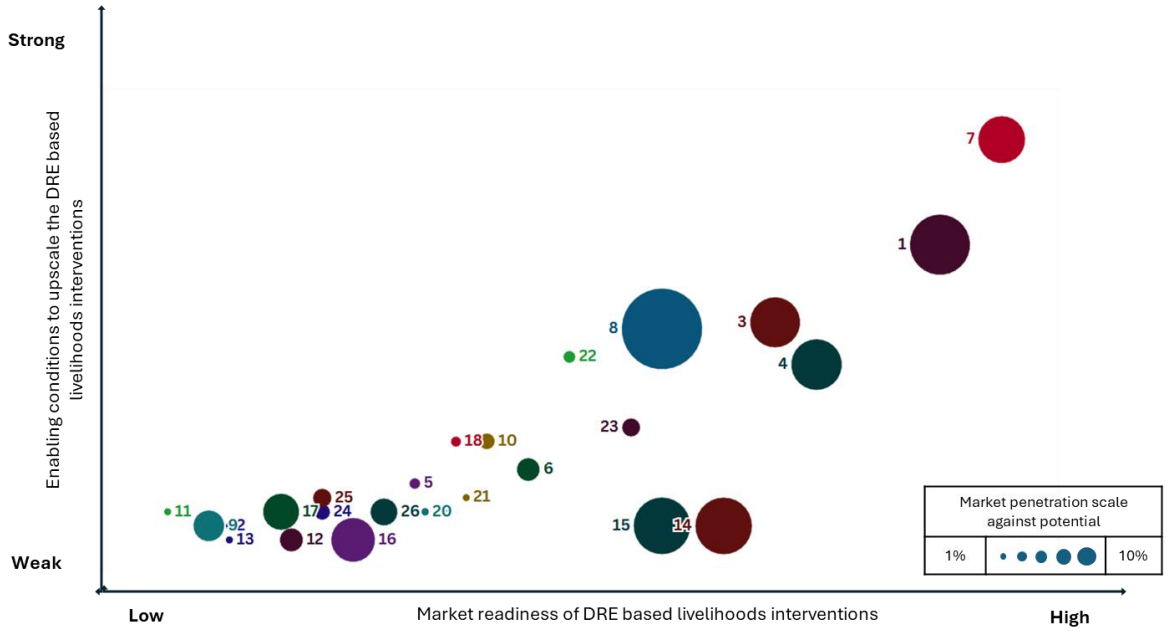


Figure7: Serviceable/ Addressable potential of DRE solutions for key livelihoods interventions

Interventions with evolving enabling conditions and fructifying demand

The framework below presents a synthesis of technologies of priorities based on their market readiness vs. the enabling conditions required for scale-up; and helps gauge the policy and market development interventions needed to ensure scale-up.



1	Micro-Cold Storage	**6**	Pellet Maker	**11**	Ice Flake Plant	**16**	Solar juicer	**21**	Solar powered Flour mills
2	Animal Deterrent	**7**	Solar Pumps	**12**	Solar Egg Incubator	**17**	Solar Water Purifier	**22**	Solar powered Rice mills
3	Solar Dryer	**8**	Bulk Milk Chiller	**13**	Solar Aerator	**18**	Solar Refrigerator/ Deep freezer	**23**	Solar powered looms
4	Bio-digester	**9**	Solar milking machine	**14**	Biomass Cookstoves	**19**	Solar powered rice huller	**24**	Solar Reeling Machine
5	Torrefaction Unit	**10**	Solar hydroponic fodder machine	**15**	Solar Cooker	**20**	Solar powered rice polisher	**25**	Solar Charkhas
								26	Solar Sewing Machines

