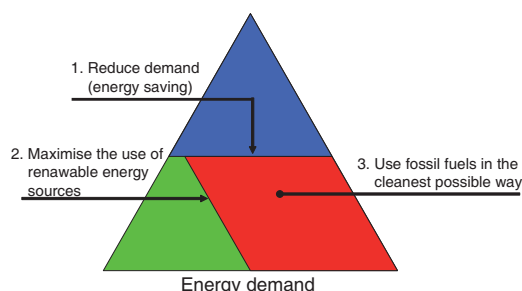


ECN Programme Energy Efficiency in Industry

ECN is the largest independent research centre in the Netherlands in the field of energy. It is situated in the dunes near Petten, a village in the northern part of Holland. ECN develops high-level knowledge and technology to facilitate the transition to a sustainable energy system in close co-operation with universities and industry.



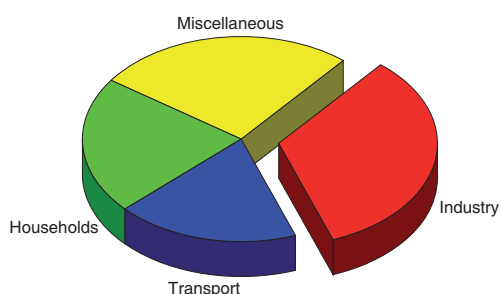
The programme Energy Efficiency in Industry (EEI) focuses on the reduction of energy use: the first step in the Trias Energetica. We pay special attention to energy-intensive production processes.



Trias Energetica

Our mission

Our mission is the development of knowledge and innovative technology and also the promotion of their implementation, leading to significant savings in energy and raw materials in production chains.

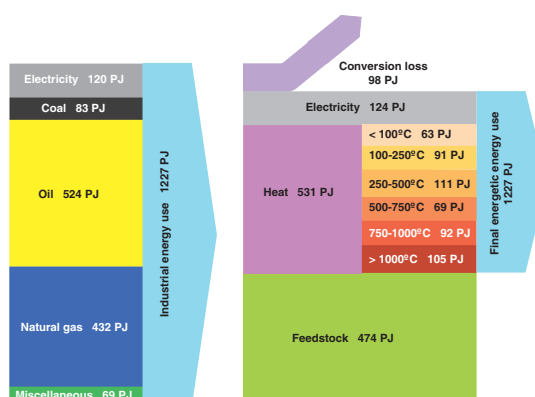


Subdivision of primary energy use in the Netherlands

Background industrial energy use

Primary energy use in the Netherlands, excluding feedstock, amounts to approximately 2500 PJ/year. Industry is responsible for roughly $\frac{1}{3}$ of this amount.

The Sankey-diagram below shows the energy carriers used in industry and the energy function they fulfil. More than 80% of the industrial energy consumption is used for heat, either in fired furnaces or in the form of steam at different pressure levels.



Industrial energy use in the Netherlands by energy carrier and function

Especially since 1990, large energy savings have been achieved. Despite of all these efforts, the total energy use is still increasing due to the growth of the economy and production.

New technologies and system innovations are necessary to achieve drastic improvements in energy efficiency. We envisage additional advantages such as lower maintenance, better product quality, new products, and strengthening of competitiveness.

Our R&D programme

The portfolio is based on energy saving potential and ECN's core competences in the following fields:

- Industrial (chemical) processes & systems.
- Heat & mass transfer.
- Functional materials.
- Modeling.
- Experimental infrastructure.

In general, the R&D activities are aimed at:

- Proof of principle/concept of new reactor, process and system concepts.
- Development of specific materials, components, equipment and (process) technology in co-operation with and in contract for external parties.
- Support of implementation.

Currently, there are three focus areas for which we have the ambition to acquire a leading position on a European level.

• Industrial Heat Technology

Our core activity is the development of industrial heat pumps based on thermoacoustic and sorption principles, and further of heat storage concepts. Both technologies enable the re-use of industrial waste heat that is currently released to the ambient atmosphere.



Construction of a waste heat driven solid sorption cooler

• Molecular Separation Technology

Our main activities in this area are centred on the development of inorganic membrane technologies for pervaporation and gas separation. Application of such membranes is expected, among other things, to replace energy-intensive distillation columns or to combine efficiently with these unit operations. We are specialised in

performing experiments up to pilot-plant scale under industrially relevant conditions.



High temperature pervaporation unit

• Process Intensification

Activities in this area are aimed at combining unit operations such as separation and reaction in order to achieve more compact and energy-efficient equipment. Our focus is on membrane reactors, monolith reactors, and heat integrated distillation columns (HIDIC).



Hydrogen membrane reactor for hydrogen separation

Our partners

Technology transfer is an integral part of our activities. Partners are e.g. engineering contractors, chemical and petrochemical companies, and equipment and material manufacturers.

Development of fundamental knowledge is done in co-operation with universities. Major clients are the Dutch Ministry of Economic Affairs, the European Commission, and large chemical companies.

<http://www.ecn.nl/en/eei/>
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