

# YENESIS

Youth Employment Network for  
Energy Sustainability in Islands

## Energy Efficiency

Developed by: Regional Agency for Energy and Environment  
of the Autonomous Region of Madeira (AREAM)

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# Presentation overview

- Get to know basic energy concepts and energy efficient technologies and behaviours.
- Understand the benefits of energy efficiency.
- EU policies and regulations regarding energy efficiency.
- Understand the energy management process, its stages and activities.
- Understand how energy efficiency can be applied in different sectors.
- Get to know trends and future needs regarding energy efficiency.
- Employment opportunities in energy efficiency.

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# I. Energy concepts



YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment.  
The project aims at creating employment opportunities for NEETs in islands

# Energy types

Today's societies increasingly rely on energy to satisfy their everyday needs. These needs are satisfied by using energy in different forms and ways:

- Heat (thermal)
- Light (radiant)
- Motion (kinetic)
- Electrical
- Chemical
- Nuclear energy
- Gravitational

# Energy units

$$\text{Energy [J]} = \text{Power [W]} \times \text{Time [s]}$$

The **joule [J]** is the SI unit of energy but the use of Watt-hours [Wh] and its multiples is more common in energy analysis.

Other common energy units include:

- toe – tonne of oil equivalent (11630 kWh)
- BTU – british thermal unit (0.2930 Wh)
- BOE – barrel of oil equivalent (1699.41 kWh)

Example:

A **40W (power)** lightbulb turned on for **2 hours (time)** will consume **80Wh (energy)**.

## Common metric prefixes used in energy quantities

k	kilo	<b>x1000</b>
M	Mega	<b>x10<sup>6</sup></b>
G	Giga	<b>x10<sup>9</sup></b>
T	Tera	<b>x10<sup>12</sup></b>

- **Temperatuur, soojushulk, energia, võimsus**
- °C – Celsiuse kraad;
- K – Kelvin (kelvini kraad);
- GJ – gigadžaul ( $10^9$  J) – energia hulk;
- PJ – petadžaul ( $10^{15}$  J) – energia hulk;
- MW•h – megavatt-tund ( $10^6$  W•h) - energia;
- TW•h – teravatt-tund ( $10^{12}$  W•h)- energia;
- MW – megavatt ( $10^6$  W) - võimsus,

$$1 \text{ GJ} : 3,6 = 0,278 \text{ MWh}$$

## Muid ühikuid

- t/ha – tonni hektarilt (saagikus);
- tm/ha – tihumeetrit hektarilt (saagikus);
- g/m<sup>3</sup> – grammi kuupmeetris (kontsentratsioon);
- kg/m<sup>3</sup> – kilogrammi kuupmeetris (tihedus);
- kW•h/kg – kilovatt-tundi kilogrammis (energiasisaldus e energiatihedus);
- kW•h/m<sup>3</sup> – kilovatt-tundi kuupmeetris (energiasisaldus e energiatihedus);
- MW•h/pm<sup>3</sup> e MW•h/pm – megavatt-tundi puistekuupmeetris (energiasisaldus);
- MW•h/rm – megavatt-tundi ruumimeetris (energiasisaldus);
- MW•h/ha – megavatt-tundi hektarilt (energiatoodang, energiasaagikus – energy yield);
- GJ/tm – gigadžauli tihumeetris (energiasisaldus);
- kJ/kg – kilodžauli kilogrammis (energiasisaldus);
- MJ/kg – megadžauli kilogrammis (energiasisaldus);
- MW•h/el – megavatt-tundi elaniku kohta (energiatarbimine);
- PJ/a – petadžauli aastas (energiatarbimine);
- TW•h/a – teravatt-tundi aastas (energiatarbimine).

# Ühikute vahelised üleminekutegurid

## Soojuslikud ühikud

	kJ	kcal*	kWh	toe
1 kJ	1	0.239	$0.278 \times 10^{-3}$	$23.88 \times 10^{-9}$
1 kcal <sup>(*)</sup>	4.1868	1	$1.163 \times 10^{-3}$	$0.1 \times 10^{-6}$
1 kWh	3,600	860	1	$86 \times 10^{-6}$
1 toe	$41.87 \times 10^6$	$10 \times 10^6$	$11.63 \times 10^3$	1
1 kWh	= 860 kcal		= 3,600 kJ (3,6 MJ)	
1 MJ	= 239 kcal		= 0.278 kWh	
1 kcal	= 4.19 kJ		= 0.00116 kWh	
1 toe	= 41.87 GJ		= 11.63 MWh	

**Toe** – tonni õliekvivalenti - statistika ühik, 1 tonni toornaftapõletamisel eralduv soojus

**Tce** – tonni söe ekvivalenti - 8 141 kWh; 8, 14 MWh; 29.31 GJ

Units	Symbol	Value in joules (J)
Calorie	cal	4.19
British thermal unit	BTU	$1.05 \times 10^3$
Kilowatt-hour	kWh	$3.60 \times 10^6$
Barrel of oil equivalent	boe	$6.12 \times 10^8$
Tonne of oil equivalent	toe	$4.19 \times 10^{10}$

*Ühikute teisendamine - <http://www.unit-conversion.info/>*

*<http://www.unit-conversion.info/volume.html#data>*

*[http://en.wikipedia.org/wiki/Conversion\\_of\\_units#Flow\\_.28volume.29](http://en.wikipedia.org/wiki/Conversion_of_units#Flow_.28volume.29)*

# Energiaühikud

- **Energia ühik** rahvusvahelises mõõtühikute süsteemis (*Système International d'unités, SI*) on põhiühikute (kilogrammi, meetri ja sekundi) alusel aastal 1849 määratletud **kg m<sup>2</sup> / s<sup>2</sup>**, mis esimesel rahvusvahelisel elektrikute kongressil Pariisis aastal 1881 pandi ette nimetada inglise füüsiku James Prescott Joule'i auks **džauliks (J)**:

$$1 \text{ J} = 1 \text{ kg m}^2 / \text{s}^2 = 1 \text{ N m} = 1 \text{ W s} .$$

- Džaul on suhteliselt väike ühik ja seetõttu kasutatakse energiatehnikas enamasti selle detsimaalkordseid, näiteks:

1 kJ (kilodžaul) = $10^3$ J	1 PJ (petadžaul) = $10^{15}$ J
1 MJ (megadžaul) = $10^6$ J	1 EJ (eksadžaul) = $10^{18}$ J
1 GJ (gigadžaul) = $10^9$ J	1 ZJ (zettadžaul) = $10^{21}$ J
1 TJ (teradžaul) = $10^{12}$ J	1 YJ (yottadžaul) = $10^{24}$ J

Teatavasti lubab Rahvusvaheline Standardimisorganisatsioon (International Organization for Standardization, ISO) samaväärselt SI ajaühikuga sekund kasutada ka ühikuid minut (min), tund (h) ja päev (d). Elektro- ja soojustehnikas ongi laialt kasutusel energiaühik vatt-tund (Wh) ja selle kümnenkordsed, näiteks:

$$1 \text{ Wh} = 3600 \text{ J}, \quad 1 \text{ kWh} = 3,6 \cdot 10^6 \text{ J} \quad \text{jne.}$$

Soojusühikuna oli energiatehnikas kasutusel (kohati praegugi toiduaines sisalduva energiahulga iseloomustamisel) **kalor**, mida defineeriti kui soojushulka, mis on vajalik 1 g vee temperatuuri tõstmiseks 1 K võrra.

$$1 \text{ cal} = 4,1868 \text{ J.}$$

# Võimsusühikud

- ***Võimsuse*** ühikuks esitati esimesel rahvusvahelisel elektrikute kongressil Pariisis aastal 1881 universaalse aurumasina leiutaja James Watti (1736...1819), auks **vatt** (W); vajaduse korral kasutatakse selle detsimaalkordseid (kW, MW, GW jne) või detsimaalosi (mW,  $\mu$ W jne).

## Energiakulu arvutamiseks tuleb teada ka masina või aparadi võimsust.

- **1 kW** vastab väikese muruniiduki võimsusele.
- **1 MW** on sagedane küla katlamaja võimsus või 40 – 50 ühepereelamu küttevõimsus.
- **1 GW** tuumaelektrijaama ühe ploki võimsus (sageli).
- **1 TW** see on nii suur elektritootmise võimsus, millest Eesti oma moodustab 1/250.
- Sisepõlemismootorite võimsust esitatakse sageli hobujõududes:
- 1 hj = 736 W, e 0,736 kW.

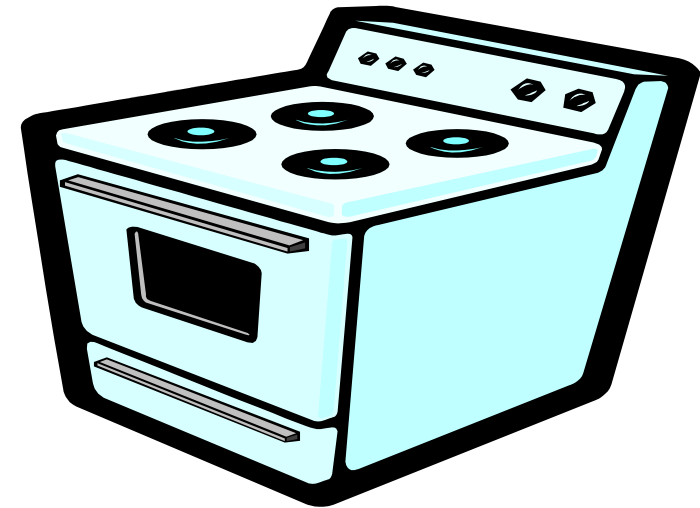


# Energiaühikute meeldejätmiseks tasub teada

- **1 kW·h** (3,6 MJ) on energia hulk, mille 100 W elektripirn tarbib tööpäeva (10 tunni) jooksul või keskmine elektriradiaator kulutab tunni jooksul.
- **1 kW·h** elektrienergiat maksis tavatarbijale 90 Eesti senti (aastal 2001) ja nt 4,8 euro senti (12.2013) + ülekanne ja muud – 11,68 euro senti kWh (1,82 EEK/kWh).



- **1 MW·h** (3,6 GJ) on energia hulk, mille tarbib kodune elektripliit (võimsusega 1 kW) tuhande tunni jooksul ehk aasta jooksul kui pliit töötab umbes kolm tundi päevas.
- Sel juhul kulub aastas söögitegemisele umbes 117 eurot.
- Umbes sama kogus energiat sisaldub 1 000 km läbimiseks vajaminevas bensiinis (kulu 10 l/100 km).
- Keskmise suurusega kolmetoaline korter tarbib talvel keskmiselt 3 MW·h soojust kuus. 1 MW·h soojust eest tuleb maksta 40-90 eurot (oleneb elukohast). Aastas vajab 60 m<sup>2</sup> pinnaga keskmine eesti korter umbes 12 MW·h soojust.



1 GW·h (3,6 TJ) on elektrienergia hulk, mille tarvitavad ära umbes 400 kaasaegset ühepereelamut aastas. Sel juhul tuleb elamu keskmine elektriarve 293 eurot aastas ehk umbes 381 eurot kuus.



# Võru linna kõik kaugkütte soojuse tarbijad kokku vajavad aastas umbes 50 GW·h soojust



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- **1 TW·h** (3,6 PJ) see on elektrienergia kogus, mille tarvitavad põhjamaad 24 tunni jooksul ehk umbes üks seitsmendik Eesti riigi aastasest tarbimisest



Eesti kõigi elektrijaamade aastane elektri toodang on 7-8 TWh.



# Where does energy comes from?

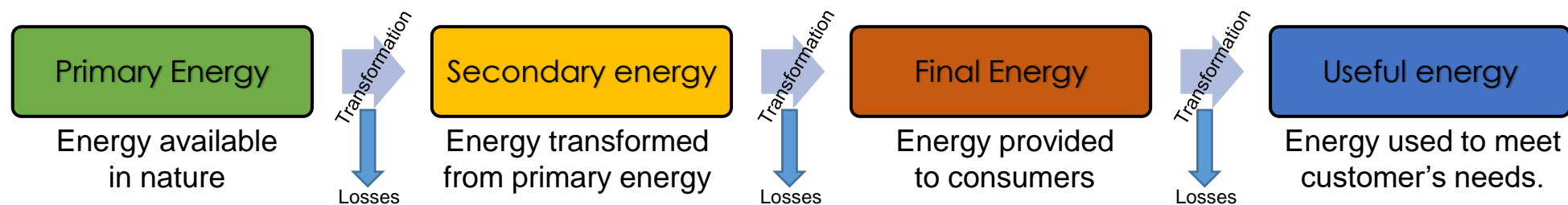
Energy is obtained from nature and is available in different forms. It is often necessary to convert that energy into other forms suitable to meet the user needs.

**Primary energy** is the energy available in nature before being converted or transformed. This type of energy may be used directly or subject to changes. It includes non-renewable energy sources, such as oil, natural gas and coal and also renewable energy sources such as solar radiation and wind.

**Secondary energy** is the result of processes involving the transformation of primary energy into forms of energy suitable for different uses. An example of secondary energy is electricity generated from renewable or non-renewable energy sources.

**Final energy** is the energy bought or used by the end user. Examples include the diesel or petrol use to fill up the car and the low-voltage electricity that reaches the household energy meters. Final energy can sometimes be obtained directly by the end user from primary energy (bypassing the secondary energy transformation stage). As an example, solar radiation can be converted into hot water for end user.

**Useful energy** is the energy that is actually meeting the service needed (lighting, cooking, heating, cooling,...), obtained by using final energy.



# Geofüüsikalised energiaressursid



**Geofüüsika** – Maa füüsika. Teadus, mis uurib Maa koore (litosfääri), tema pinnal asetsevate veekogude (hüdrosfääri) ja teda ümbritseva õhkkonna (atmosfääri) füüsikalisi omadusi ja nähtusi.

- **Geofüüsikalised energiaressursid** – energiaressursid, mis on koondunud Maa koorde, selle pinnale ja atmosfääri.
- Elusoodne kliima jm geofüüsikaliste tingimuste kogum Maal on tekkinud ja kestab tänu Päikeselt langevale kiirgusenergiale. See loob oma otsese toime ja loodusliku muundumisega elusale loodusele vastuvõetava keskkonna.

- Tehisprotsessides saab **päikeseenergiat kasutada** nii otse (passiivne päikese küte) kui ka peale looduslikku muundumist või tehismuundamist, **salvestamatult** (tuule- ja laineenergia) või **salvestatult** (kütuse ja toidu keemiline energia, paisjärvede hüdroenergia).
- Peale päikeseenergia ja selle muunduste kasutatakse, geotermilist ja gravitatsioonienergiat (looded – tõus ja mõõn ookeanides).
- Salvestusastme ja taastumiskiiruse järgi eristatakse tinglikult **mittetaastuvaid** (fossiil- ja tuumkütuste energia) ja **taastuvaid energiavarusid** (otsese päikesekiirguse, biomassi, hüdro- ja tuule- ning lihaseenergia).

# Taastuvad ja taastumatud energiaallikad

- Tavaliselt loetakse **taastuvateks energiaallikateks** selliseid energiaallikaid, mis uuenevad pidevalt päikese kiirgusenergia arvel.
- **Mittetaastuvateks energiaallikateks** loetakse aga selliseid, mille taastumine päikese kiirgusenergia arvel kestab inimese elueaga võrreldes tunduvalt kauem või mille taastumine on tunduvalt aeglasem kui kasutamine.
- “Tavaliselt” on taastuvate energiaallikate kohta öeldud sellepärast, et päikese energiaallikaks on termotuumareaktsioon, milles energia vabaneb kergete aatomituumade ühinemise arvel. Kuigi neid kergete aatomituumasid jätkub miljoniteks (miljarditeks) aastateks, ei ole nende kogus siiski lõpmatu. Seega on päikeseenergia põhimõtteliselt samuti mittetaastuv.
- Inimühiskonna jaoks aga võib päikeseenergiat lugeda siiski ammendamatuks.