Figure 8: Market readiness and Enabling conditions evaluation framework

		Enabling Conditions		
	Scale	Strong	Moderate	Weak
Market Readiness	High	Solar Pumps		
	Moderate		RE powered Micro-Cold Storage, Solar Dryers, Solar powered rice huller, polisher, Rice mills, Solar powered flour mills, Solar Refrigerator/Deep freezer, Bio-digester, RE powered Bulk Milk Chiller, Solar powered looms	Biomass Cookstoves, Torrefaction Unit, Pellet Maker, Solar Vertical hydroponic fodder machine, Solar Cooker, Solar Water Purifier
	Limited			Animal Deterrent, Solar milking machine, Ice Flake Plant, Solar Aerator, Solar juicer, Solar Reeling Machine, Solar Sewing Machines, Solar Egg Incubator, Solar Charkhas

Market readiness has been framed per serviceable market opportunity, ease of replication across the State and current market penetration level against respective potential while the enabling conditions have been assessed per the policy efficacy, supplier readiness/ adequacy of tech support and end user financing availability.

Given the current market landscape and enabling conditions for DRE interventions, the sector exhibits a diverse range of readiness levels, policy support, and scalability potential for different livelihoods applications in the state.

Out of the DRE livelihoods interventions assessed, even as the solar pump segment is broadly market ready with enabling conditions for upscaling in place, its pace has been hampered by thrust towards solarization of agri feeders through tail-end plants.

Outside of this, RE-powered micro-cold storage, solar dryers, and solar mills present potential, however intensification of enabling conditions is needed to truly catalyze scale. In case of RE powered micro cold storages, significant sensitization and market linkage connects are needed to trigger resilient demand (and in turn usage) in the F&V segment. The demand for the same in milk, sea food and fisheries has been continuously building up. Related to this, RE powered ice flake plants and solar aerators could emerge as key solutions to strengthen the fisheries ecosystem in the State (Odisha ranks fourth in fish production in the Country). There is potentially a great opportunity for solar aerators but a policy to catalyze sensitization and adoption is needed to translate the high serviceable potential (~20% of the total addressable market in India).

For other interventions such as animal deterrents and solar egg incubators, the overall enabling ecosystem as also the market readiness is on the lower end.

Potential geographies of opportunities for priority interventions

Odisha, being one of the top states in terms of DRE opportunities, has significant high potential clusters to support livelihood enhancement across agriculture, livestock, and non-farm sectors. The overleaf highlights the list of prioritized DRE based livelihoods interventions with high potential in the state.

Livelihood Intervention	DRE Interventions of interest	Market (Mn USD)	High potential clusters for deployment
Post harvest management	RE powered Micro-Cold Storage	100+	Ganjam, Sambalpur, Cuttack, Bargarh, Mayurbhanj
Food processing	Solar Dryer	32+	Ganjam, Sambalpur, Cuttack, Bargarh, Mayurbhanj
Fishery	Solar Aerators	7+	Ganjam, Mayurbhanj, Baleshwar, Bargarh, kalahandi
Agri based non-farm enterprises	Solar powered rice huller, polisher, mills	28+	Mayurbhanj, Ganjam, Balasore, Bargarh, Kalahandi
	Solar powered grain mills	41+	Sundargarh, Koraput, Balangir, Gajapati

Table 1: Serviceable/ Addressable potential of prioritized interventions in Odisha

In post-harvest management, districts such as Ganjam, Sambalpur, Cuttack, Bargarh, and Mayurbhanj show significant potential for RE-powered micro-cold storage, addressing critical needs to reduce produce loss and improve storage capacity. Food processing applications, particularly solar dryers, have promising deployment opportunities in the same clusters, facilitating improved drying efficiency and value addition.

The fishery sector in districts with highest inland fish production in state like Ganjam, Mayurbhanj, Baleshwar, Bargarh, and Kalahandi offers scope for solar aerator installations, which can enhance fish production and support sustainable aquaculture practices.



Figure 9: High potential districts for prioritized DRE interventions in Odisha

For agri-based non-farm enterprises, solar-powered rice hullers, polishers, and mills in Mayurbhanj, Ganjam, Balasore, Bargarh, and Kalahandi are one of the highest rice producing districts offering opportunities to develop and strengthen the rice processing value chain. Additionally, solar-powered grain mills have considerable potential for millet value chain (can be leveraged with Odisha Millet Mission) in districts such as Sundargarh, Koraput, Balangir, and Gajapati.

