

## Energy Optimization in Seafood Processing Industries

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### Fisheries in India

India is endowed with long stretches of marine coastal line of around 8,130 kilometres and 1,95,210 kilometres of rivers and canals, 2.9 million hectares of minor and major reservoirs, 2.4 million hectares of ponds and lakes, and about 0.8 million hectares of flood plain wetlands contributing to the country's freshwater reserve (FAO, 2010). Indian fisheries and aquaculture have always been a major sector contributing to both food production and employment generation. Indian seafood processing sector has emerged as one of the world's leading supplies of processed high value seafood products especially shrimp. While considering world aquaculture export market, India is ranked 1<sup>st</sup>, 2<sup>nd</sup>

and 4<sup>th</sup> largest exporter to USA, Europe and Japan, respectively. Indian contribution to global fish production is about 6.3%, which values about 1.1% of national GDP and 5.16% of national agricultural GDP. Seafood export is an ever-growing sector of the nation, which accounted to about US \$5.78 billion in the year 2016-17 (Anom, 2017).

More than 62% of India's total processing capacity (total of 23,000 MT) include EU approved plants, and out of these 506 utilize latest sophisticated technologies for fish processing. Proper quality control systems and HACCP followed in these plants ensure highest quality outputs from these plants. Nevertheless, reports suggest that the energy utilized in fish processing does not match the actual requirements for the

**Table 1.** Major reason for poor energy efficiency in seafood industries (BEE, 2015)

Constraints	Alternatives suggested
Energy efficiency not on the priority list	Conduct periodic energy audits
Lack of awareness of energy efficiency	Take initiatives to create awareness. Organise constant training/ sensitization programs
Lack of local service providers who can support the initiatives	Empower local service providers who can provide technology backstopping. Promote start-up companies with innovative technology solutions. Create secondary employment for the local people
Limited technical manpower	Upgrade the workers skill through training and demonstration
Fear of production disruption and quality issues	Use appropriate experts/consultants for the services
Lack of thrust by government agencies on high energy-efficient and low carbon footprint products and technologies.	Promotion by governments to use alternate energy sources and thrust on processed products with low carbon foot prints. Tax/Tariff benefits to firms with energy optimization measures.

same. This actually points the finger to the inefficient energy practices followed by these processing units (MPEDA, 2017).

Energy consumption in seafood processing plant depends largely upon the age and scale of the plant, level of automation, and range of products manufactured. Energy consumption at various phases of fisheries activities namely pre-harvest (consisting of vessel construction and maintenance), harvest and post-harvest (including fish transportation and processing) is substantially high. An especially huge amount of energy is utilized for various fish processing activities including chilling, freezing, cleaning, packing, sorting, etc. Fish being a highly perishable commodity, continuous and uninterrupted supply of power is to be ensured and therefore the scope of usage of renewable energy resources is limited to some extent. The rising energy costs have a negative impact on the economic return for the seafood processors. To maintain a competitive position in the global seafood trade, cost-reduction measures by improving energy efficiency should essentially be a priority for seafood industries. Major reasons for low energy efficiency in seafood processing firms have been listed by the Bureau of Energy Efficiency (BEE, 2015). Some of the important constraints with suggested interventions are given in Table.1.

Fisheries play a very significant role in global climate change, primarily through the production and release of greenhouse gases such as carbon dioxide, methane, nitrous oxide etc. Emission of GHG is directly contributed at different levels like; fish catch transportation, processing and storage of raw material and processed products. Though catch of fish is major contributor of GHG, processing and storage of fish and fisheries products also contribute significantly towards GHG emission. The global fuel use intensity in the fisheries sector, for 2011, is estimated to be 489 litres/ tonne of fish which accounts to total carbon dioxide emissions of 179 million tonnes CO<sub>2</sub> equivalent (Parker et al., 2018).

### Energy optimization and its significance

Of the export-oriented industries in India that have developed during the post-independence period, the fish processing industry is of special significance (Pillai, 1973). Marine and freshwater catch fishing along with aquaculture fish farming is a rapidly growing industry in India. Owing to the

energy intensiveness of the sector, many initiatives were taken up in the past, across the world, to study the energy use pattern of seafood processing units.

Energy optimization in seafood industry essentially involves reducing the amount of energy, be it electrical energy or conventional energy, sources like fossil fuels, oil, etc., consumed by an industry during the period between procurement of raw material delivery of the final processed and product. Energy optimization can substantially contribute to the reduction in operating cost during the processing of seafood materials. Moreover, utilization of large quantities of energy can lead to poor processing efficiency and increased emission of effluents to the environment, which has a negative impact on the products' carbon footprint count.