**Taastuvad** energiaallikad on sellised energiaallikad, mis uuenevad pidevalt päikese kiirgusenergia arvel ja nende taastumisaeg on võrreldav inimese elueaga:

- Päikeseenergia (otsene ja kaudne kiirgus),
- Biomass (fotosünteesi energia),
- Hüdroenergia (voolav/langev vesi),
- Tuuleenergia (õhu liikumine),
- Merelainete ja hoovuste energia (merevee liikumine),
- Tõusu-mõõna energia (Päikese ja Kuu ning Maa vastastikmõju),
- Geotermaalenergia (maa sisesoojus)

# Elektrituruseadus (Vastu võetud 11.02.2003, kehtiv kuni 30.09.2019 )

(<https://www.riigiteataja.ee/akt/113032019045>)

## § 57. Taastuvad energiaallikad

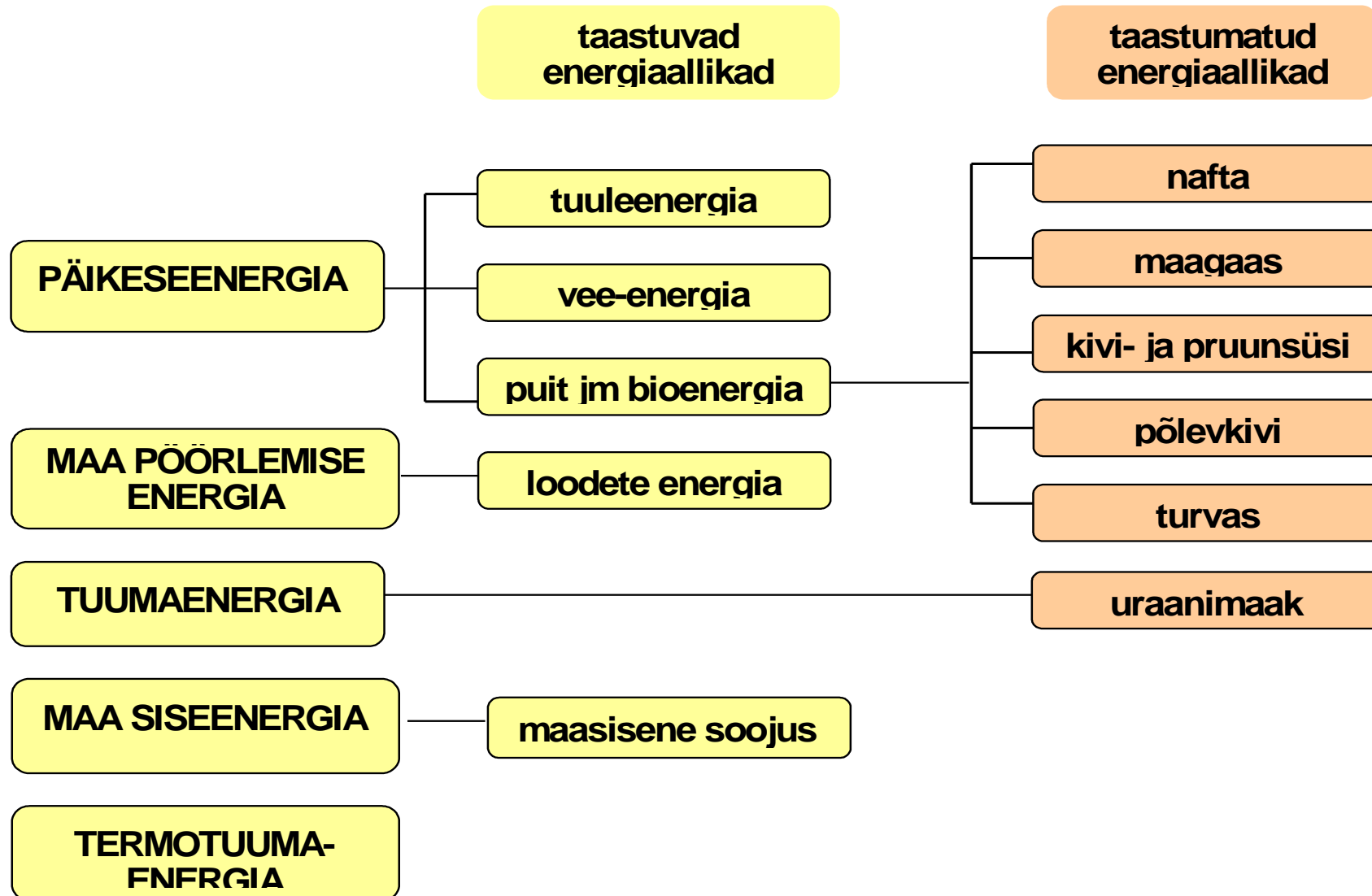
- (1) Käesoleva seaduse tähenduses on taastuvad energiaallikad vesi, tuul, päike, laine, tõusmõõn, maasoojus, prügilagaas, heitvee puhastamisel eralduv gaas, biogaas ja biomass.
- (2) Käesoleva seaduse tähenduses on biomass põllumajanduse (sealhulgas taimsete ja loomsete ainete) ja metsanduse ning nendega seonduva tööstuse toodete, jäätmete ja jääkide bioloogiliselt lagunev osa ning tööstus- ja olmejäätmete bioloogiliselt lagunevad komponendid.
- (3) Vedelat biokütust käsitatakse käesoleva seaduse tähenduses taastuva energiaallikana ainult siis, kui see kütus vastab atmosfääriõhu kaitse seaduse § 120 lõike 1 kohaselt kehtestatud biokütuste säästlikkuse kriteeriumidele.

# MITTETAASTUVAD ENERGIAALLIKAD

**Mittetaastuvad** energiaallikad on sellised energiaallikad, mille taastumine päikese kiirgusenergia arvel kestab inimese elueaga võrreldes tunduvalt kauem või mille taastumine on tunduvalt aeglasem kui kasutamine:

- Fossiilsed kütused: nafta, kivisüsi, pruunsüsi, maagaas, põlevkivi,
- Tuumakütus – materjalid, mis eraldavad energiat raskete aatomituumade (uraan, plutoonium jt.) lõhestamisel (tuumaenergia) ja samuti kergete aatomituumade (deuteerium ja triitium) ühinemisel (termotuumaaenergia),
- Kerged elemendid – vesinik, heelium, liitium.

# Taastumatud ja taastuvad energiaallikad



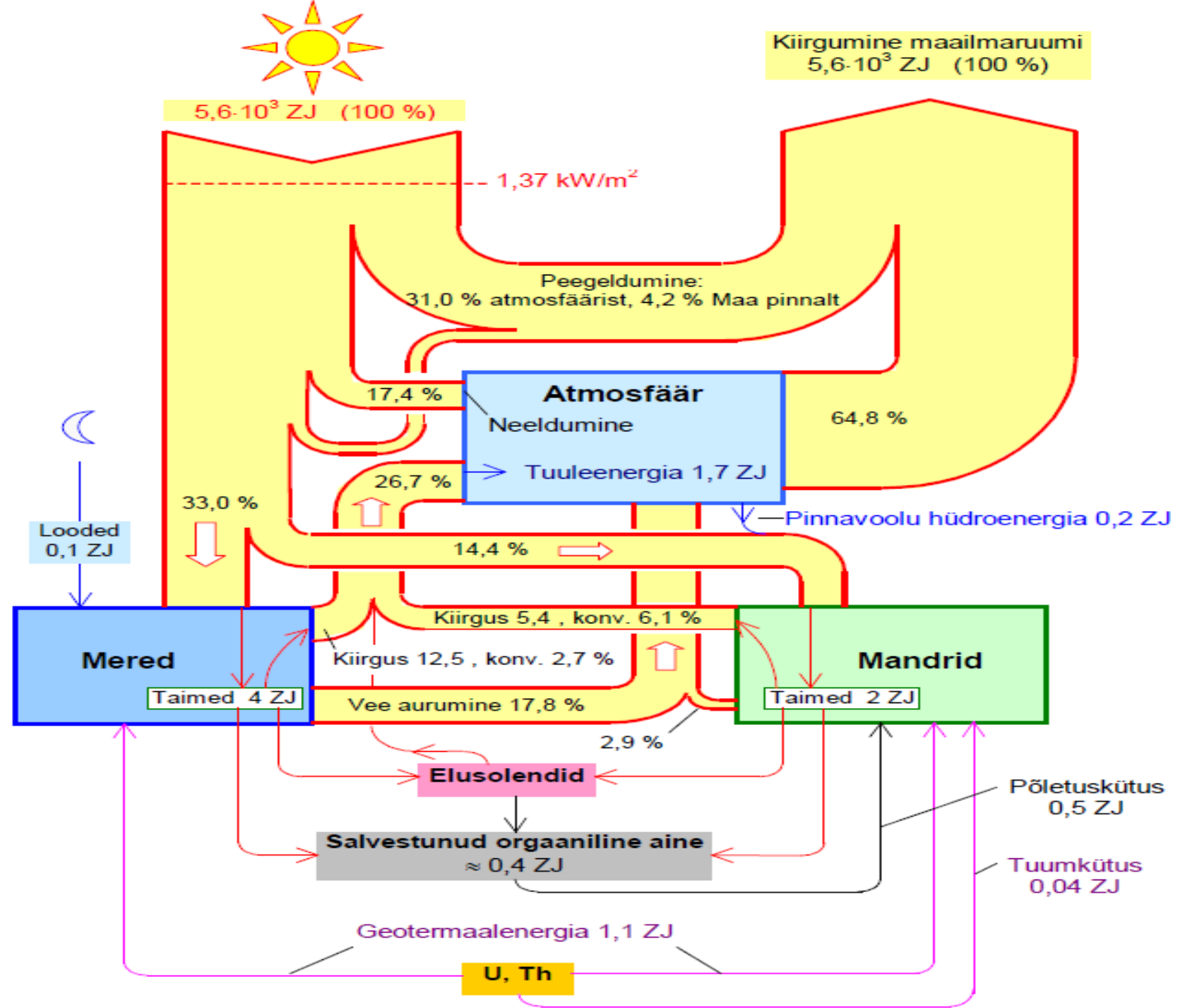
Iceland  
Liechtenstein  
Norway grants

## Maa energiabilanss

Aastal 2005 õnnestus Jaapanis antineutriinode voo mõõtmise teel kindlaks teha, et uraan-238, toorium-232 ja kaalium-40 radioaktiivsel lagunemisel Maa sisemuses eralduv soojusvõimsus on vahemikus 16 kuni 60 TW, mis tähendab energiakogust 0,5 kuni 1,9 ZJ aastas.

Eelpool esitatud arvvaartust 1,1 ZJ, mis on saadud soojustehniliste mõõtetulemuste hindamise teel aastal 1993, võib lugeda seega kinnitatuks.

YENESIS benefits from a € 2.3 M g



# Maa energiabilanss II

- Päikeselt tulevat kiirgust iseloomustab päikesekiirte ristasandi kiiritustihedus Maa atmosfääri ülapiiril (*solaarkonstant*) **1 372 W/m<sup>2</sup>**; sellest kiirgusest peegeldub:
  - atmosfäärist 31,0 % ja
  - maapinnalt 4,2 % lühilainelise optilise kiirgusena kohe tagasi maailmaruumi.
- Ülejäänud kogus neeldub soojusena:
  - atmosfääris (17,4 %),
  - meredes (33,0 %),
  - mandritel (14,4 %).
- Meredes neeldunud 33,0 protsendist Maale tulevast päikesekiirgusest tagastub atmosfääri:
  - vee aurumise kaudu 17,8 %,
  - pikalainelise soojuskiirgusena 12,5 %,
  - konvektsiooni teel 2,7 %.
- Mandritelt tagastub samal viisil vastavalt 2,9 %, 5,4 % ja 6,1 % Maale tulevast päikesekiirgusest.

# Maa energiabilanss III

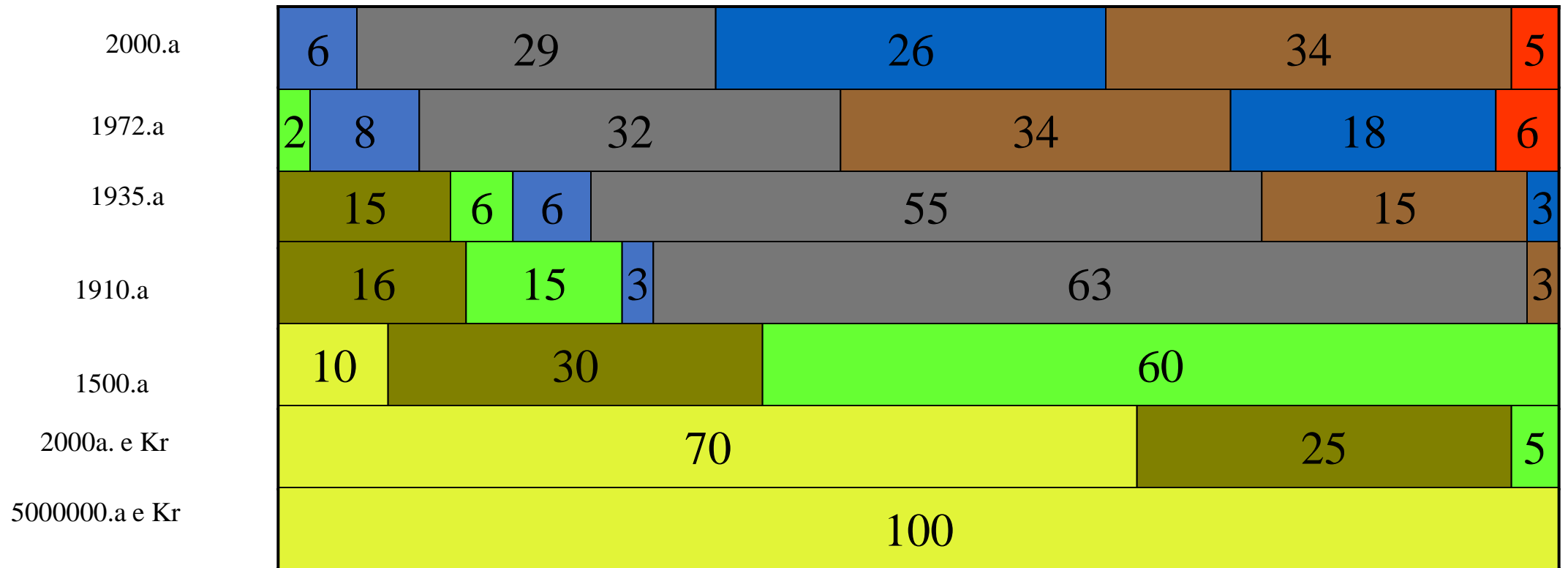
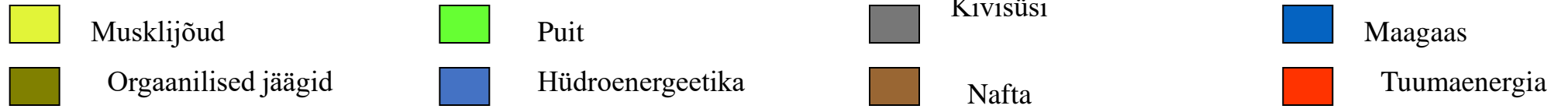
- Suhteliselt väikese koguse energiat (**6 ZJ** ehk ligikaudu  $10^{-4}$  % Maale tulevast päikese kiirgusest) haaravad fotosünteesiks maa- ja veetaimed (esimesed ligikaudu 4 ZJ, teised ligikaudu 2 ZJ). Osa sellest tagastavad taimed soojuskiirgusena atmosfääri, osa salvestavad aga **biomassina**.
- Maapõues või merepõhjas võib surnud biomass aeglaselt muunduda fossiilkütusteks.
- Osa taimede biomassist tarbivad taimetoiduna elusolendid, kes tarbitud energia samuti osalt soojusena atmosfääri või hüdrosfääri eraldavad, osalt aga omaks biomassiks muundavad, mis samuti võib hiljem salvestuda fossiilkütusena.
- Puiduna, turbana ja väga väikesel määral ka fossiilkütustena salvestub aastas käesoleval ajal ligikaudu 0,4 ZJ energiat.