Analysis of key policies/ schemes influencing the DRE livelihoods solutions in Odisha

Odisha's policy environment presents a growing, though fragmented, foundation for promoting DRE solutions across different livelihoods segments majorly in agriculture and allied sectors. A range of central and state schemes currently provide financial incentives, capital subsidies, and other ecosystem development support. However, the support remains fragmented, and opportunities for convergence and scale are yet to be fully realized. The overleaf presents the analysis of schemes/ policies for key DRE segments.

Schemes/ Policies	PHM	FP	AW	DR	LA	AB	FS	Incentives/ Features
Integrated Scheme for Agricultural Marketing (ISAM)								The scheme provides a back-ended capital subsidy of 25% (subject to a maximum of INR 25 lakhs) to 33.33% (subject to a maximum of INR 30 lakhs) of the project cost.
Sub-Mission on Agricultural Mechanization (RKVY)								Proposed component in updated guidelines (May 2025) to include financial assistance @50% of the cost of the machine for small and marginal farmers, SC, ST and women farmers. 40% for all other farmers
PM Formalisation of Micro Food Processing Enterprises Scheme								To provide financial, technical, and business support for the upgradation of existing micro food processing enterprises. The scheme provides credit-linked grants to 35% of the project cost for developing common infrastructure including cold storage
National Bio-energy Program (Biogas Programme)								Provides support in setting up of small biogas plants (1 to 25 CUM) with Central finance assistance of INR 9,800/- to INR 70,400/-, and for

PHM	Post harvest management- RE powered micro cold storage	DR	Dairy- RE powered bulk milk chillers, Vertical hydroponic fodder machine
FP	Food processing- Solar Dryers	LA	Local shops/ appliances- Solar Refrigerators/ freezers
AW	Agri waste to biofuel- Biodigesters	AB	Agri based enterprises- Solar powered rice huller, polisher and mills, Solar powered Flour mills
FS	Fishery- Solar Aerators	IP	Fishery- Ice Flake plants

Legends
Direct enabling policy/ scheme
Indirect enabling policy/ scheme
State schemes/ Programs
Central schemes/ Programs
Public Private Partnership schemes/ Programs

Schemes/ Policies	PHM	FP	AW	DR	LA	AB	FS	Incentives/ Features
								power generation (25 – 2500 cubic meter/day plant capacity) with CFA of INR 35,000/- to INR 45,000/- per kilowatt for power generation
Mission on Integrated Development of Horticulture (MIDH)								MIDH is being implemented in the states as the State Horticulture Mission (SHM). As per the MIDH Guidelines 2025, beneficiaries are eligible for 35% back-ended financial assistance for solar-powered cold rooms
Gobardhan' (Galvanizing Organic Bio-Agro Resources Dhan)								Central finance assistance of INR 7,500 to INR 35,000 got individual household biogas plant with capacity up to 1 to 25 CUM, Under Swacthh Bharat Mission (G) INR 50 lakhs per district is allocated for community level/ cluster level biogas plant
Submission on Feed and Fodder Development								50% percent capital subsidy towards project cost to the beneficiary for Infrastructure development related to hay/silage at village level/ Fodder blocks making units
Mukhyamantri Krushi Udyog Yojana (MKUY)								Supports through maximum capital investment subsidy upto INR 1 Cr and maximum project cost allowed is INR 50 Cr and minimum project cost eligible id INR 5 Lakh for setting up Commercial Agri Enterprises, 40% of the fixed capital investment for general male entrepreneurs and 50% of the fixed capital investment for SC/ ST/ Women/ Trans/ PWD entrepreneurs
Odisha Integrated Irrigation Project for Climate Resilient Agriculture (OIIPCRA)								Solar cold room of 5 MT capacity and Grid electricity connected cold room of 30 MT are eligible under the project, the selection of beneficiary is as per MIDH guidelines and the pattern of assistance may/ may not be credit linked and will support 95% of the project cost maximum up to INR 14,25,000 per project
Odisha Renewable Energy Policy, 2022								Provision of large-scale deployment of solar applications such as solar food dryers shall be promoted to generate solar energy locally and in a decentralized manner to encourage its use for livelihood activities and to enable development of bio energy-based projects
MMKY- Popularization of fisheries machinery/ equipment								The beneficiary is eligible for back ended subsidy of 40% on the unit cost and promote establishing machinery and equipment at fishery value chain

