



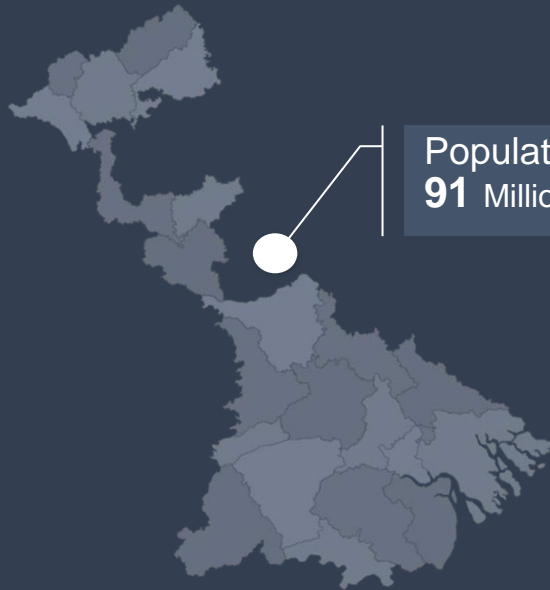
Integration of Inland Waterways Transportation in the Cold Chain in West Bengal - Technologies, Gaps and Policy Interventions

West Bengal at a Glance

A GDP of
204.64 billion USD

FY 2020-21

West Bengal is the fourth largest state economy in India, it contributes about 10 % of the country's GDP.



Population:
91 Million



Inefficient flow of freight traffic, unplanned land use, insufficient transport investments, and fractured institutional coordination.



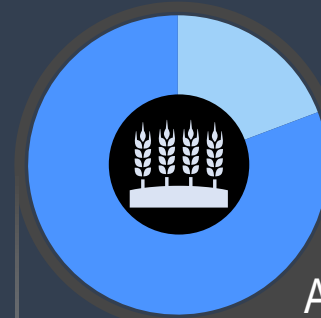
Contributes 14.8 million tons GHG emissions to the country. Transport is responsible for 18% of the total CO2 emissions



Strategic location and potential for inland waterway transportation



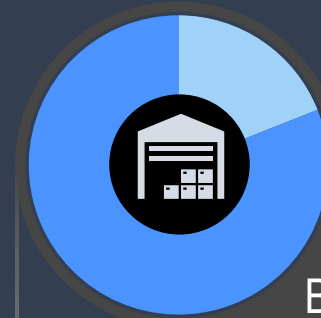
IWT is capable of reducing transport GHG emissions. For every tonne-Km transported on water, the GHGs are **50 %** of that by road.



21%

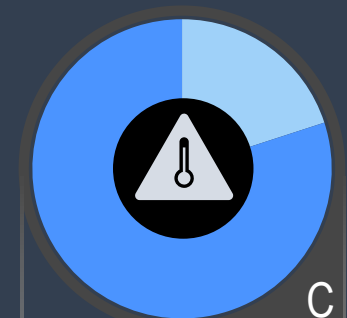
Contribution of
Agriculture to the
states GDP

FY 2019-20.



19%

of India's cold
storage capacity is
located in West
Bengal (90 % is
dedicated to potato
storage)



20%

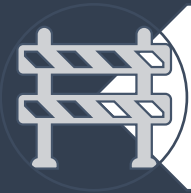
of post-harvest fruit
& veg losses in the
state is attributed to
a lack of TCL.

West Bengal IWT, Logistics and Spatial Development Project (WBILSDP)

Development Issues



Fragmented institutions, policy and planning



West Bengal cannot capitalize on its strategic location and there is severe congestion



River transport is unsafe, underdeveloped and has limited accessibility due to insufficient planning

Opportunity to include considerations of Temperature Controlled Logistics (TCL) when improving waterway transport