# Maa energiabilanss IV

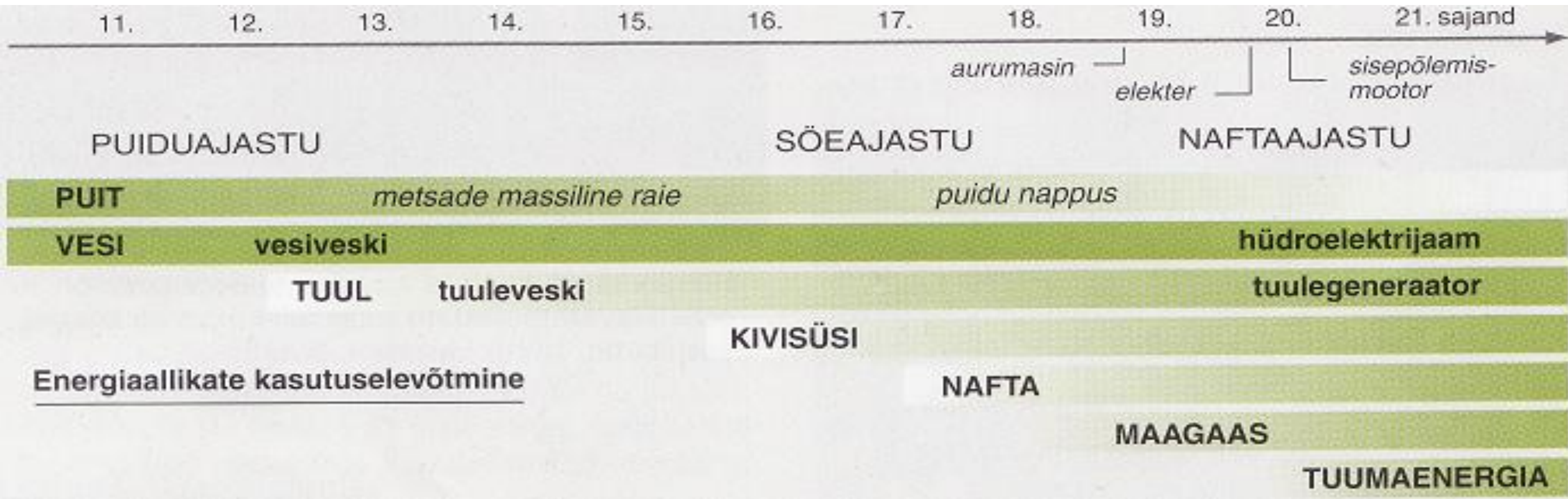
- Atmosfääris ülalkirjeldatud viisil Maa päikesepoolsele osale neeldunud energia (64,8 % maakerale saabuvast päikese kiirgusest) kiirgub Maa mõlemal poolel pikalainelise infrapunase (soojus-) kiirgusena tagasi maailmaruumi, põhjustades maapinna ja õhu temperatuuri ööpäevast vaheldumist.
- Väike osa (ligikaudu 1,7 ZJ) muundub enne seda *tuuleenergiaks*, veel väiksem osa (ligikaudu 0,2 ZJ) aga *pinnavoolu hüdroenergiaks*.

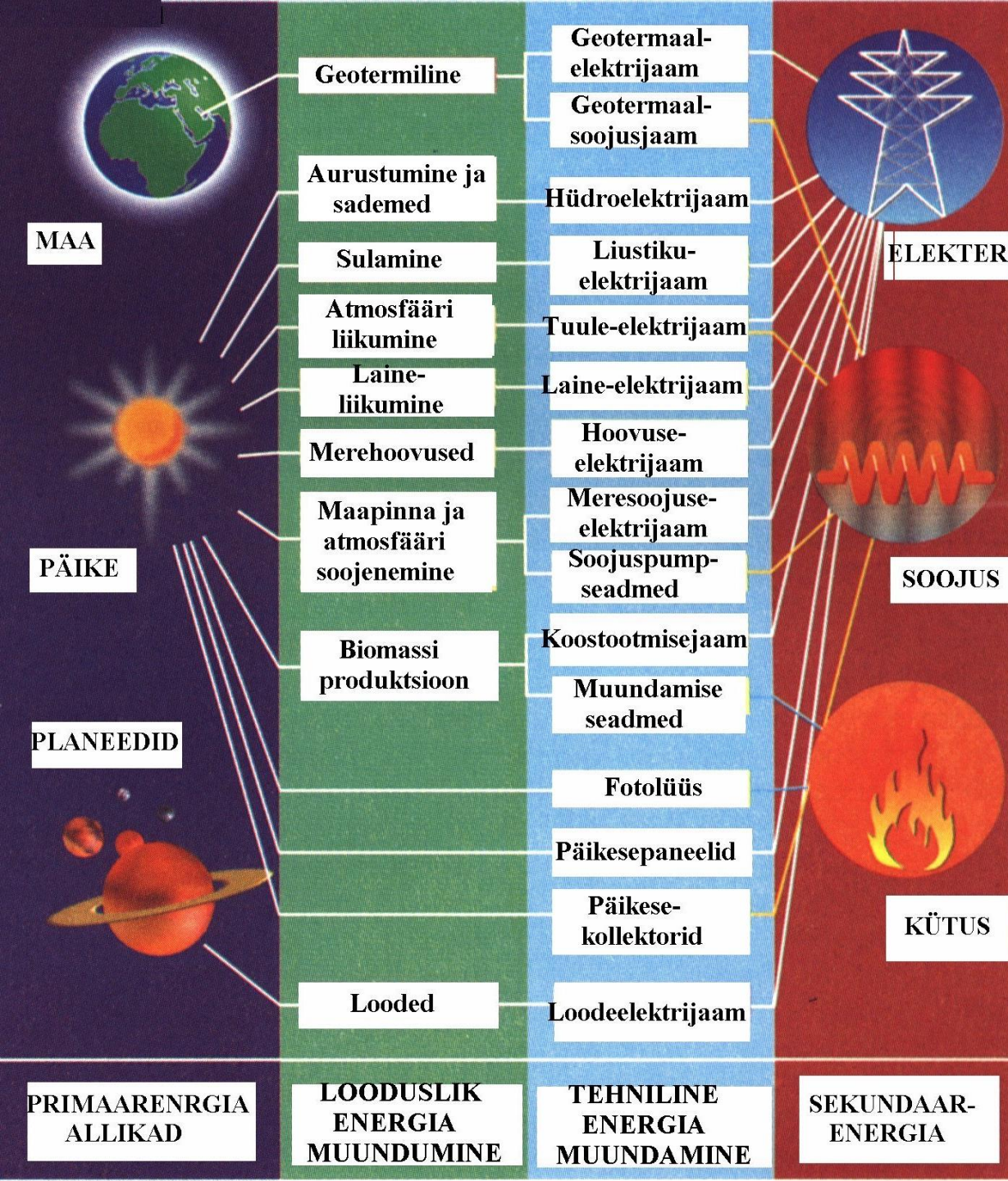
# TRADITSIOONILISED ENERGIALLIKAD

Maailmaenergeetika areng: kasutatavad energialiigid, %



# Energiaallikate kasutuselevõtmise ajatelg





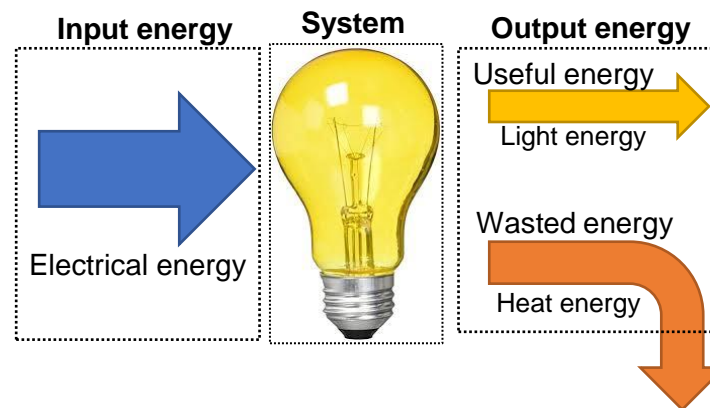
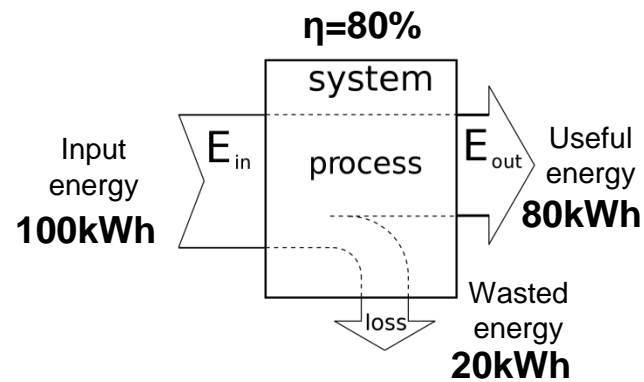
## Geofüüsikaliste energiaressursside, muundamise ja kasutamise võimalused

Varudes sisalduv ehk primaarenergia muundatakse paljudel juhtudel edastus- ja rakendussoodsamaks vääris- ehk sekundaarenergiaks (elektri-, kuuma veega ja auruga edastatav soojus, suruõhk, keemilised sidemed jm).

# Energy transformation process

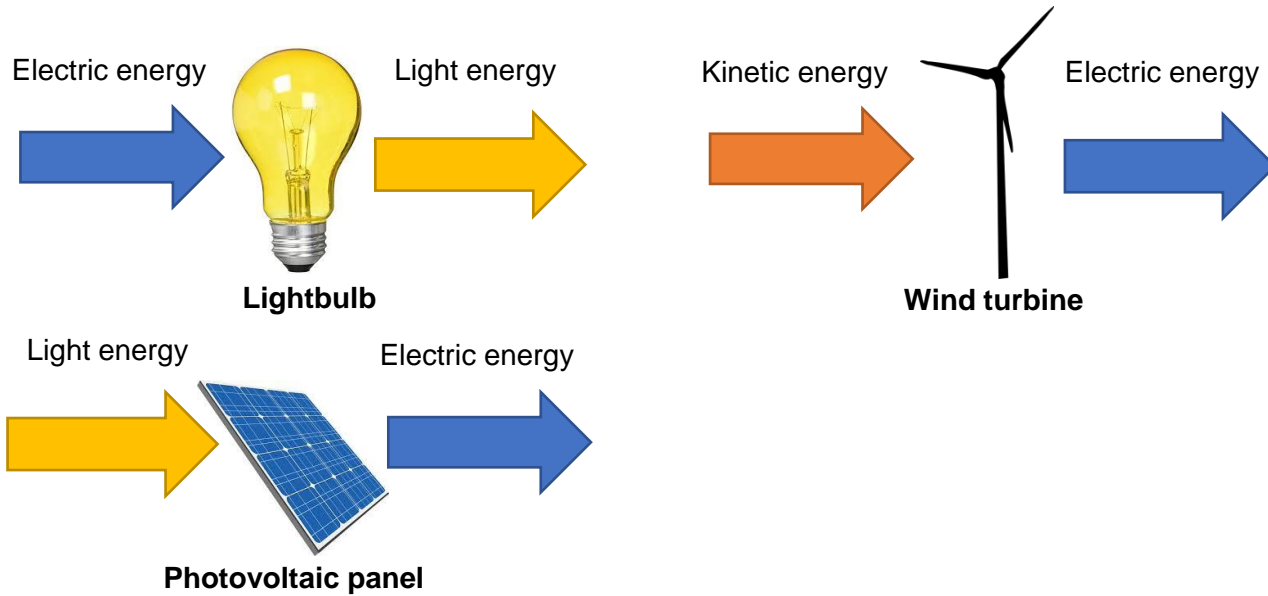
Energy transformation is the process of transforming one energy carrier to another energy form (for instance, fuel to electricity). During these processes there are losses which are inherent to the technologies and thermodynamics.

Energy efficiency is quantified by a percentage which relates output energy and the input energy used in a system to transform.

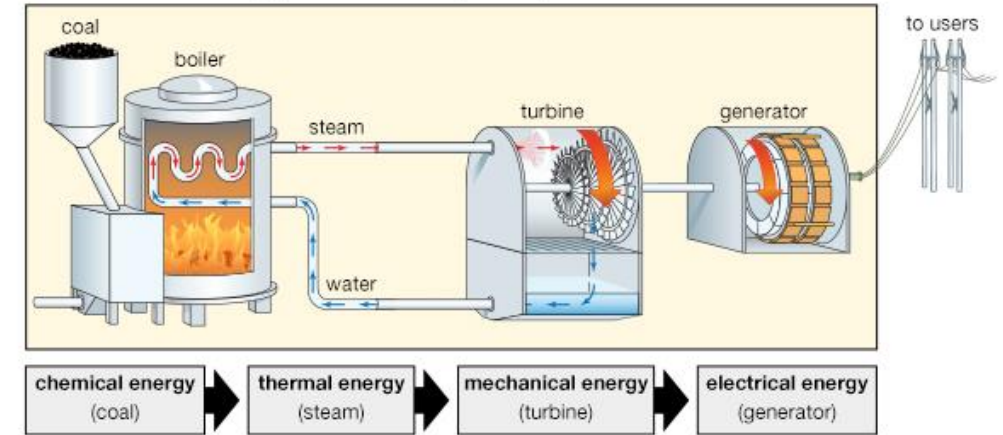


**The First Law of Thermodynamics** also known as Law of Conservation of Energy, states that energy can neither be created nor destroyed; energy can only be **transferred or changed from one form to another.**