PHM	Post harvest management- RE powered micro cold storage	DR	Dairy- RE powered bulk milk chillers, Vertical hydroponic fodder machine
FP	Food processing- Solar Dryers	LA	Local shops/ appliances- Solar Refrigerators/ freezers
AW	Agri waste to biofuel- Biodigesters	AB	Agri based enterprises- Solar powered rice huller, polisher and mills, Solar powered Flour mills
FS	Fishery- Solar Aerators	IP	Fishery- Ice Flake plants

Legends	
	Direct enabling policy/ scheme
	Indirect enabling policy/ scheme
State schemes/ Programs	
Central schemes/ Programs	
Public Private Partnership schemes/ Programs	

Central Policies	State policies	Adequate Targets	Market Building	Incentives	Budgetary allocations	Perspective
Post Harvest Management (RE powered Micro-Cold Storage)						
						State schemes are primarily focused on system installations, with subsidies reaching up to 95% in some programs. Various state schemes and programs, such as MKUY, installations under the Department of Horticulture, and OIIPCRA, support micro cold storage solutions at different subsidy rates
Agri Waste to biofuels (Biodigesters)						
						Bioenergy scheme launched by MNRE and Gobardhan scheme launched by Ministry of Jal Shakti are key policy enablers
Dairy (RE powered milk chillers, Solar powered vertical hydroponic fodder machine)						
						There is no specific scheme or policy promoting renewable energy-powered appliances within the dairy sector. An emerging segment in the dairy value chain is solar-powered vertical hydroponic fodder systems, which are supported under central schemes
RE powered appliances for shops/ commercial (Solar Refrigerator/ Deep freezer)						
						Although the serviceable opportunity for the solution is high, there are no schemes/ policies to scale the solutions. Also, the solution is covered under the MUDRA scheme and Priority sector lending, but uptake is low
Food processing (Solar Dryers)						
						Along with micro cold storage solutions, this has been incorporated into major schemes and policies related to the horticulture value chain and is supported under central schemes such as MIDH and SMAM, as well as state-level programs like OIIPCRA
RE powered Agri based enterprises (Solar powered rice huller, polisher and mills, Solar powered Flour mills)						
						Even as some schemes like SMAM have included the solutions for support, no concrete policies have been formulated to support the RE powered Agri-based enterprises directly

High		Low

Impetus and Catalytic Actions across different interventions

Odisha has emerged as a state of focus for DRE based livelihoods, consistently drawing attention from donor agencies, catalytic platforms, and mission-driven enterprises. This can be reflected on the past programmatic interventions from donor and catalyst organizations that have focused on leveraging clean energy for rural development, especially from tribal communities, and strengthen rural value chain. While these interventions have showcased potential, many remain at an early or exploratory stage, with limited scale and a need for stronger institutional anchoring

In 2021, UN Women, in partnership with S4S Technologies, implemented 30 solar dryers in the aspirational districts of Koraput and Rayagada deployment program targeting women farmers. Similarly, in the Tasar silk value chain, the Odisha Livelihoods Mission (OLM) partnered with social enterprise Resham Sutra to introduce solar-powered reeling machines in select clusters such as Mayurbhanj, replacing traditional manual thigh reeling methods. In 2022, Mission Shakti, the state's flagship women SHG platform, proposed a comprehensive initiative titled Mission RE-SHAKTI, in collaboration with GIZ. The proposal envisions widespread electrification of SHG-run rural enterprises using DRE technologies. As part of early-stage pilots, solar-powered spinning wheels (charkhas) and solar looms have been tested in weaving clusters to improve productivity and reduce drudgery for women artisans. Taken together, these initiatives reflect a growing recognition of DRE as an enabler for women-centric livelihoods in Odisha. However, most interventions so far have remained projectized, with limited mainstreaming into government schemes or commercial financing channels.