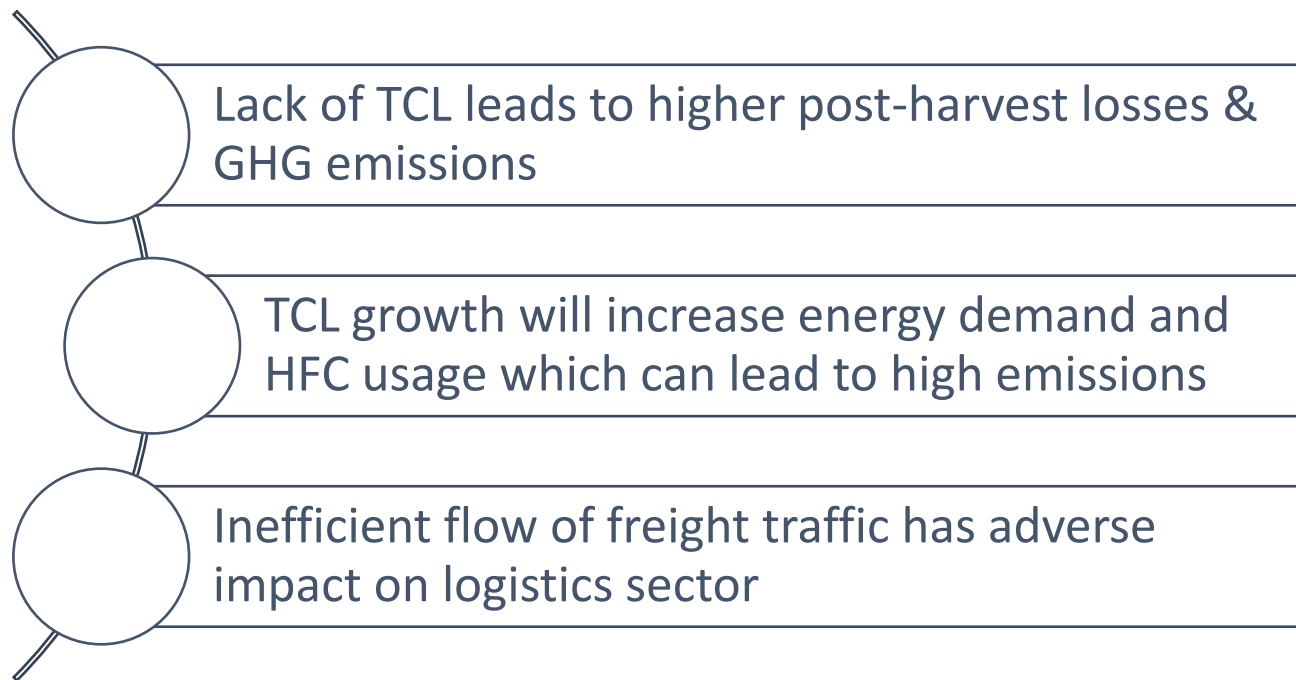
Improve efficiency and safety across Hooghly River

Establish Planning framework to enhance Kolkata Metropolitan Area (KMA) accessibility

Key Objectives

Integration of Inland Waterways Transportation in the Cold Chain in West Bengal

Development Issues



Strategic guidance & knowledge base for investment prioritization of HFC phase-down in cold chain transportation in West Bengal

Objectives

Support the integration of IW in a multi-modal cold chain network and a shift of temperature sensitive cargo flows to inland waterways