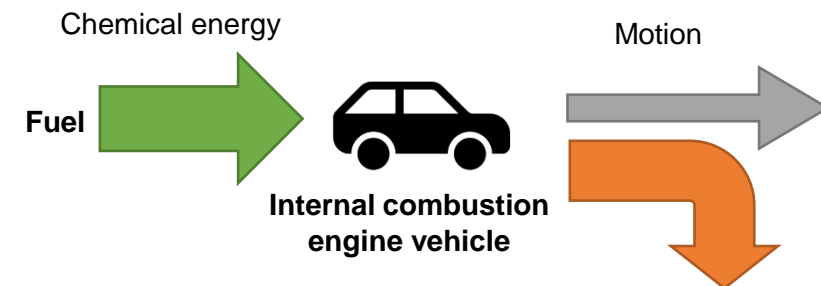
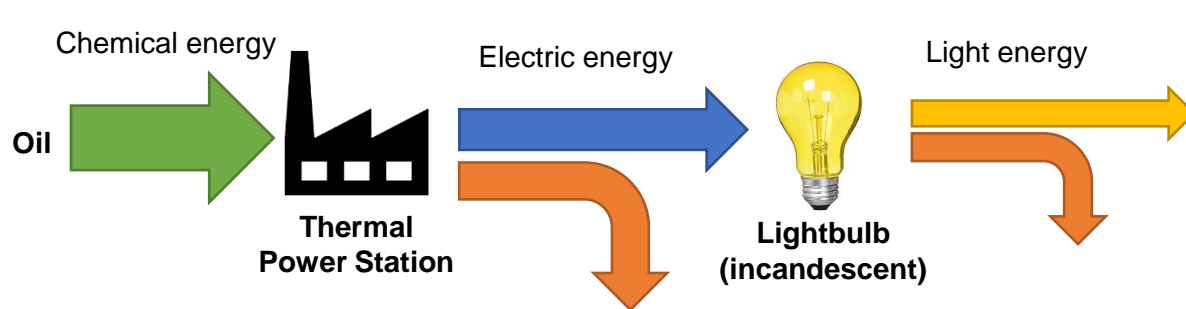
# Examples of energy transformation processes



The conversion of energy at a coal-fired power plant

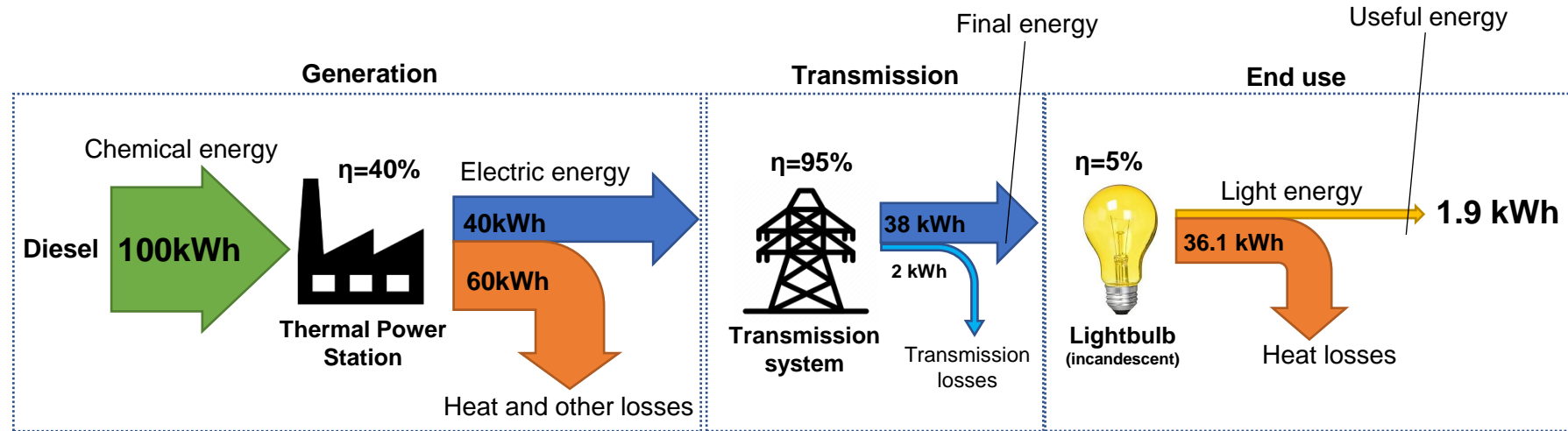


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YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment. The project aims at creating employment opportunities for NEETs in islands

# Example – Energy chain



The overall efficiency would be:  $\eta = 40\% \times 95\% \times 5\% \approx 1.9\%$

In this example, only 1.9 kWh of the initial 100kWh present in the fuel is converted in light energy (useful energy).

This means that along this energy chain, 98.1% of the initial energy is wasted.

Because of high losses along the energy transformation chains, only a small part is available for the needed end uses. For this reason, it is of high importance to preserve energy resources while maintaining the quality of services or the quantity of useful energy.

# What is Energy Efficiency?

Energy efficiency can have different meanings **the depending on the context it is being used**. As seen before, the strict technological meaning of the term relates to how machines and systems are able to convert between different types of energy.

However, in a broader sense, energy efficiency can be defined as the **ratio of output of performance, service, goods or energy / input of energy**.

$$\textit{Efficiency} = \frac{\textit{Output}}{\textit{Input}} = \frac{\textit{Service Output}}{\textit{Used Resource}}$$

This definition is more useful to quantify the energy efficiency of businesses, entities and countries as it is **concerned with evaluating how efficiently energy is being used in order to achieve an output**.

# How to increase energy efficiency?

Energy efficiency may be improved with **technology, behaviour or economic changes.**

Through these improvements, the amount of energy used for a particular use will vary, which can be quantified as energy savings.

Energy savings are the amount of saved energy determined by measuring and/or estimating consumption **before and after implementation** of an energy efficiency measure, whilst ensuring normalisation for external conditions that affect energy consumption.

**Being energy efficient is doing more with less energy.**

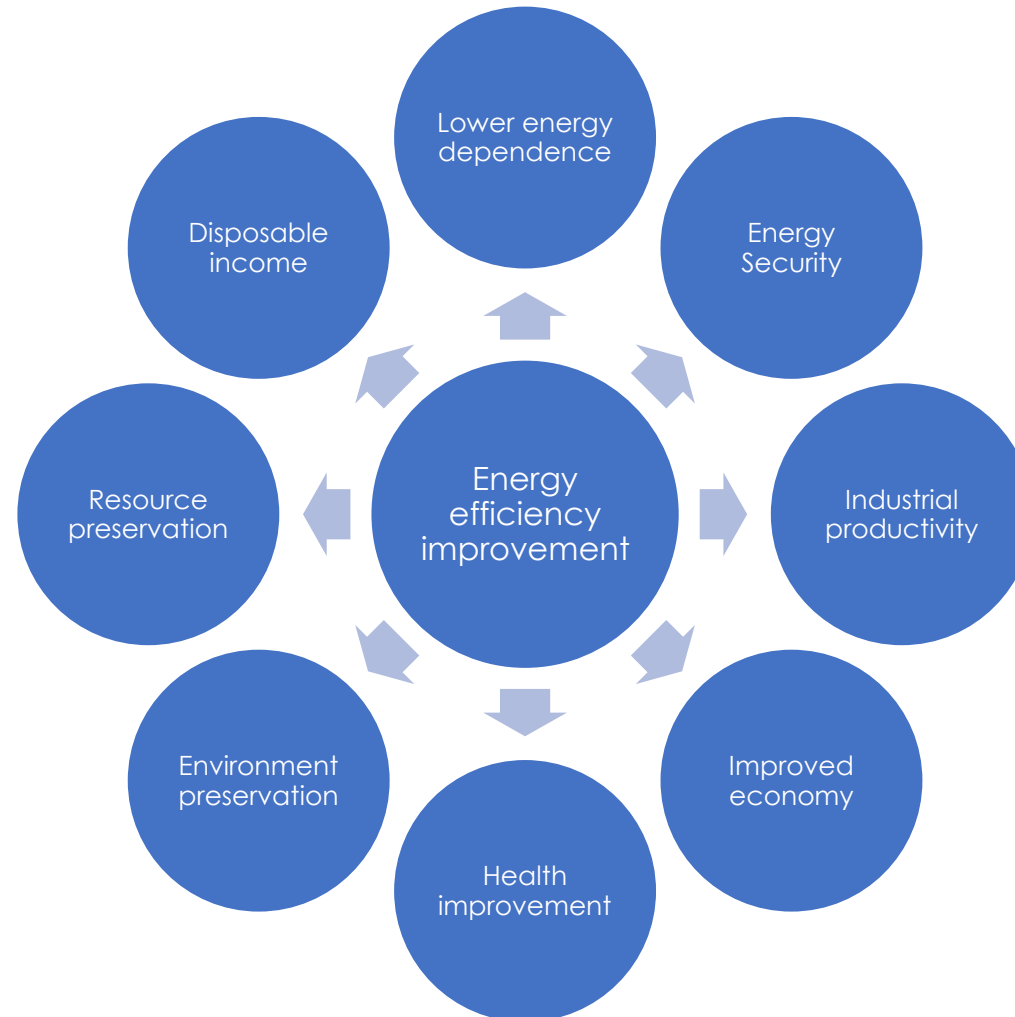
# Why is Energy Efficiency important?

**Energy use is essential for development** but it has negative impacts on the environment – climate change, pollution, resource depletion and destruction of ecosystems.

- Efficient energy use can help to reduce the negative impacts of its use and still allowing for the same economic development.
- Efficient energy use represent lower costs for end users – increase families disposable income and improve competitiveness for companies and businesses.
- Reduces energy imports and energy external dependence.
- Allows for energy-dependent activities to better contribute to economic well being.
- Energy efficiency is an effective way to reduce GHG emissions and mitigate climate change, but is also an adaptation measure.

**Society as whole benefits from energy efficiency.**

# Why is Energy Efficiency important?



YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment. The project aims at creating employment opportunities for NEETs in islands

# Why is Energy Efficiency important for islands?

- Mitigate energy external dependence, reducing energy imports and energy costs.
- Helps to reduce negative impacts on the environment related to energy use and helps to preserve local ecosystems in islands.
- Helps to alleviate energy poverty (lack of access to energy).
- Can help energy-dependent businesses to be more competitive and overcome economic insularity.

# Where can Energy Efficiency be applied?

All energy-dependent activities in sectors such as:

- Residential
- Transport
- Industry
- Services
- Electricity generation
- Etc...

# Examples of energy efficient technologies

## End use

### Lighting

**LED lighting** – Led lightbulbs are more efficient than fluorescent and incandescent lightbulbs. Also, LED lamps last more than other types of lamps.



### Space climatization and hot water

**Heat pumps** – heat pumps are efficient systems for heating and cooling spaces or for hot water. It makes use of temperature differences in air, water or use a geothermal source.



### Transportation

**Electric vehicles** – Electric vehicle efficiency\* is a factor of about 3 to 5 higher than thermal engine vehicles. Other advantages include the non-existence of exhaust emissions of CO<sub>2</sub>, NO<sub>x</sub>, NMHC and PM in urban areas. Electric vehicles provide quiet and smooth operation and consequently create less noise and vibration.



\*Tank-to-wheels efficiency

# Examples of energy efficient solutions

## End use

### Lighting

**Minimizing the use of artificial light** – During the day, space lighting needs may be supplied by the natural solar radiation and artificial lighting may be turned off to save energy.

### Space climatization

**Thermostat adjustments** – When using heating and cooling systems, thermostat temperature should be adjusted according to outside temperature. In general, the closer the thermostat setting is to outside temperature, the less energy is needed in climatization.

### Transportation

**Optimized travel routes and eco-driving** – Driving vehicles, is important to plan a route which requires less energy to reach the destinations. Practicing eco-driving is also a good way to reduce energy use.

## II. Policy framework related to energy efficiency

European Union and Portugal



# Why is Energy Efficiency important for European Union?

“Improving energy efficiency throughout the full energy chain, including energy generation, transmission, distribution and end-use, will benefit the environment, improve air quality and public health, reduce greenhouse gas emissions, improve energy security by reducing dependence on energy imports from outside the Union, cut energy costs for households and companies, help alleviate energy poverty, and lead to increased competitiveness, more jobs and increased economic activity throughout the economy, thus improving citizens' quality of life.”

# Miks on energiatõhusus Euroopa Liidu jaoks oluline?

- Energiatõhususe parandamine kogu energiaahelas, sealhulgas energia tootmises, edastamises, jaotamises ja lõpptarbimises, toob kasu keskkonnale, parandab õhukvaliteeti ja rahvatervist, vähendab kasvuhoonegaaside heitkoguseid, parandab riikide energiajulgeolekut, vähendades sõltuvust energiast, mida imporditakse väljastpoolt ELi. Vähenevad leibkondade ja ettevõtete energiakulud, leeveneb energiapuudust (-vaesus) ning suurendab kogu majanduses konkurentsivõime, rohkem töökohti ja majandustegevust, mille kaudu paraneb kodanike elukvaliteet.

# European Policy



- Putting energy efficiency first is a key objective of the EU, as energy savings are the easiest way of saving money for consumers and to reduce greenhouse gas emissions.
- Energy efficiency is considered an important dimension for the implementation of the “Energy Union”.
- The European Union established a set of targets for decarbonization and energy efficiency to be achieved by 2020, 2030 and 2050.
- In order to achieve these targets, significant investments are to be made in energy efficiency.
- The long term definition of energy goals means that there will be a need in the workforce for tasks directly or indirectly connected to energy efficiency.

# Europe energy efficiency targets



## 2020 target

- **20%** improvement in **energy efficiency** - [Energy Efficiency Directive (2012/27/EU)]
- This improvement will result in a primary energy reduction of **368 Mtoe**.
- Portugal set itself an energy efficiency target of **25%**.

## 2030 target

- **At least 32.5%** improvement in **energy efficiency** - [Energy Efficiency Directive (2018/2002/EU)].
- This improvement will result in a reduction of **1 273 Mtoe** of primary energy and **956 Mtoe** in final energy.
- Portugal set itself an energy efficiency target of **35%**.

## 2050 target

- Make the EU “**Climate Neutral**” - [A Clean Planet for All (COM(2018) 773)].
- Reduce greenhouse gas emissions by 80-95%.
- Portugal created the “Roteiro para a Neutralidade Carbónica 2050”.



# European Policy

## Energy efficiency directive



Under the directive, all EU countries are required to use energy more efficiently at all stages of the energy chain, including energy generation, transmission, distribution and end-use.