### Energy optimization methodologies

Energy optimization methodologies can be broadly classified in the following six categories:

- **Automation of existing process line:** Energy wastage in seafood industry can be greatly reduced by precisely controlling the working of all equipment in the process line. Merely by controlling the timely switching on and off equipment can save a lot of energy, which can be practically impossible in manual operation. The literature suggests that almost 10-40 % reduction in energy consumption can be attained by automation of equipment.
- **Sensitize the labor about energy conservation:** The operation level labors' attitude and behavior have a major impact on the energy optimization point of view. Awareness among the labors regarding energy wastage that can occur due to mere negligence or ignorance has to be created. This strategy could bring about 10-30% reduction in energy consumption. Instructions can be given to them regarding reducing energy wastage, for example, the chill room doors should be closed immediately after loading or unloading to prevent temperature rise inside, etc.
- **Equipment upgrade:** Existing equipment should be monitored for their efficient working through periodic repair and maintenance. Regular servicing and if required replacement of worn out parts

should be done. This can actually improve the processing efficiency of the equipment and in turn of the whole plant. Energy savings of 5-10% can be anticipated by this method.

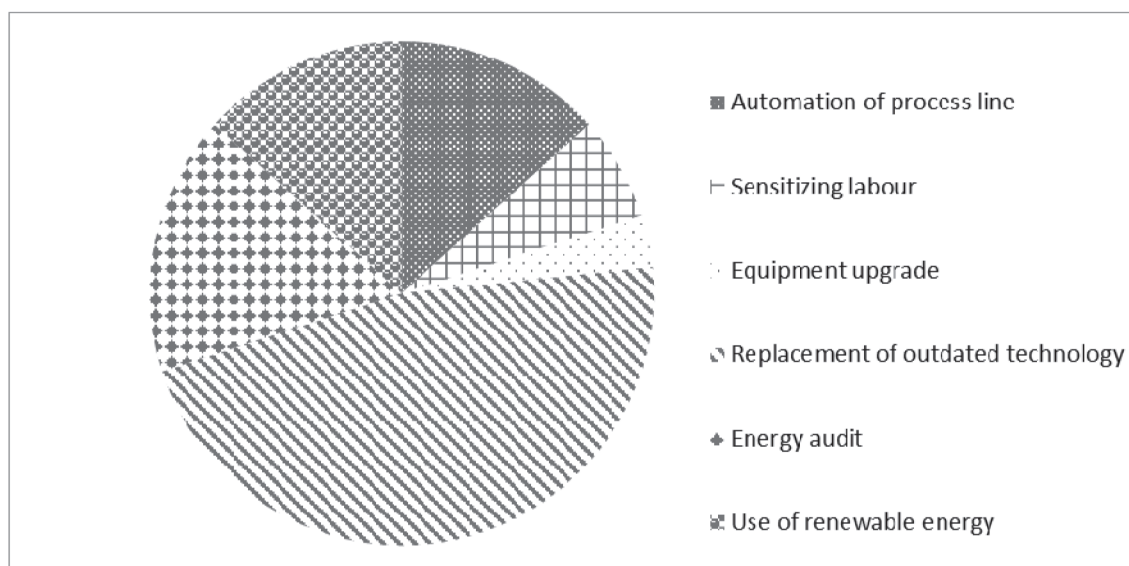
- **Replacement of out-dated equipment and technology:** This is a relatively capital-intensive method, but as high as 60% reduction in energy consumption can be obtained. Latest technologies and sophisticated and energy saving equipment can be explored to reduce the energy consumption of plant. For example, reciprocating and centrifugal type compressors can be replaced by screw compressor, which can give higher processing efficiency.
- **Energy auditing and budgeting:** Effective reduction in energy consumption can be achieved through proper energy auditing of the seafood industry. Energy audits can give an idea about the extent of energy utilized for various purposes in the industry and accordingly energy conservation measures can be executed.
- **Use of renewable energy and green industry concept:** Switching to renewable energy sources from conventional sources are of great advantage not only to the industry but also to the environment as a whole.

Nowadays, green industry is a trending concept which emphasizes on those activities and measures which help curb environmental depletion, swapping to renewable energy is one among many.

All these factors have significant impact on optimizing energy consumption of fish processing firms. Figure 1 depicts the expected impact of various energy management methodologies or strategies on the energy savings of seafood industries (BIM, 2017).

## Conclusions

From a global perspective, considering the over-exploitation of the earth's natural resources, energy optimization is a promising area to be explored. As there is more and more focus on the environmental impacts from seafood industries, it is of increasing importance to ensure that technologies and practices implemented has to achieve a high level of environmental performance along with higher production efficiency. Apart from controlling the energy expenses of the industries, energy optimization can invariably help in sustaining our planet's resources. Energy optimization initiatives in seafood processing firms would invariably help in reducing the operating expenses. While on process level, it would be considered as an attempt towards a carbon negative India.



**Fig 1.** Impact of energy optimisation methodologies on energy savings of seafood industries

## Further reading

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