Key challenges and barriers to the opportunity for the uptake of DRE based livelihoods intervention in Odisha

Based on stakeholder interactions and analysis of the operating landscape, key enabling conditions and market challenges have been identified for targeted interventions. The table overleaf outlines intervention-specific gaps - both on the supply and demand sides- highlighting barriers that currently hinder large-scale adoption and impact.

Livelihoods interventions	Barriers for market readiness	Barriers for enabling conditions
RE powered Micro Cold Storage	• Underutilization of the asset due to lack of adequate market linkages at the first mile - structured market led demand still missing • Lack of confidence in technology and awareness on the use cases – lack of wide array of standardized products and inability of first mile end-users to verify claimed specifications • Turnaround time for service by OEMs is higher due to underdeveloped distribution and service networks.	• High dependency on govt. tendered / donor supported subsidy schemes for crafting demand • Current schemes/ policies creating an initial benchmark but not enough demand aggregation • Limited technical capacity among the implementation agencies • Variation in incentives across different schemes leading to confusion among the beneficiaries; and consequently, slower adoption

Livelihoods interventions	Barriers for market readiness	Barriers for enabling conditions
		• Limited knowledge among the beneficiaries for available end user financing options
RE powered Mills	• Beneficiaries are hesitant to adapt to the newer technology due to unfamiliarity with the solution; as also perceived concerns on ability to operate during rainy season vs the diesel counterpart • Strong potential for income generation/ savings is offset by significant upfront costs, along with longer payback	• Lack of dedicated scheme/ policy at central and state level • Limited incubation and capacity building support for technology providers and installers to formulate requisite demand aggregation • End-users financing options seen as limited due to higher loan sizes, outside the typical range of MFI /SHG financing ecosystem, and require collateral
Solar Dryers	• Limited uptake by individual farmers due to lack of market linkages for offtake of the dried produce • Lack of training and usage support for end users for product usage • Lack of standardized products and verification process • Limited after sales support due to tech providers operating from distant locations	• Lack of dedicated targets /allocations in current schemes • Access to credit available through PSL, MUDRA, AIF but underutilized due to limited awareness among the farmers
Solar Aerators	• Lack of requisite level of familiarity with the technology and lack of awareness among farmers about the benefits of solar-powered aerators • Lack of awareness among agencies about viable business models and appropriate implementation sites • Limited evidence of scalable and replicable models in the state, despite higher market potential compared to other states	• Lack of dedicated scheme/ policy at central and state level • Inadequate availability of reliable suppliers and service providers for Solar based Aerators • Lack of end user financing availability

Policy elements and programmatic framing for upscaling the prioritized DRE livelihoods interventions in Odisha

The identified DRE livelihoods applications can only achieve their potential uptake if policies and business models are set into place. The findings are being framed into specific recommendations encompassing the facets indicated below. An overview of the areas in which actions are deemed necessary for the uptake and prioritization of these technologies in Odisha is summarized below.

Action Areas	RE powered micro cold storage	Solar powered mills	Solar Dryer	Solar Aerators
Demand aggregation	✓	✓		
Training and capacity building	✓	✓	✓	✓
Market linkage support	✓		✓	
Standardization and quality assurance	✓	✓	✓	✓
Strengthen distribution and service ecosystem	✓			✓
Access to affordable end user financing	✓	✓	✓	✓
R&D and incubation support for tech suppliers to optimise product specs.	✓	✓		✓

Table 2: An overview of action areas necessary for uptake of DRE livelihoods interventions

Policy Elements	Key Programmatic Components	Key Institutions
RE powered Micro cold storage at on farm/ near farm within the horticulture value chain		