The EED contains articles addressing the following topics:

### Efficiency in energy supply

- Promotion of efficiency in heating and cooling
- Energy transformation, transmission and distribution

### Efficiency in energy use

- Energy efficiency targets
- Building renovation and the exemplary role of public buildings
- Energy efficiency obligation schemes
- Energy audits and energy management systems
- Metering and Billing information and access to these
- Consumer information and empowerment

### Horizontal provisions

- Availability of qualification, accreditation and certification schemes
- Information and training
- Energy services
- Other measures to promote energy efficiency
- Energy Efficiency National Fund, Financing and Technical Support

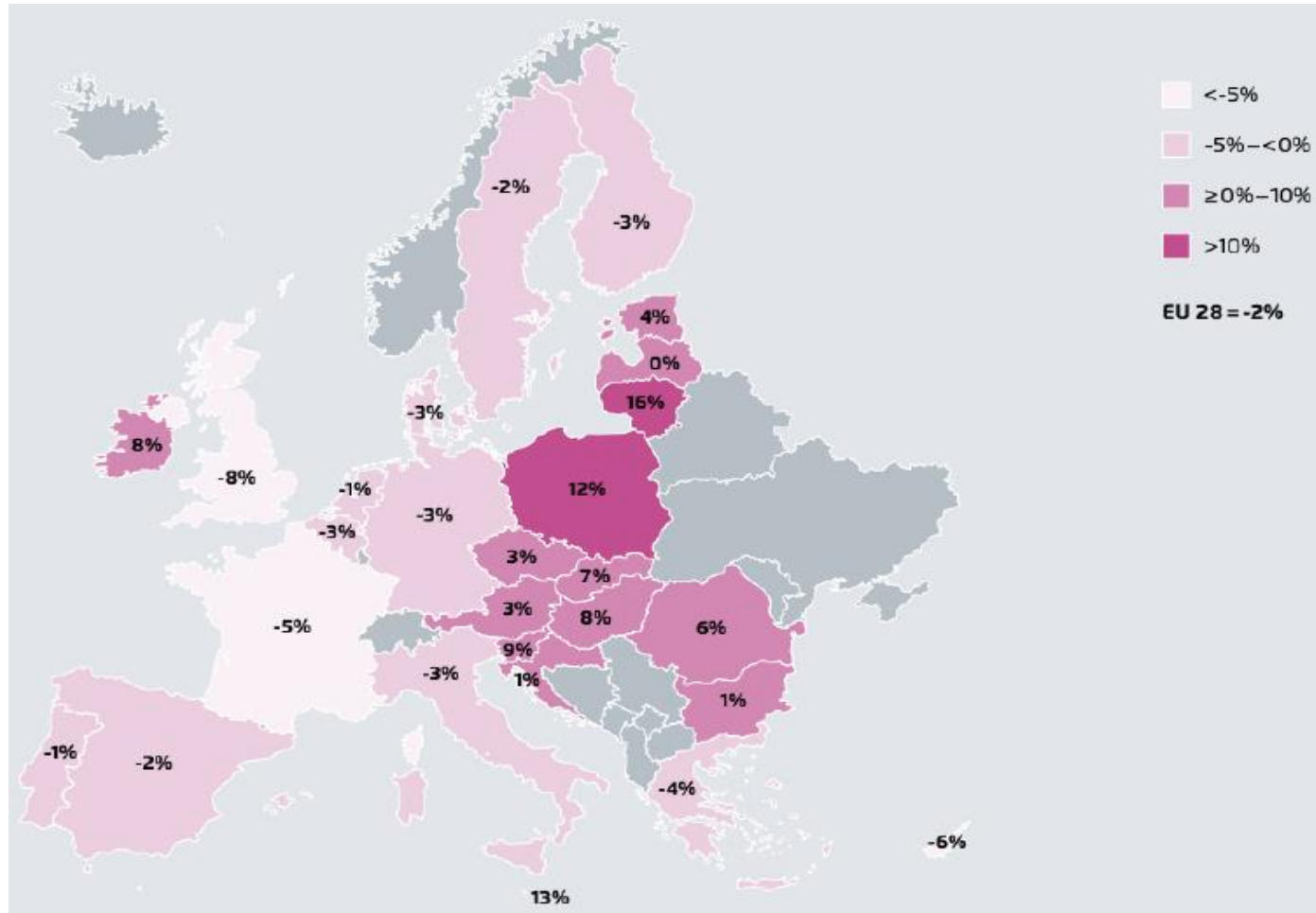
# Energiatootmise muutus Euroopas

- Taastuvad energiaallikatel toodetav elekter moodustas 2018. aastal kogu Euroopas toodetavast elektrist 32,3%.
- Kasv võrreldes 2017. aastaga on 2,3%.
- Pool taastuvatest energiaallikatest toodetavast elektrist tuli hüdroelektrijaamadest, teise poole moodustasid tuulepargid, biomassi ja päikeseenergia (PV-jaamade) struktuurne kasv.
- 2018. aastal on tuuleenergia osakaal suurim, moodustades 12% Euroopa elektrist.
- PV-jaamade (päikseenergia) osakaal oli 4%, mis on vähem kui biomassis saadav elekter ja kolmandik tuulest saadavast elektrist.

# Energiakasutuse muutus Euroopas

- Globaalne energianõudlus kasvas 2018. aastal 2,3% (2x rohkem kui 2008).
- Elektritarbimine Euroopas kasvas 2018. aastal 0,2% ehk 7 TWh.
- Euroopa üldine elektritarbimine on kasvanud viimased neli järjestikust aastat, ehkki tase on aeglasem kui varasematel aastatel. Selle põhjuseks peetakse tööstustoodangu langemist viimastel aastatel.
- 2018. aasta kogutarbimine jääb siiski 2% madalamaks kui 2010. aastal, kuigi SKT tõus on olnud viimased 8 aastat 13% ja rahvastiku suurenemine 2%.
- 2018. aasta oli kogu maailmas väga soe aasta, Euroopas oli võrreldes 2017. aastaga 0,4 kraadi C soojem. Üldiselt olid talvekuud soojad, seega tasakaalustas vähendatud küttevajadus täiendava kliimaseadmete nõudluse kuumadel suvekuudel.

# Elektritarbimise muutus ELis 2010-2018. aastatel

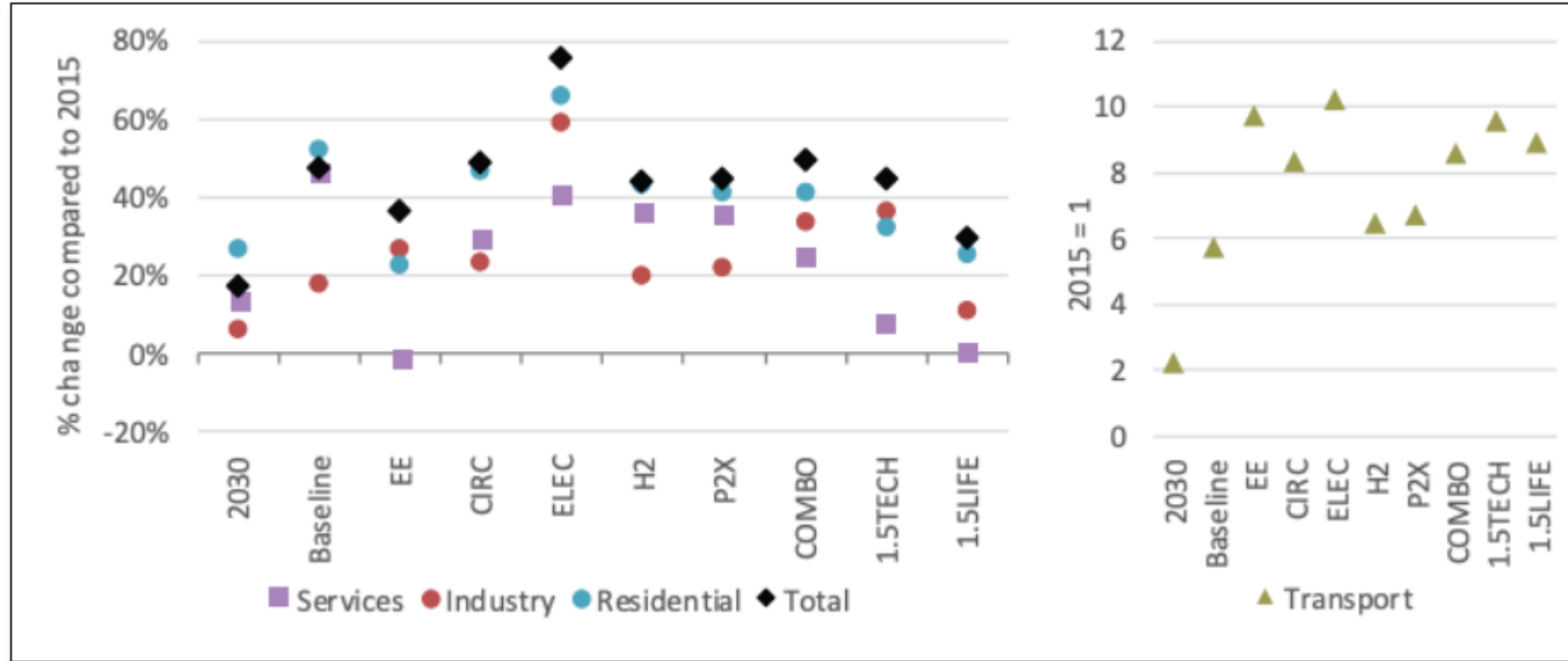


YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment. The project aims at creating employment opportunities for NEETs in islands

# Energiatarbimise prognoos ELis

- Eeldatakse, et elektritarbimine maailmas suureneb. Euroopa Komisjon avaldas 2018. novembris pikaajalise strateegia 2050. aastaks, kus viidatakse sellele, et elektritarbimine tõuseb 2030. aastaks 18% alates 2018. aastast.
- Elektrifitseerimist transpordi, soojuse ja tööstuse sektoris peetakse peamiseks mõjutajateks elektri sektoris.
- Pikaajalises strateegias „*Long Term Strategy 2050*“ prognoositakse, et kõige suurem kasv toimub transpordis, sest selles sektoris on eesmärk elektrifitseerida 10% aastaks 2030.
- Samuti ootab elamu- ja tööstusettevõtteid ees suurem elektrifitseerimine 2050. aastaks (Joonis 2).
- Võrreldes 2030. aastaga, kasvab prognoosi kohaselt 2050. aastaks elektrienergia kasutamine elamutes 31% ja tööstuslikes hoonetes kuni 50%.
- Koostatud stsenaariumite järgi sealt edasi kasvu näha ei ole, pigem langust, sest elektrifitseerimist tasakaalustatakse energiatõhususe parandamisega.
- Küll aga viitavad uuringud igal juhul **elektritarbimise kasvule Euroopas.**

# Proгнос elektrienergia tarbimise muutustes 2050. aastal võrreldes 2015. aastaga



- .
- Vasakpoolne graafik näitab % muutust 2015-2050 kogu, elamu, teeninduses ja tööstuses.
- Parempoolne graafik näitab % muutust 2015-2050 transpordisektoris.

# Sektorid, kus elektrikasutus hakkab suurenema

- Transpordi ja soojusmajanduse elektrifitseerimise suurem hüpe on veel ees.
- Euroopa soojuspumpade turud laienesid 2018. aastal, kuid väikses mahus. Kütte, ventilatsiooni ja jahutuse sektor.
- Elektriautode müük 2018. aastal kasvas 34%, kogu autode müügist moodustavad elektriautod 2,4%.

# European Policy

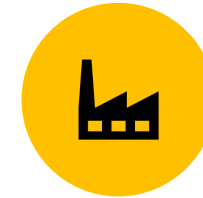
## Energy efficiency directive



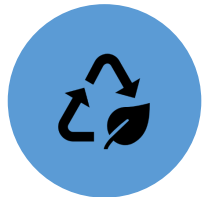
Energy performance of buildings



Heating and cooling



Cogeneration of heat and power



Energy efficiency of products



Financing

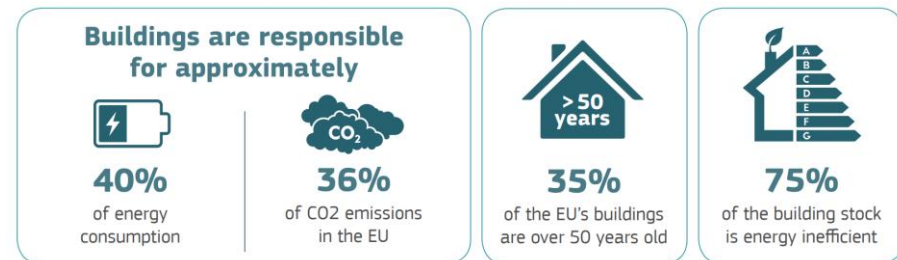
# Energy Performance of Buildings



- Buildings are responsible for approximately 40% of energy consumption and 36% of CO2 emissions in the EU, making these the single largest energy consumer in Europe.
- Renovation of existing buildings can therefore lead to significant energy savings and play a key role in the clean energy transition.
  - Potential to reduce the EU's total energy consumption by 5-6% and lower CO2 emissions by about 5%
- Investments in energy efficiency also stimulates the economy, especially the construction industry.
  - Generates about 9% of Europe's GDP and directly accounts for 18 million direct jobs.
  - Small and medium-sized enterprises in particular benefits from a boosted renovation market, as they contribute more than 70% of the value added in the EU building sector.

## European Directives

[EED \(2012/27/EU\)](#)  
&  
[EPBD \(2010/31/EU\)](#)  
&  
[EPBD \(2018/844/EU\)](#)



**More energy efficient buildings can save energy, reduce bills, address health issues, lower air pollution, and improve people's quality of life.**

# Energy Performance of Buildings

## “Sistema de Certificação Energética (SCE)”



### Main national legislative documents

[Decreto-Lei n.º 118/2013](#)  
and its amendments  
and upgrades

The energy certification of buildings consists in evaluating buildings according to its energy performance.

It allows building owners to know how well their buildings perform and what measures are needed to improve the energy class.

It is useful for improving information and transparency in the market and valorise the best performing buildings:

- It classifies the building in an energy performance scale from A+(most efficient) to F (least efficient). New buildings need to be at least B-;
- The building energy certificate is a mandatory document to sell or rent buildings;
- SCE has two different regulations: one for residential buildings and other for service buildings;
- Depending on the regulation, it classifies the buildings according to its constructive elements and systems such as walls and windows as well as climatization, hot water and lighting;
- Includes suggestions for measures to improve the energy performance of the building.
- Certification is handled by a qualified experts, such as engineers, architects or energy specialists, who audits the building and systems;
- The guarantee of indoor air quality is an additional requirement of the certification.

# Energy Performance of Buildings

## “Sistema de Certificação Energética (SCE)”



Main national legislative documents

[Decreto-Lei n.º 118/2013](#)  
and its amendments  
and upgrades



In Portugal mainland, SCE is managed by ADENE, a national energy agency.



SCE is managed in Madeira by AREAM.

- In Madeira there are about 21470 certified buildings.
- Nationwide, there are more than a thousand qualified experts from which about 50 are registered in Madeira.



Example of an energy certificate

**KÜTTESÜSTEEM:**

- terviklik asendamine:
- torustiku soojustamine:
- soojussõlme seadmetik:
- kütteseadmed ning nende osad:
- süsteemi hüdrauliline tasakaalustamine:
- küttesüsteemi sektioneerimine:
- küttekahade termostaatventiilid:
- muu:

**JAHUTUSSÜSTEEM:**

- terviklik asendamine:
- jahutusseadmed ning nende osad:
- jahutussüsteem (va seadmed):
- süsteemi hüdrauliline tasakaalustamine:
- vabjahutus:
- passiivne jahutus:
- muu:

**SOOJA TARBEVEE SÜSTEEM:**

- terviklik asendamine:
- torustiku soojustamine:
- tarbevee soojendamise seadmed ning nende osad:
- süsteem (va seadmed):
- süsteemi hüdrauliline tasakaalustamine:
- muu:

**VALGUSTUS:**

- terviklik asendamine:
- valgustusseadmed ning nende osad:
- muu:

**VENTILATSIOONISÜSTEEM:**

- terviklik asendamine:
- ventilatsioonisüsteemi seadmed ning nende osad:
- ventilatsioonisüsteem (va seadmed):
- õhuhulkade reguleerimine:
- muu:

**AUTOMAATIKA:**

- terviklik asendamine / väljaehitamine:
- küttesüsteem:
- jahutussüsteem:
- tarbevee soojendamise:
- valgustus:
- ventilatsioonisüsteem:
- muu:

**KANALISATSIOONISÜSTEEM:**

- haitvee soojuse ärakasutamine:
- muu:

**VÄLISPIIRDED:**

- väliseinad:
- katud:
- põrand:
- avatäited:
- õhulekate tihendamine:
- muu:

Hoone energiatõhusust näitav energiamärgis Eestis

EHRis on näha hoonete energiamärgised. Siseneda konkreetse hoone aadressiga või ehitisregistri koodiga.