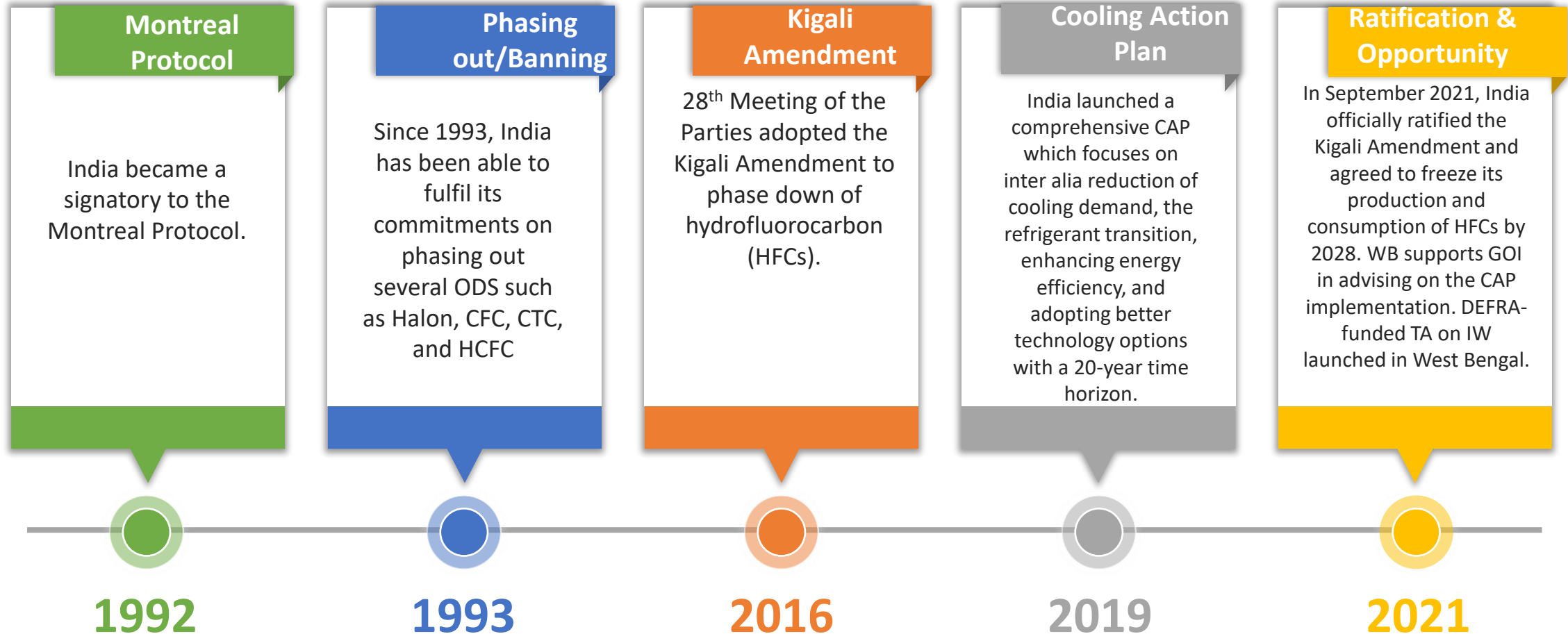
Contribution to WBIWTLSDP:

The components inform the preparation of four major technical assistances under the WBIWTLSDP:

- A spatial development strategy (SDS)
 - A logistics master plan (LMP)
 - An integrated strategic development plan (ISDP)
 - A comprehensive mobility plan (CMP) - for the Kolkata Metropolitan Area (KMA).
-
- One of the pilots for the integration of IWT in the cold chains could be financed under **Component C: Infrastructure Investments to improve water transport of the WBIWTLSDP.**