Demand Assessment & Project Development	• OREDA to enable demand assessment and right beneficiary selection; can be sharpened by institutional convergence across key state agencies *(as indicated under Key Institutions)* to avoid fragmented efforts by different departments
	• Conduct demand assessment and identify priority blocks from the high potential deployment clusters i.e. Ganjam, Sambalpur, Cuttack, Bargarh, Mayurbhanj etc. via Odisha Livelihoods Mission leveraging SHG/ Producer companies' network at block level
	• Map existing SHGs and producer companies led income generating activities in fruit and vegetable clusters and assess the extent of post-harvest losses in those clusters. This can be undertaken in collaboration with OLM, which has active SHG members engaged in vegetable-related livelihoods including mushroom cultivation (8,024 members), floriculture (875 members), and hybrid vegetables (7,096 members) - already linked with the Directorate of Horticulture and also the 49,900 producer companies' members
	• Include micro cold storage demand in State Agriculture Plan (SAP) and District Agriculture Plan (DAP)
	• Set up block-level Horticulture Cold Chain Working Groups with representatives already active at the district level from OLM, ORMAS, Horticulture, APICOL, and KVKs
	• Directorate of Horticulture to identify crop cycles- include produce-specific seasonality, region-wise horticulture surplus, and market access gaps in the high potential clusters.
	  ○ Assess the availability and functional status of existing cold storage infrastructure in these clusters to identify critical gaps and avoid redundant investments
	  ○ Evaluate the distance from key market linkages and aggregation points to prioritize locations where cold
		OREDA, Odisha Livelihoods Mission, Directorate of Horticulture, DAFE, APICOL

Policy Elements	Key Programmatic Components	Key Institutions
	storage solutions can enable quicker uptake, reduce post-harvest losses, and improve market integration for producers	
Supplier Innovation & Standardization	• Mandate integration of MNRE and NCCD cold storage specifications in future tenders for product performance assurance • Prioritize empanelment of vendors in tenders that maintain a local service presence and can ensure a defined turnaround time of no more than 36 hours, given the limited shelf life of perishable produce. This will help minimize downtime and prevent post-harvest losses • Mandate a comprehensive Annual Maintenance Contract (AMC) for a minimum duration of 3 years, with a preference for extending it to 5 years, to ensure sustained performance and timely servicing of deployed assets • Mandate integration of IoT-based remote monitoring systems to enable real-time tracking of asset functioning and utilization, thereby supporting proactive maintenance and optimizing performance	OREDA
Skill Development & Capacity Building	• The Skill Council for Green Jobs (SCGJ) under NSDC could collaborate for capacity building among employment-related training institutes such as Rural Self-Employment Training Institutes (RSETIs) and the National Institute of Rural Development (NIRD) to leverage their existing focus on rural entrepreneurship in the cold storage sector • Enhance and integrate training modules for on-ground technicians by incorporating cold storage systems into existing skilling programs, such as the Surya Mitra Skill Development Program under the National Institute of Solar Energy (NISE), to ensure technical readiness and field-level service capacity • Train local technicians on installations, repair, maintenance checks and infra specifications for RE powered micro cold storage systems under Rural Self-Employment Training Institutes, National Institute for Rural Development, Skill India and Surya Mitra scheme • OUAT to develop crop-specific handling and post-harvest operation modules for ICAR institutes, KVKs, and ICER institute to deliver location-wise, commodity-specific cold storage training for SHGs, FPOs and create district-level training program to scale outreach • District Industries Centre (DIC) to extend support to entrepreneurs on project feasibility and develop financial proposals in line with the prerequisites from the financial institutions • Strengthen beneficiary capacity by enabling structured market linkages via ORMAS, ensuring consistent off-take and optimal asset utilization.	NSDC, NISE, NIRD, RSETIs, OUAT, ICAR institutes, KVKS, ICER institute, DIC, ORMAS