**HOONE ENERGIAMÄRGIS**



Kaalitud energiaerikasutus  
**11** kWh/m<sup>2</sup>-a



Energiamärgise nr: 2011567/00114  
 Address: Pärnu maakond, Pärnu linn, Pärnu linn, Raua tn 6  
 Ehitisregistri kood (www.ehr.ee): 120692862  
 Märgis kehtib kuni: 18.01.2020

**ENERGIAMÄRGIS**

Energiamärgise nr: 2011567/00114  
 Hoone kategooria: elamu  
 Hoone kasutamise otstarve: 11101 Üksikelamu  
 Address: Pärnu maakond, Pärnu linn, Pärnu linn, Raua tn 6  
 Ehitisregistri kood: 120692862  
 Ehitisaasta: 2015  
 Kõetav pind: 212.1 m<sup>2</sup>  
 Soojusvarustus: lokaalküte  
 Energiaallikas: elekter, soojuspump, õhk-õhk soojuspump

Tallija: Aare Väliste

Energiamärgise algandmete allikas: Tallija andmed



Kaalitud energiaerikasutus (KEK): 11 kWh/m<sup>2</sup>-a  
 Märgise väljaandmise kuupäev: 19.01.2020  
 Märgis kehtib kuni: 18.01.2020

Märgise väljaandja:

Äriühing/FIE: OÜ Pilvere  
 Registrikood: 10076866  
 Vastutav spetsialist: ÜLO KASK

Hoone energiaerikasutus


Energikandja	TARNITUD ENERGIA		EKSPORDITUD ENERGIA, kWh/a	LOKAALSE TAASTUENERGIA SÜSTEEM	ERIKASUTUS (tarnitud - eksporditud), kWh/(m <sup>2</sup> -a)
	elekter / kaugküte / kaugjahutus, kWh/a	TARNITUD KÜTUSED kogus/a			
elekter	9261		8108	soojuspump, päikesepaneel	5,43
ERIKASUTUS KOKKU, kWh/(m <sup>2</sup> -a):					5,43

# Heating and cooling



Heating and cooling in buildings and industry accounts for **half of the EU's energy consumption**. Households and industry account for a big part of this energy:

- **Households**
  - Heating and hot water account for 79% of total final energy use (192.5 Mtoe)
  - Cooling is a fairly small share of total final energy use, but demand is rising during the summer months. This trend is also linked to climate change and increases in temperature.
- **Industry**
  - 70.6% of energy consumption (193.6 Mtoe) was used for space and industrial process heating and just 2.7% (7.2 Mtoe) for cooling.

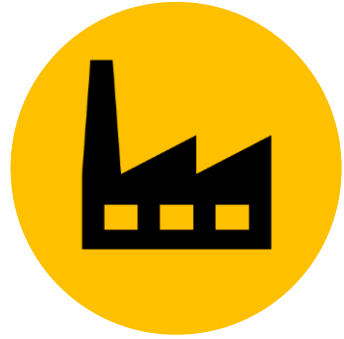


[Heating and cooling infographic](#)

## EU strategy for heating and cooling

- Promote advanced construction design techniques and the use of high-performance insulation materials.
- Promote systems that allow availability to information and control of energy consumption using intelligent thermostats.
- Promote energy-efficient technologies in industry such as cogeneration.
- Promote the use of renewable heating and cooling technologies such as biomass boilers and solar heating systems.
- Promote energy management solutions and technologies.
- Upgrade heating and cooling equipment such as boilers to the latest, most efficient technologies.

# Cogeneration of heat and power



## European Directives

[EED \(2012/27/EU\)](#)

Cogeneration is the **simultaneous generation of electricity and useful heat**. In a regular power plant, the heat is lost, often through the chimneys. In a cogeneration plant, this heat is recovered for use in homes and industry.

Cogeneration plants can achieve **energy efficiency levels of around 90%**. Increased cogeneration could lower greenhouse gas emissions by up to 250 million tonnes by 2020.

Power generation, industrial processes and waste incineration are some of the activities with great potential to apply cogeneration.

Heat can be distributed through a district heating system to supply customers.

## EU strategy for cogeneration

- EU countries are required to carry out a comprehensive assessment of the efficiency potential for thermal systems, namely heating and cooling.

# Energy efficiency of products



## Energy label - Customers

The EU energy labels provide a clear and simple indication of the energy efficiency of products at the point of purchase.

It provides for the labelling of those products and the provision of standard product information regarding energy efficiency, the consumption of energy and of other resources by products, enabling customers to choose more efficient products.



## European directives and regulations

### Energy label

[Regulation \(EU\) 2017/1369](#)

### Ecodesign

[EU's Ecodesign Directive \(2009/125/EC\)](#)  
And respective product-specific regulations

[Regulation by product group](#)

## Ecodesign - Manufacturers

As there is a demand for more efficient products, which help to reduce the energy consumption and other natural resources in line with improving overall sustainability, the EU created legislation to address this subject.

The EU legislation on ecodesign is an effective tool for improving the environmental performance of products by setting mandatory minimum standards for energy efficiency. This eliminates the least performing products from the market. This regulations are mostly addressed to product manufacturers.

Ecodesign regulations apply to a variety of products such as lighting and household appliances, heating and cooling devices, some specific electric devices and other products.

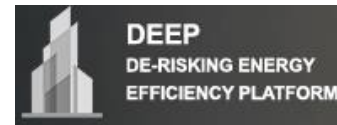
# Financing



- The EU has **increased the amount of public funds available for energy efficiency**. However, to meet the objectives of the Energy Union and support the transition to a clean energy system, there is a **need to further unlock private financing**, in particular for energy efficiency investments.
- It is estimated that an **additional €177 billion per year** will be necessary **over the period 2021-2030** to reach the EU's energy and climate objectives for 2030.

Examples:

- **European Structural and Investment Funds** (ESIF) will **allocate €18 billion to energy efficiency** in the period 2014-2020.
- **Smart Finance for Smart Buildings** - includes practical solutions to mobilize **private financing for energy efficiency and renewables in buildings** in three main areas: more effective use of public funding, more assistance to create project pipelines and changing the risk perception of financiers and investors.



## Project Development Assistance (PDA):

- **Horizon 2020** - Secure, Clean and Efficient Energy
- **ELENA** - Supporting investments in energy efficiency and sustainable transport

# EU Energy Efficiency policy

## Keypoints

- The EU places energy efficiency as a very important tool to implement its energy policies and to attain its decarbonization targets.
- The energy policy of the EU plays an important role on its economic and social well being.
- The EU identified and regulated key topics with high potential to help reduce energy use through energy efficiency.
- Buildings, the single largest energy consumer in Europe, is an important sector to apply energy efficiency measures such as building renovation and the construction of new energy efficient buildings.
- Heating and cooling represent a high energy use specially in households and industry.
- Cogeneration is an effective way to increase the efficiency of power plants by generating electricity and useful heat.
- The EU developed an energy label to help customers to compare and choose the most energy efficient products in order to reduce energy consumption.
- The Ecodesign directive places standards and regulation on the energy efficiency of several products to be respected by manufacturers.
- Funding for energy efficiency projects will need to be increased in the next years to reach energy efficiency targets. There is also a need to attract private financing for energy efficiency investments.

# Energy Efficiency in Portugal



## Main Portuguese instruments related to energy efficiency:

Portuguese policies regarding energy efficiency mainly follow the guidelines established in its Energy Efficiency Action Plans. These plans are made according to the European Energy Efficiency Directive. The directive establishes that EU Member States must draw up these plans every three years and they must report the progress achieved towards their national energy efficiency targets on an annual basis.

### **PNAEE – Plano Nacional de Ação para a Eficiência Energética (until 2020)**



- Was implemented in different phases, starting with PNAEE 2008.
- Contains policy frameworks to achieve Portugal's energy efficiency objective for 2020 (25% decrease in primary energy demand).

### **PNEC 2030 – Plano Nacional Energia e Clima (2021-2030)**



- Includes national goals for energy efficiency, renewable energy, GHG emissions and electric grid improvements.
- Replaces previous plans: PNAEE (energy efficiency), PNER (renewable energy) and PNAC (climate).
- Is articulated with RNC2050 for long-term decarbonization goals and PNI2030, a national investment plan.

### **RNC 2050 – Roteiro para a Neutralidade Carbónica**



- Its main goal is to implement measures which would allow the Portuguese economy to be carbon neutral by 2050;
- Is in line with Paris Agreement objectives.

## III. Energy management



YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment.  
The project aims at creating employment opportunities for NEETs in islands

# Energiamajandusejuhtimine ehk energiahaldus ...

- Energiahaldus (EnM) vastavalt VDI juhendile VDI 4602:
- "... On energia hankimisel, muundamisel, jaotamisel ja kasutamisel tulevikku suunatud, organiseeritud ja süsteemne koordineerimine, et see vastaks vajadustele ning milles võetakse arvesse ökoloogilisi ja majanduslikke eesmärke."
- Energiahaldussüsteem (EnMS) vastavalt standardile ISO 50001:
- "... Suhete või interaktiivsete elementide olemus energiapoliitika ja strateegiliste energiaeesmärkide rakendamiseks, samuti protsessid ja meetodid nende eesmärkide saavutamiseks."
- Energiahaldussüsteemide rakendamine aitab parandada ettevõtte energiatõhusust.

# What is energy management?

Energy is becoming an increasingly high cost in organizational structures. Energy use, not only represent a financial cost but also an environmental cost, thus is crucial to raise awareness for economical and environmental sustainability through energy efficiency.

As environmental problems become more evident and impactful on our everyday lives, the need for good management of this resource is evident in organizations, large and small.

Energy management is an ongoing act that understands energy efficiency as a global commitment and makes use data to better understand and make decisions about energy use.

The ultimate goal of energy management is to ensure that the least energy is used maintaining or improving the quality of services.

**Energia on organisatoorses struktuuris muutumas üha kallimaks. Energiatarbimine ei tähenda mitte ainult rahalisi kulutusi, vaid ka keskkonnakulusid, seega on ülitähtis majandusalase ja keskkonnasäästlikkuse teadlikkuse tõstmine energiatõhususe kaudu.**

**Kuna tekkinud keskkonnaprobleemid mõjutavad meie igapäevaelu on ilmne vajadus energiaressursside hea haldamise järele nii suurtes kui ka väikestes organisatsioonides.**

**Energiahaldus on pidev toiming, mis mõistab energiatõhusust kui ülemaailmset kohustust ja kasutab andmeid energiatarbimise paremaks mõistmiseks ja otsuste tegemiseks.**

**Energiahalduse lõppeesmärk on tagada, et teenuste ja toodete kvaliteedi säilitamiseks või parandamiseks kulutataks võimalikult vähe energiat.**

# Energiamajanduse juhtimine (energiahaldus)

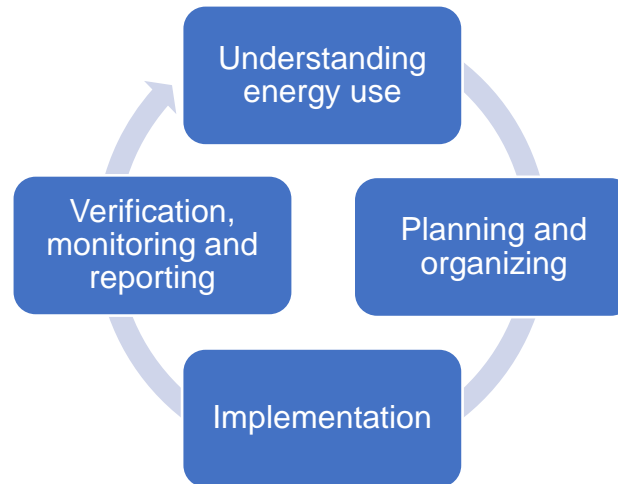
- Energiahaldus hõlmab energiatootmise ja energiatarbimisüksuste kavandamist ja käitamist.
- Eesmärgiks on ressursside säilitamine, kliimakaitsese ja kulude kokkuhoid, samal ajal kui kasutajatel on püsiv juurdepääs vajaminevale energiale.
- See on tihedalt seotud keskkonnajuhtimise, tootmise juhtimise, logistika ja muude väljakujunenud ärifunktsioonidega. VDI-juhend 4602 andis välja määratluse, mis sisaldab majanduslikku mõõdet: „Energiahaldus on energia hankimise, muundamise, jaotamise ja kasutamise ennetav, organiseeritud ja süsteemne koordineerimine nõuete täitmiseks, võttes arvesse keskkonna- ja majanduseesmärke.”

- The energy management process usually begins with an energy audit where energy flows are identified and quantified and existing energy systems are analysed. This energy accounting tasks will allow for an energy baseline to be established.
- Opportunities for improving energy use are identified and a set of energy efficiency measures are proposed, analysed and compared.
- A planning and organization process follows to select the technical and economic feasible measures. A plan is laid out that considers all necessary resources to effectively implement the measures during a predefined timeline.
- The results of implemented measures are evaluated through a process of monitoring and verification in order to compare with expected results.
- New energy efficiency measures can be proposed, analysed and implemented in order to respond to new requirements and achieve a continuous improvement of energy efficiency.
- **Energiahaldusprotsess algab tavaliselt energიაauditiga, kus tuvastatakse ja kvantifitseeritakse energiavood ning olemasolevaid energiasüsteeme analüüsitakse. Need energiarvestuse ülesanded võimaldavad luua energiakasutuse lähtetaseme.**
- **Selgitatakse välja võimalused energiatarbimise parandamiseks ning pakutakse välja, analüüsitakse ja võrreldakse energiatõhususe meetmete kogumit.**
- **Järgneb planeerimis- ja korraldamisprotsess, et valida tehniliselt ja majanduslikult teostatavad meetmed. Esitatakse kava, milles võetakse arvesse kõiki vajalikke ressursse meetmete tõhusaks rakendamiseks etteantud aja jooksul.**
- **Rakendatud meetmete tulemusi hinnatakse seire ja kontrollimise käigus, et võrrelda neid oodatavate tulemustega.**
- **Uutele nõudmistele vastamiseks ja energiatõhususe pideva parendamise saavutamiseks on võimalik välja pakkuda, analüüsida ja rakendada uusi energiatõhususe meetmeid.**

# The energy management cycle

Although there are many options and variations for the stages of the energy management process, the end goals and general activities to carry out this type of management are very similar.

Having this in mind, the following figure describes the cycle steps that are generally followed during energy management processes.



# Where can energy management be applied?

Energy management is relevant and beneficial to be applied in any company, department or service that wants to consciously and effectively manage its energy use to reduce energy costs and environmental impacts.

Examples include:

- In public buildings such as schools
- In industry
- In domestic buildings
- In public transport fleets
- In hotels, restaurants, etc.

# Energy management

## Keypoints

- Energy management is the proactive, organized and systematic management of energy use in a wide range of activities in order to satisfy both environmental and economic requirements.
- Energy management implies making decisions about energy use that are supported by data.
- Energy management stages include understanding energy use, planning and organization, implementation and verification, monitoring and reporting.

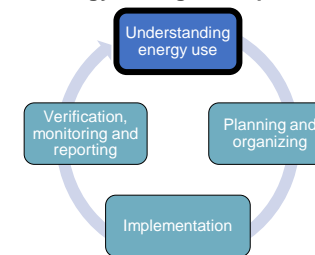
## III. a) Understanding energy use – Energy audits



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# Understanding energy use

The energy management process



Energy use can be accessed through an energy audit.

An energy audit consists in characterizing how much, where and how energy is being used within an organization or facility.

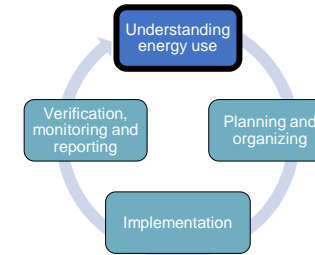
Energy audits provide essential information that allows the identification of key areas for energy efficiency improvements and the establishment of an energy use baseline.

Depending on the intended use of the energy audit and the size of the facility, the energy audit can be simple, complete or even target a specific sector or equipment type.