India's Commitment to Sustainable Cooling

And Sustainable Temperature Controlled Logistics



Need for technology shift for West Bengal's Cold Chain

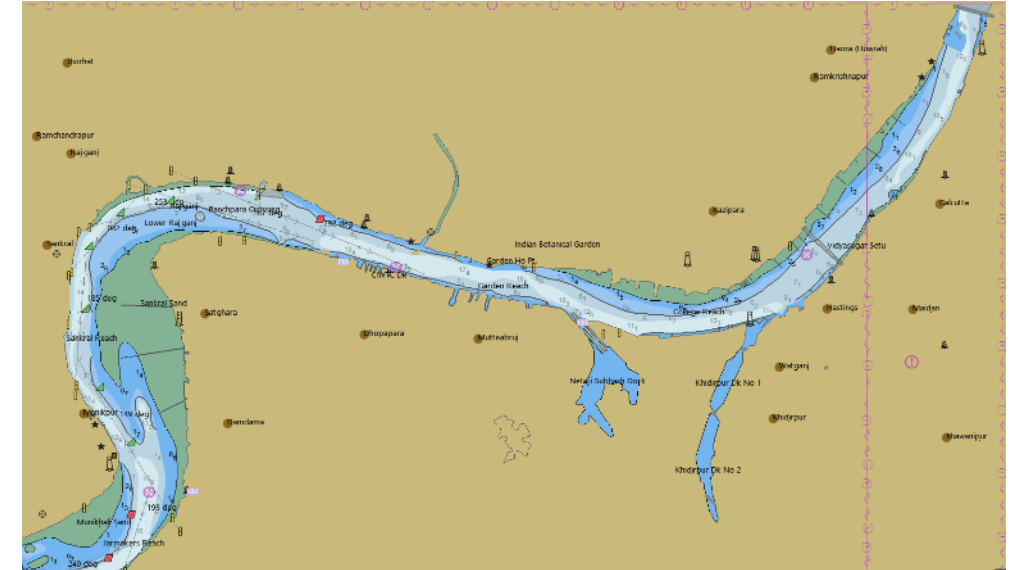
Products Considered



Key Challenges for IWT in West Bengal

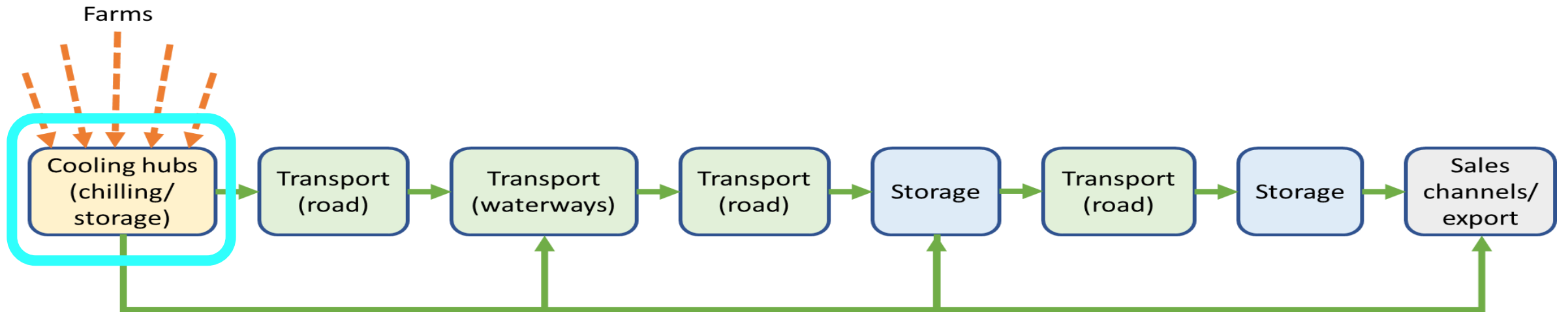
- Difficult waters to navigate
- Lack of infrastructure
- Tidal restrictions
- Currents and sandbanks
- Not all areas adequately dredged and buoyed
- Low draft in many areas
- Navigation not always possible at night
- Fuel source (avoiding diesel)
- Type of IWT transportation refrigerated trailers/ trucks/ vans/ refrigerated containers
- Volumes and return journeys

Navigational draft on NW-1



#	Stretch	Length	Average LAD
1	Haldia (Sagar) to Tribeni	193 km	4 m
2	Tribeni to Sahibganj	443 km	3 m (2 – 2.5 m during March to May)
3	Sahibganj to Bhagalpur	79 km	2.5 m
4	Bhagalpur to Barh	178 km	2.5 m
5	Barh to Patna	62 km	2 – 2.2 m
6	Patna to Varanasi	363 km	1.8 m

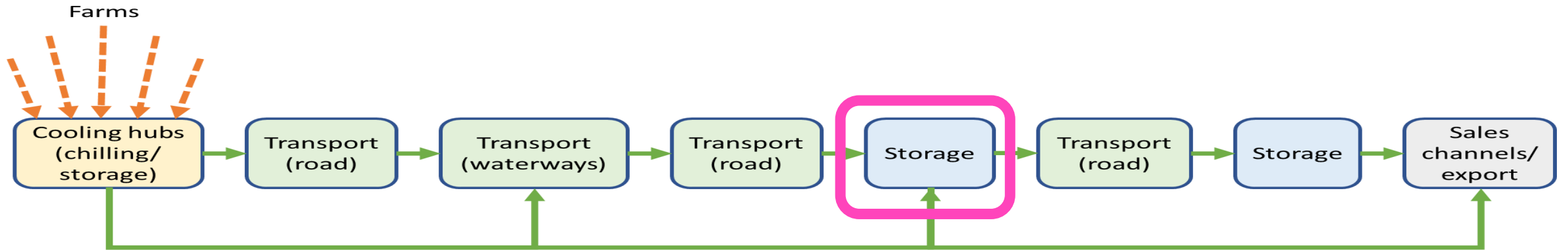
Technologies for cooling hubs



Cooling Hubs

- **Flake ice** can be used for fish
- **Ice bank system** can be used for milk/dairy
- **Air based chiller** and stores can be proposed for fruit and vegetables
- Thermal storage necessary if using RES
- Low GWP refrigerant alternatives - R513A / R450A / R518B / R454A / R449A / R1234yf/ze / R454C, etc.
- **Need business model to support** FPOs (Farmer Producer Organization) - Consortia of ~300 farms who typically utilize a 5 MT chiller and 2 x 10 MT stores, ~size that is commercially viable