Policy Elements	Key Programmatic Components	Key Institutions

Access to Finance	• To mitigate concerns on high upfront capital burden as also access for the same, promote lease-to-own or pay-as-you-go models to enhance economic viability end beneficiary for the and improve asset utilization
	  ○ Vendors may partner with financing entities to offer a lease-to-own model for FPOs and SHGs. Vendors can secure financing from these institutions to deploy the model
	  ○ The model can be supported by offering partial risk guarantees to financiers or viability gap funding for the installer during the initial years of operations
	• Convergence of schemes such as MIDH/ PMFME can be leveraged for credit-linked subsidies, while AIF can be utilized to avail interest subvention benefits
	• NABARD can play a key role in facilitating capacity-building programs for financial institutions, focusing on business models and the range of relevant schemes through which loans for MCS can be accessed
	• Credit guarantee fund managed by Nabsanrakshan can further enhance the access to finance by providing credit guarantees for loans extended to FPOs thereby reducing the perceived risk for lenders and encouraging credit flow for the first time borrowers
		NABARD, OLM, OCSB

Solar powered mills in rural areas (Rice, Millets, Wheat etc.)		

Demand Assessment & Project Development	• For retrofit, identify the existing diesel mill usage across PVTG PVTG (Particularly Vulnerable Tribal Groups) clusters via OPELIP. Use OMM's block-wise database to map existing diesel and manual flour/rice/millet mills in Kandhamal, Rayagada, Koraput, Keonjhar, Nuapada, and other high millet production clusters
	• Map all PVTG cluster-level diesel mill installations especially in districts like Malkangiri, Nabarangpur, and Gajapati to prioritize locations where existing mills are underutilized and face challenges due to erratic electric supply
	• OREDA to promote the adoption of solar-powered milling units in the identified clusters, aligning with the objectives of the Odisha Renewable Energy Policy, which emphasizes the use of solar energy for promoting use of solar energy for livelihood activities
	  ○ Integrate inclusion/ upgradation of Solar into existing Odisha Millet Mission already targeting establishment of processing units for millets
	  ○ Promote the inclusion of solar-powered mills in the Odisha PVTG Empowerment & Livelihoods Improvement Programme (OPELIP) to improve access to milling facilities in areas
		OPELIP, OMM, OREDA, OLM

Policy Elements	Key Programmatic Components	Key Institutions
	○ Implement block-level pilots under OREDA to showcase viability and lifecycle cost benefits of solar-powered retrofitting • Promote the integration of solar-powered milling units with SHGs and paddy procurement clusters supported by OLM. Solar mills may be positioned in proximity to existing Paddy Procurement Centres (PPCs) and Millet Aggregation Points to ensure higher utilization and operational efficiency	
Supplier Innovation & Standardization	• To prevent the VOC of the solar array to drop on cloudy days, which may lead to mismatch or failure to start the motor- the VFD rating to defined • Standardize the selection and specification of Variable Frequency Drives (VFDs) in solar-powered rice hullers, polishers, and rice/ grain milling units to ensure compatibility with local solar array designs, particularly considering VOC (Open Circuit Voltage) and cloudy-day performance ○ MNRE may issue national technical guidelines for solar agro-processing systems, similar to those under PM-KUSUM/ RE powered cold storage ○ BIS (Bureau of Indian Standards) to develop performance standards for VFDs and solar-powered mills • APICOL, as the state nodal agency for agri-enterprise promotion under schemes like MKUY, may integrate these technical specifications for VFD compatibility and solar array design requirements into vendor empanelment criteria and subsidy eligibility guidelines	MNRE, BIS, OREDA, APICOL
Skill Development & Capacity Building	• Work with the Skill Council for Green Jobs (SCGJ) and MoFPI to develop and deliver capacity-building programs specifically focused on solar-powered mills. This could include partnerships with RSETIs and NIRD, which already focus on rural entrepreneurship • State level training institutes of RSETI and NIRD to impart training to district level resource institutions which shall further train the beneficiaries at district level on operations, maintenance procedures and also the technical specifications of Solar array system and mechanical milling operations	SCGJ, MoFPI, RSETI, NIRD, SLTIs
Access to Finance	• Encourage system installers to co-develop bundled solution offerings in partnership with financial institutions, wherein product deployment is integrated with pre-approved end-user financing packages • Appropriate long-term asset financing to be facilitated to the beneficiary as the business returns are dependent on the future cash flows	OREDA, Financial institutions
Solar Dryers		
Demand Assessment &	• Conduct demand assessment and identify priority blocks from the high potential deployment clusters i.e. Ganjam, Sambalpur,	OLM, OREDA, Directorate of

