

**COMMERCIALIZATION OF  
RENEWABLE ENERGY:  
ICE MAKING AND  
COOLING**

J.A. Verschelling MSc  
Ir Q. Sluijs

June 2000  
E25155

Assigned by UNEP/AREED

## SUMMARY

---

There is a large and growing demand for chilled and frozen goods in developing countries. In most cases, the electricity for cooling/freezing can be supplied by the grid. In areas where no grid is available, fuel cost are high and where transport of ice from other places is hard, costly or unreliable, there may be a market for renewable energy (RE) ice making or cooling.

### PMCs

There are four main product market combinations (PMCs) where renewable energy cooling/freezing may be commercialised:

- Convenience and tourism (chilled drinks, ice cream, ice (cubes) for domestic purposes, air conditioning);
- Agriculture and fisheries (ice for fishing, cooling of agricultural crops/fruits, meat and milk cooling)
- Health (vaccines)
- The production of refrigerators and other RE cooling appliances

The commercialisation of these PMCs largely depends on the local situation: demand for the product and value added due to cooling/freezing, availability of the grid, import taxes, kWh/ fuel cost, transport cost, etc.

Application	Technology (C= compressor based cooling, A= absorption cooling)	Maturity of the technology (comm.=commercially available, early = prototype),	Scale of the operation (small, medium or large)	Investment cost (low, med or High)	Variable cost	Conventional alternative	Desired reliability of service
<b>Convenience and tourism</b>							
Chilled drinks	Solar fridge (C) Solar Ice maker (A)	Comm Early	S M	L M	L	Grid, gas/kerosene fridge, ice from grid fridge	-
Ice cream	Solar fridge (C)	Comm	S-M	L	L	Grid, gas/ kerosene fridge	+
Ice (cubes) for domestic purposes	Solar fridge (C) Solar Ice maker (A),	Comm Early	S M	L M	L	Grid, gas/kerosene fridge	-
Air conditioning	Solar Air-co (C)	Just avail.	S	M	L	Grid, diesel	-
<b>Agriculture and fisheries</b>							
Ice for fishing	Solar freezer (C) Solar (A/C)/ Wind-Diesel Ice maker (A/C),	Comm Custom made	S M-L	M M-H	L L-M	Grid, diesel ice plant	+
Cooling of agricultural crops/fruits and meat	Solar fridge (C) Solar (A) / Wind-Diesel cool store (C)	Comm Early Custom made	S M-L	L M-H	L L-M	Grid, diesel	+
Milk cooling	Solar fridge (C)	Comm Early	S M	L M	L	Gas/ kerosene or grid fridges, ice from grid fridge,	+

	Solar Ice maker (A)					Diesel	
<b>Health (va ccines)</b>	Solar fridge (C)	Comm.	S	L	L	Gas/ kerosene or grid fridges	++
<b>The production of fridges and ice makers</b>	PV solar compression fridges and solar Ice makers (A)	Comm early.	S-M	M-H	M-H	Gas/ kerosene or grid fridges	+

### Renewable Energy products available

Unfortunately, only PV solar fridges are standard RE products widely available that can, depending on the local fuel cost and solar irradiation, compete with its conventional alternative (gas/kerosene fridges). Other products are either custom made/design products that need specialist knowledge (such as hybrid wind-diesel ice plants for fishing) or they are not yet commercially available at competitive prices (such as the ISAAC solar thermal ice maker and the ECN mobile outlet for cold drinks).

### Market indicators for RE cooling and ice making

Most important indicators of markets are:

- No grid or reliable source of cheap ice available, high transport/fuel cost
- High demand for fresh and good quality products
- High value, highly perishable produce/foods
- (inter)national regulations/wholesalers requiring cooling for quality/hygiene reasons

### Conclusions

- Solar fridges are the only RE cooling/ice-making equipment widely commercially available
- If RE products are available: high up front cost, thus high risk, unfavourable for a starting business: detailed market study and planning is needed before starting a RE cooling/ice-making business.
- Low investment cost alternatives are usually widely available: gas/kerosene fridges and diesel generators for AC fridges or ice machines
- Market niches where commercial cooling / ice-making may be feasible (depending on the local situation):
  - small scale milk cooling (recommended for further study)
  - ice making for fish with wind-diesel or with series produced and optimized ISAAC
  - local production or assembly of solar fridges or other cooling/freezing equipment.

### Recommendations

- Research, market assessment and product development for RE milk cooling is recommended
- Market assessment and development of a standardised hybrid system for ice making for fish
- Demonstration, optimisation and evaluation of existing 'early' RE ice making/cooling technology (ISAAC, ECN vending cart) aimed at local series production
- Development of dedicated loans on favourable terms for investments in RE ice making and cooling that make it possible to compete with low investment conventional options