Technologies for cold stores



Cold Stores

- Majority of current cold stores use R717 (ammonia)
- 20-25% energy savings possible
- ~100,000 kWh/store/yr potential
- Most paybacks 4-8 years
- Lack of experienced auditors necessitates training
- Efficiency may be improved through:
 - Removing excess heat loads
 - Control system settings and improvements
 - EC fans
 - Optimisation of the expansion device
 - Reducing Infiltration/ improving door protection
 - Repairing insulation
 - Applying low energy lighting
 - Replacing old components
 - Product temperature optimisation
 - Room temp settings
 - Service/maintenance/monitoring

Available alternative energy resources

- Solar / wind
- Biogas
- Financial viability of varied solar systems for milk chilling and food storage in India
 - Solar PV with a PCM thermal battery most preferable option when considering OPEX and CAPEX
 - Compared to solar PV with battery, solar PV with biomass, solar PV with battery and grid, solar PV with battery on grid and diesel generator or refrigerator on diesel generator



Solar PV

Promethean Power Systems - refrigeration systems for cold-storage and milk chilling - the battery bank utilizes 1000 W solar panels (~4 panels of 2.3 m²).



Solar PV

Inficold produce solar milk coolers and storage rooms.



Biogas (absorption):

New Leaf Dynamic Technologies (P) Ltd - cold storage facilities for on farm usage (5, 10 and 15 MT, 500-1000 litre milk chiller

Ship types & refrigerated vehicle types



Ferry require adequate draft



Dedicated Container Barge
Only containers



Local Ferry
Cargo and people



Cargo Cat
Low draft fast and flexible



Transport refrigerants and costs

Transport units typically use HFC134a or HFC-404A

Current alternatives to HFC-134a are HFC-blends such as R513A and eventually R1234yf or R290 (stand-alone)

Current alternatives to HFC-404A are HFC-blends such as R452A and eventually R455C or R290 (stand-alone)

Transport Refrigerant Costs:

- Depends on the quantities purchased and the type of refrigerant
- Newer lower GWP refrigerants tend to be more expensive, some flammable (A3) or mildly flammable (A2L)
- Often lack of availability in India

Refrigerant	Class	Cost/kg (INR)	ODP	GWP (100 yr)
R717	B2L	62	0	0
R1234yf	A2L	2176	0	<1
R744	A1	800	0	1
R290	A3	250	0	3
R455C	A2L	~2100	0	146
R513A	A1	1396	0	631
R449A	A1	1473	0	1397
R134a	A1	543	0	1430
R22	A1	620	0.055	1810
R452A	A1	2249	0	2140
R404A	A1	1086	0	3922

Policy & institutional reforms for higher adoption of improved technologies and greener cold chains

The Government of West Bengal needs to set clear directional guidelines to indicate financial risks in not adopting energy efficient technologies

Extend energy labelling for cold chain infrastructure in West Bengal

Strengthen measures to standardize and modernize the vessel fleet

Promote technology and products for transportation that are green, low carbon, potential to be recycled

Regulate a phase-wise shift to LNG and other alternative fuel in West Bengal

- Provide tax relief on new equipment
- e.g. Enhanced capital allowance dependent on energy efficiency (e.g. UK & France)

Possibly impose a Green Levy i.e tax on polluting substances and use revenue to finance green initiatives

Design financial incentive programs for market players who choose technologies to shift to greener cold chain solutions

- *It can be difficult to shift to new refrigerants and fuels whilst existing ones are readily available at cheaper cost*
- *Government may levy **tax on polluting refrigerants/ fuels**, or control their **supply by increasing the price** and make greener alternatives competitive*

Role of Govt/private sector in the development of IWT

Role of public sector

- Set up a **network of strategically placed jetties with loading cranes and barges with container power supplies.**
- Set up **LNG terminals at major harbors** and jetties for alternative vehicular fuel options.
- Support the setting up of **electric charging infrastructure at all major terminals**
- **Promote greener refrigerants** and **regulate cost** of greener refrigerants in West Bengal
- Support the private sector by providing **adequate fiscal incentives** to facilitate investment in greener cold chain technologies
- Drive **technology transfer** from developed countries
- **Provide training to up skill** refrigeration engineers to be able to handle zero and low GWP refrigerants

Role of private sector

- **Channelize investment in greener technologies** in West Bengal's cold chain
- Phase down high GWP refrigerants and **shift to lower / low / zero GWP refrigerants**
- Invest in **alternative fuel fleets**
- Invest in **efficient low carbon transportation technologies** in West Bengal