**A detailed energy audit is the starting point for a successful energy management process.**

# Energy Audits - Tasks

The energy management process



A detailed examination of the energy use conditions of a given facility may include:

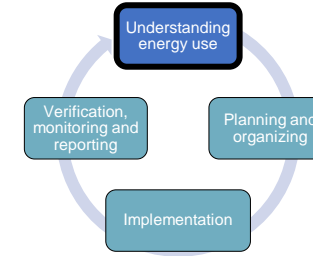
- Identification and quantification of the energy flows (electricity, gas, fuel types, etc.) through bill and meter analysis or direct measurement;
- Characterization of existing energy systems, their conservation status, conversion yields and their maintenance plans through observations and measurement taking;
- Evaluation of specific energy consumptions of each end use and / or each sector of the installation (lighting, heating, ventilation, kitchen, etc.);
- Interviewing key staff members and supervisors to better understand the facility operation.

During these tasks, the energy auditor must be able to detect inefficiencies related to energy use and propose feasible solutions to address them.

Other general tasks that can be carried out during an energy audit include the verification of correct operation of energy systems, verification of user comfort and compliance with applicable legislations.

# Bills and energy meter analysis

The energy management process



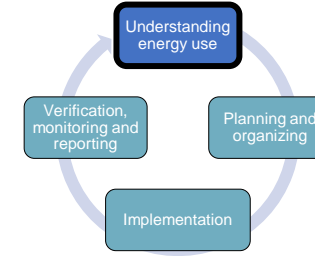
Bill analysis consists in cataloguing and gathering data from energy bills which can be a useful and fast way to understand how much energy is being consumed. The processing of this data allows the visualization and identification of energy use patterns.



Additionally, energy supply contracts can be analysed in order to make sure the contract is the best suited of the facility and energy costs are the lowest. This is called energy procuring.

# Equipment characterization

## The energy management process



Equipment characterization consists in cataloguing equipment that use or influence energy use in the studied facility.

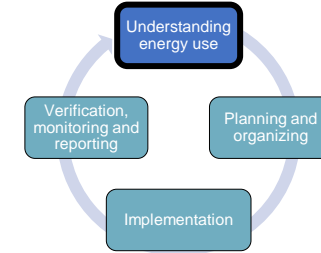
By understanding the specifications of installed equipment it may be possible to identify which ones have a low energy efficiency and consider them for future renovations.

During this task, and with the help of measurements (if necessary) the conservation state of equipment should be verified.

As an example, during an energy audit of a building, the a lack of wall insulation and the use of an old, outdated boiler for water heating may signal the auditor that these areas may be considered for implementing energy efficiency measures.

# Examples of equipment characterization

## The energy management process



Name: LED lightbulb  
Energy vector: Electricity  
Location: Room  
Equipment type: Lighting systems  
Lightbulb Type : LED  
Rated power: 10W  
Age: 2 years  
Conservation state: Good



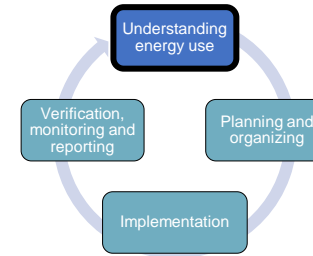
Name: NW Window  
Location: Bathroom  
Floor: 1<sup>st</sup>  
Orientation: NW  
Frame material: Wood  
Frame insulation: n/a  
Total area: 3m<sup>2</sup>  
Glass type: Simple  
Glass area: 2.5m<sup>2</sup>  
Age: >20 years  
Conservation state: Poor



Name: Biomass water boiler  
Energy vector: Biomass (wood pellets)  
Location: Attic  
Equipment type: Water heating system  
Rated power: 10kW  
Age: 5 years  
Conservation state: Moderate

# Measurement taking

The energy management process



Taking energy measurements allow for a more precise accounting of energy use. This can be achieved through the use of power analysers, thermometers, flow sensors and humidity meters, thermographic imaging or any other specialized measurement devices



Power analyser



Flowmeter

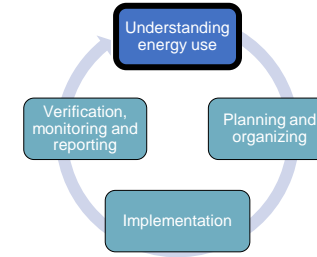


Thermographic imaging

Measurements can be taken to access the real energy use of equipment, understand energy usage patterns and also detect anomalies or deviations from the normal operation of certain systems.

# Staff interviewing

## The energy management process



Staff interviewing consists in gathering information about how equipment is used and understanding the role users play in energy consumption.

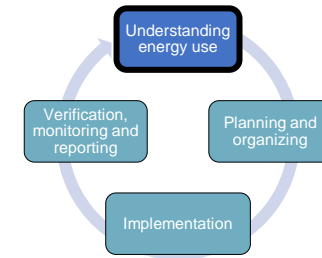
Since users are the ones who have a more intimate relation with equipment, they can provide valuable information about operation schedules.

Staff interviewing also allows the detection of possible inefficiencies that may be corrected by adjusting behaviours through staff training.

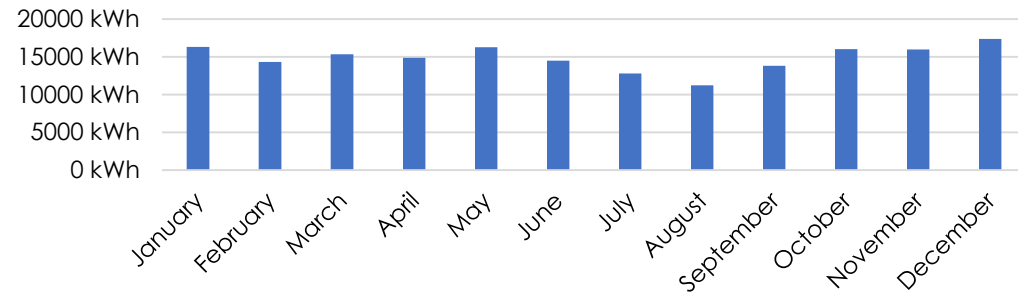


# Examples of energy data analysis

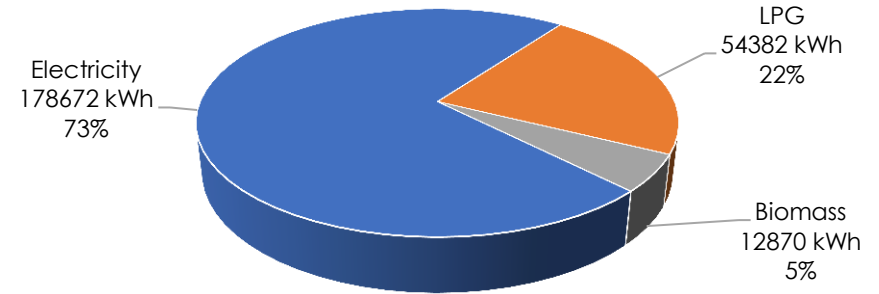
The energy management process



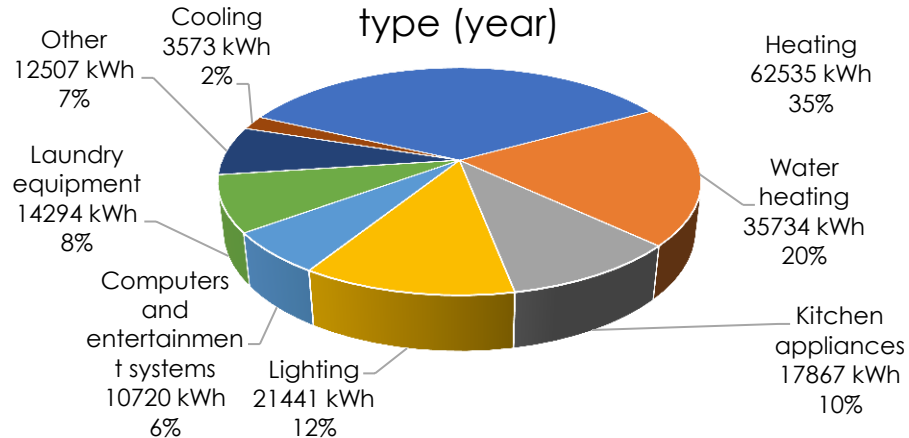
Electricity Consumption (year)



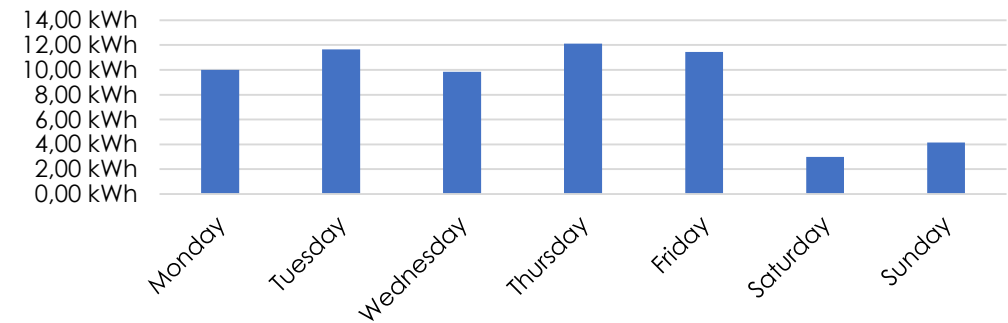
Total energy consumption by vector



Electricity consumption by equipment type (year)



Water heater weekly energy consumption



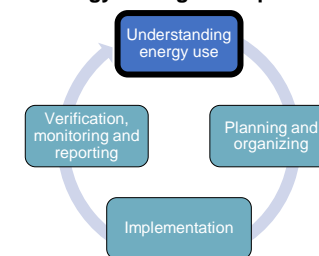
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# Understanding energy use

## Keypoints

- Energy audits main objective is to understand how energy is being used in a facility in order establish an energy baseline and to identify possible energy efficiency opportunities.
- Some tasks made during an energy audit include energy bill analysis, equipment characterization, measurement taking and staff interviewing.
- A full energy characterization of a facility consists in cataloguing energy consuming equipment and any other factors that influence energy consumption use. This activity requires knowing the different types of equipment an their technical specifications and allows the detection of low efficiency equipment to later consider them for a possible energy efficiency improvement measure.
- Depending on available energy data, it may be possible to evaluate energy consumption during a particular period, for different types of equipment or energy carriers, for example.

The energy management process



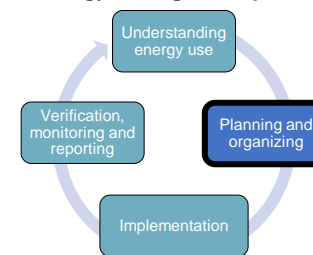
## III. b) Planning and organizing – Energy efficiency action plans



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# Planning and organizing

The energy management process



In energy management, the planning and organization stage can be summarized by producing an energy efficiency action plan.

An energy efficiency action plan consists outlines relevant conclusions gathered during the energy audit and includes detailed guidelines for implementing energy efficiency measures clearly stating the entity's goals and expected results by implementing them.

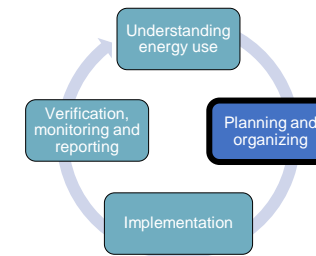
Proposed energy efficiency measures should be analysed and classified by their technical and economic feasibility and their implementation be prioritized according to available resources.

The establishment of a measure implementation timeline and a robust verification strategy allows the progress follow-up by comparing real results with predicted results.

Because the making of this plan should involve the input of staff and other stakeholders, it ultimately represents the entity's commitment in reducing energy consumption and improving energy efficiency.

# Planning and organizing

The energy management process

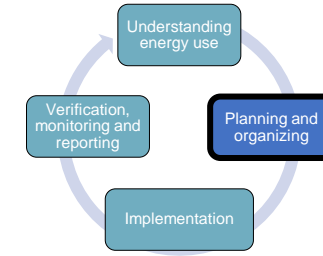


A energy efficiency action plan usually contains the following topics:

- Energy characterization (energy audit outputs);
- Proposal of different energy efficiency measures and indication of expected energy and economic savings;
- Expected timeline for measure implementation;
- Resource management related to measure implementation;
- A training program for staff and other stakeholders;
- A measurement and verification plan.

# Why is planning important?

The energy management process

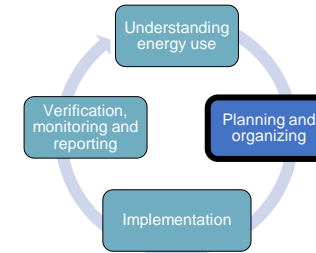


- Enables to detect deviations from the plan and allows a timely reaction and adaptation to unforeseen conditions.
- Gives necessary information to involve investors and stakeholders in the energy management process.
- Helps to coordinate the implementation of measures and ultimately helps the achievement of proposed goals.

Creating energy efficiency action plans involves information awareness, critical thinking, effective communication and decision making.

# Energy Efficiency Measures

The energy management process



Energy efficiency measures (EEM) are any measure intended to reduce energy use without affecting the overall performance of an organization or comfort of its users.

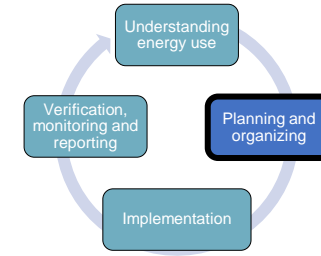
There are two main types of EEM: behaviour based and equipment based. The first consists in reducing energy waste through behavioural changes and better scheduling of equipment operation while the second implies the installation of higher energy efficient equipment.

The proposal of energy efficiency measures should make sense both technically and financially. The environmental impact should also be an important factor for selecting the best performing measures.

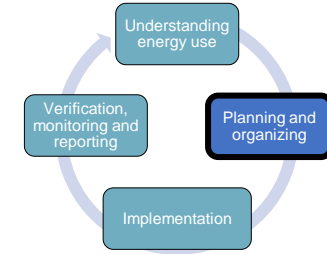
Type	Investment	Energy savings potential
Behaviour based	Low to medium	Low to medium
Equipment based	Medium to high	Medium to High

# Energy Efficiency Measures

## Examples



- Maintenance of a climatization system in an office.
- Fluorescent lamps replacement with LED lamps in a shopping centre.
- Installation of thermal insulation and energy efficient windows in a household.
- Installation of a cogeneration and district heating system in a power generation system.
- Installation of an energy monitoring system in an hotel.
- Introduction of electric vehicles in a public transport company.
- Public transport intelligent management.
- Logistics company route optimization.



# Energy Efficiency Measures

## Examples

In the energy efficiency action plan, measures should be described and justified with great detail. Each measure should have a technical, energy, environmental and economic analysis with the help of real data or the most reliable estimates possible.

Measure	Description	Implementation period	Cost	Yearly energy savings	Avoided CO2 emissions	Yearly savings	Payback period
Measure #1	Optimization of lighting systems through automatic switching	1 month	250€	625 kWh	312.5 kg	125€	2 years
Measure #2	Replace existing lightbulbs with LED	1 month	1250€	2500 kWh	1250 kg	500€	2.5 years

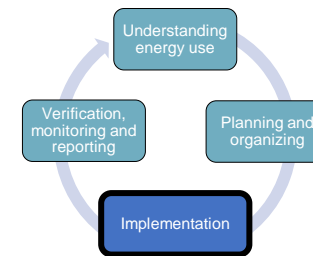
## III. c) Implementation – Project implementation



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# Project implementation

The energy management process



Project implementation is concerned actually applying the proposed energy efficiency measures.