Policy Elements	Key Programmatic Components	Key Institutions
Project Development	Cuttack, Bargarh, Mayurbhanj etc. via Odisha Livelihoods Mission leveraging SHG/ Producer companies' network at block level • Promote installations under Van Dhan Yojana already enabling entrepreneurship among tribal communities and identify horticulture dominant VDVK clusters with TDCCOL and, SC/ST Development Department	Horticulture, TDCCOL, SC/ST Development Department, ORMAS
Supplier Innovation & Standardization	• Develop and roll out technical standards and quality benchmarks for various types of solar dryers to be led by NISE and BIS and OREDA to adopt these standards in local context o Define output parameters like moisture content targets, drying time ranges, temperature consistency, load capacity and drying time o To maintain compliance with food-grade material standards and post-harvest hygiene requirements	OREDA
Skill Development & Capacity Building	• OUAT to develop post-harvest processing modules for ICAR institutes, KVKs, and ICER institute to deliver training to the district level resource institutions/ partners • Facilitate structured training support through ground partners/ resource institutions for SHGs and farmers on the operational protocols, hygiene maintenance practices, and commodity-specific techniques for cutting, chopping and slicing to optimize the drying time • Conduct exposure visits to mandis/ wholesale markets to familiarize the beneficiaries with the prices, helping them manage and reduce input costs, and facilitate access to eNAM platform • Leverage ORMAS to strengthen market linkages by facilitating structured market access for farmers, enhancing produce offtake through organized retail channels, and integrating farmer networks with established food processing value chains	OUAT, KVK, ICER Institute, ORMAS
Access to Finance	• Establish financial linkages (under MUDRA, AIF etc.) through the existing networks of OLM's Business Correspondence Agents (BCA) in districts to reach unbanked and underbanked gram panchayats • Use OLM's Business Correspondent Agents to conduct financial literacy and loan facilitation at Gram Panchayat level	OLM, OGB, OSCB
Solar Aerators		
Demand Assessment & Project Development	• Conduct demand assessment and implementation site identification through FISHFED for clusters using diesel aerators, high potential clusters to be looked at i.e. Ganjam, Mayurbhanj, Baleshwar, Bargarh, kalahandi • OREDA to Incentivize for transition from diesel-based aerators to solar based systems • Implement pilot demonstrations for solar retrofitting of diesel-powered aerators through OREDA and the department of	OREDA, Dept of Fisheries, FISHFED, OLM

Policy Elements	Key Programmatic Components	Key Institutions
	fisheries to leverage the state's potential for aerators in inland waterbodies • Integrate inclusion/ upgradation of Solar into existing Mukhyamantri Matsya jibi Kalyan Yojana (MMKY) already promoting machinery and equipment at fishery value chain	
Supplier Innovation & Standardization	• Implement Solar aerator designs suited for Odisha's pond ecosystem with anti-corrosion, DO-sensor and Standard Oxygen Transfer Rate (SOTR) monitoring integration for future installations • Enforce minimum quality benchmarks in tenders for rotational speed, oxygen delivery, and solar panel durability	OREDA
Skill Development & Capacity Building	• Extend training support to end user beneficiaries on operational protocols, maintenance, aeration techniques, monitoring of water parameters like dissolved oxygen levels (DO) through ICAR-Central Institute of Freshwater Aquaculture (ICAR-CIFA), Fisheries Training Institute (FTI), Balugaon and other sectoral partners	ICAR-CIFA, FTI
Access to Finance	• Solar-powered aerators may be considered for inclusion in the eligible equipment list under MMKY to support energy-efficient and sustainable aquaculture practices	Fisheries & Animal Resources Development Department