Energy efficiency measures may involve maintenance tasks and installation of new equipment, either by total substitution or by retrofits.

Training sessions may be necessary in order to teach how to operate new equipment or to change staff's energy using habits.

The implementation difficulty, time and cost vary significantly depending on the type of energy efficiency measures.

Although simple measures can be implemented by the entity, there may be a need for contracting a third party for tasks which require technical expertise or intensive labour.

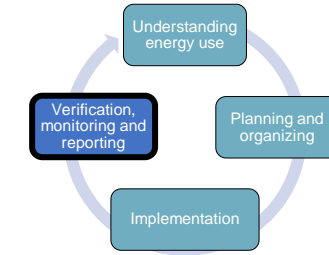
## III. d) Verification, monitoring and reporting – Measure and Verification



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# What is verification, monitoring and reporting?

The energy management process



It is the process of planning, measuring, collecting and analyzing data for the purpose of verifying and reporting energy savings within an individual facility resulting from the implementation of energy efficiency measures.

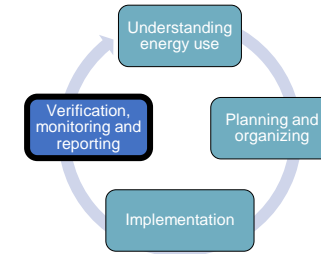
Since energy savings represent the absence of energy use, they cannot be directly measured. Instead, savings are determined by comparing measured use before and after implementation of a measure, making appropriate adjustments for accounting changes in operating conditions.

The monitoring and follow-up process should verify the execution of the programmed measures and compare their results with the initially planned ones in order to identify possible resources shortages and / or deviations from the established goals.

On energy management, this step is often just called “measurement and verification” which implies the same general goals and activities described above.

# Measurement and verification activities

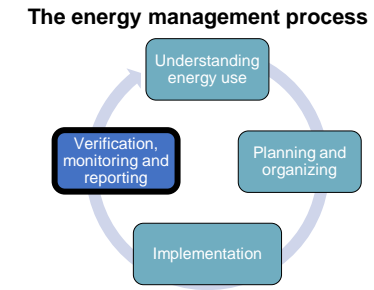
The energy management process



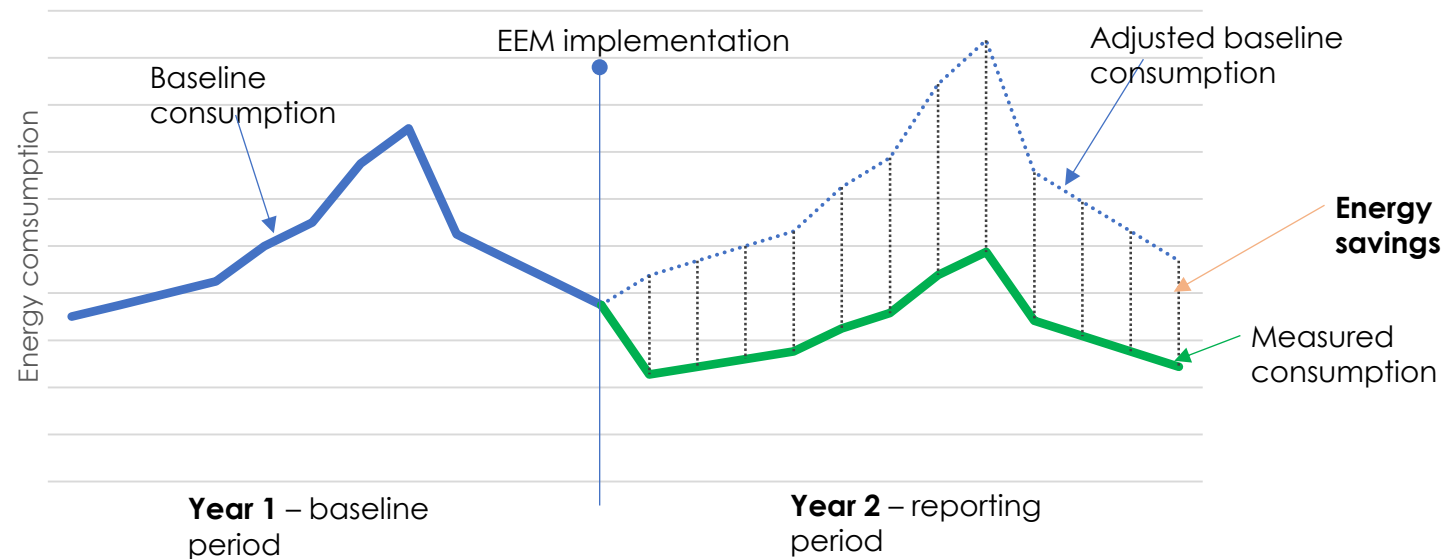
Measurement and verification activities involve activities such as:

- Meter installation, calibration and maintenance;
- Data gathering and screening;
- Development of computations methods to make valid and acceptable estimates and adjustments;
- Computations with measured data and periodic reporting;
- Quality assurance of reports by a third party, if applicable.

# Measurement and verification



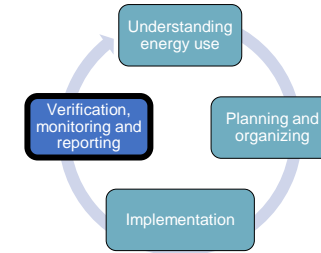
Energy savings are determined through a comparative analysis of consumption measured before (baseline period) and after EEM implementation (reporting period), making appropriate adjustments taking into account possible changes in the operating conditions of the facility.



The IPMVP – International Performance Measurement and Verification Protocol is a widely adopted protocol for determining energy savings.

# Other measurement and verification facts

## The energy management process



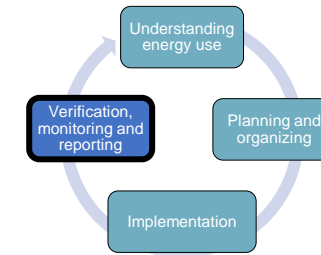
Savings from improvements could fund the development of new phases of the energy efficiency action plan.

The use of energy monitoring systems or any other automated data gathering system is a useful way to monitor and follow the energy efficiency measures.

Energy monitoring systems do not, by themselves, decrease the energy consumption but give equipment operators useful information to better adjust and schedule equipment use in a timely fashion.

A rebound effect is observed when expected energy savings fall short of predicted numbers. This is caused mainly due to a behavioral change, that happens when users end up using an equipment more frequently because it is more energy efficient.

The energy management process



# Verification, monitoring and reporting

## Keypoints

- Its main goal is to track the progress of the energy efficiency action plan and verify the effectiveness of implemented EEMs.
- It involves the data gathering, analysis and reporting by measuring energy consumption and other relevant metrics that describe the operation conditions.
- Energy savings are computed by comparing current energy use to baseline values and adjusted to reflect the report period operating conditions.

# IV. Energy efficiency and ICTs

Information and Communication Technologies and their role in  
energy efficiency



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# Energy efficiency and ICTs

Although there is no single, universal definition of ICT, the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations to interact in the digital world.

ICT comprise of a very broad field of study and are becoming increasingly present in more and more activities.

In particular, ICTs can help to improve energy efficiency in different sectors through the use of energy monitoring systems and control in order to improve and optimize the operation of energy using systems.

ICTs give consumers the ability to monitor their energy use in real time, which incentivises users to react and adapt their energy using behaviour. Also, with intelligent control systems, appliances can be controlled to meet users needs while optimizing their energy usage.

For electricity suppliers, ICTs will have a prominent influence in creating smart grids which will allow a better match between demand and supply.

ICTs also provide solutions for a more reliable and effective energy management process, mainly for energy auditing and monitoring stages.

# ICTs and Energy Use

Although these systems have the potential to increase energy efficiency in different sectors, ICTs themselves are responsible for the use of energy during all stages of their lifecycle. With the expected increase of ICT use there will also be a tendency to increase their overall energy use.

With this concern in mind, arose the concept of “green computing” which is the study and practice of environmentally sustainable computing and IT.

The goals of green computing include the maximization of energy efficiency during the product's lifetime, the reduction of hazardous material use and factory waste and the improvement of recyclability or biodegradability of defunct products.

# How can ICT help Energy Efficiency?

ICTs can be applied for:

- In electricity distribution through the use of smart grids;
- Smart buildings, smart homes and smart metering;
- Transport systems;
- Dematerialisation;
- Industrial processes;
- Organisational sustainability.



# V. Energy efficiency and finance



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# Energy Performance Contracting (EPC)

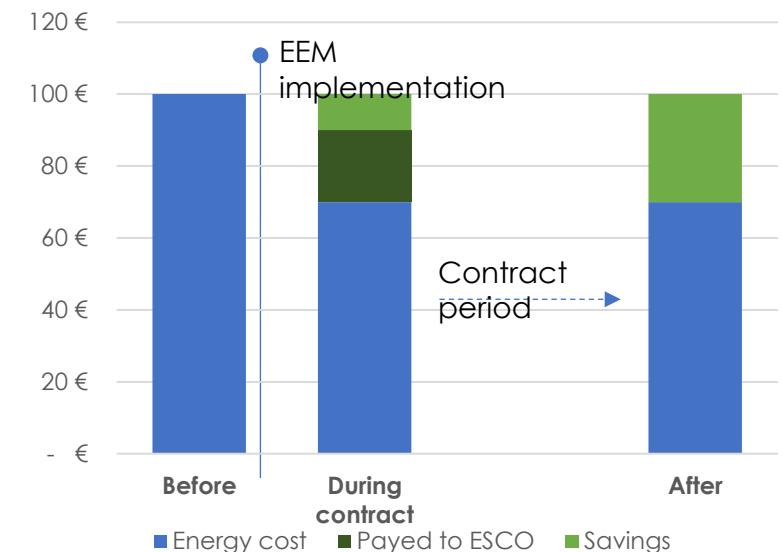
Energy Performance Contracting (EPC) is a form of 'creative financing' for capital improvement which allows funding energy upgrades from cost reductions.

Under an EPC arrangement an external organization, an Energy Services company (ESCO) implements a project to deliver energy efficiency, or a renewable energy project, and uses the stream of income from the cost savings, or the renewable energy produced, to repay the costs of the project, including the costs of the investment.

EPCs can be a viable option for large investments for implementing energy efficiency measures if the consumer is not able to undertake such investments.

Example of an EPC implementation sequence:

1. An ESCO makes an energy audit and analyses the potential for implementing energy efficiency measures in a customer's facility.
2. The ESCO invests and installs an efficient equipment which helps to reduce energy use and related costs.
3. During the contract, the customer pays the ESCO a previously agreed proportion of the total energy savings.
4. After the ending of the contract, the customer keeps the equipment and enjoys the full benefit of energy cost savings.



# VI. Energy efficiency and other YENESIS thematic areas



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# Energy efficiency - a transversal topic

Energy efficiency is a transversal topic which influences the sustainability of a wide range of human activities.

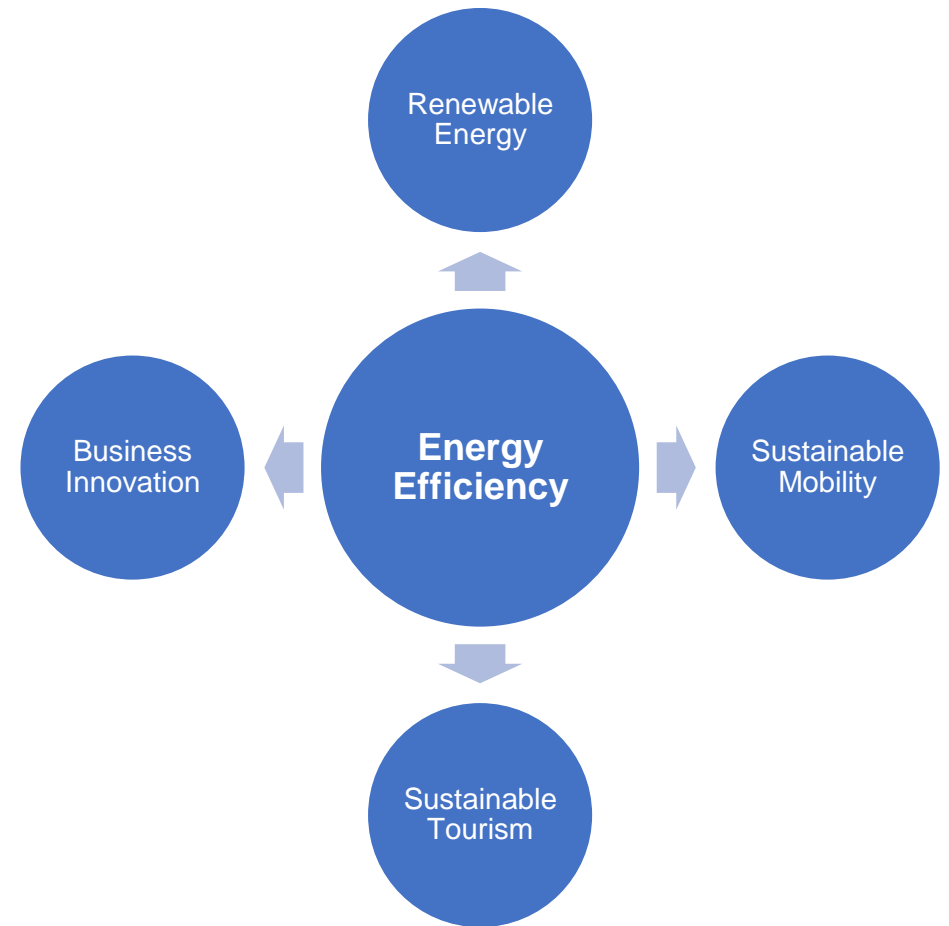
**Energiatõhusus on läbiv teema, mis mõjutab paljude inimtegevuse jätkusuutlikkust.**

Energy efficiency is a relevant topic when addressing the issue of sustainability of society's needs such as mobility and also economic activities such as tourism.

**Energiatõhusus on asjakohane teema ka siis, kui käsitletakse ühiskonna vajaduste (nt liikuvus) ja ka majandustegevuse, näiteks turismi jätkusuutlikkuse küsimust.**

The widespread nature of energy efficiency matters makes it a great platform for innovation and promotes competitiveness.

**Energiatõhususe küsimuste laialdane olemus muudab selle suurepäraseks innovatsiooniplatvormiks ja edendab konkurentsivõimet.**



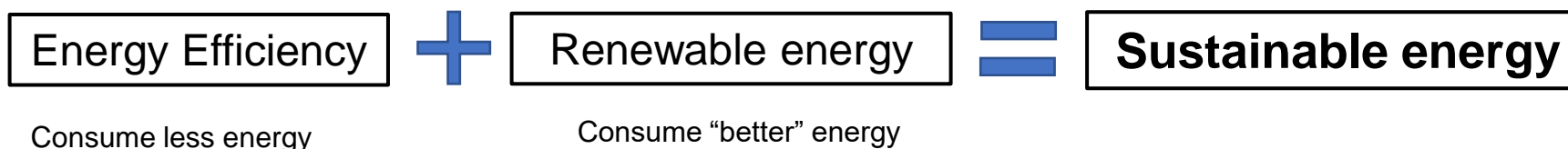
# VI. a) Energy efficiency and Renewable energy



YENESIS benefits from a € 2.3 M grant from Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Youth Employment.  
The project aims at creating employment opportunities for NEETs in islands

# Energy efficiency and Renewable energy

Energy efficiency combined with renewable energy compose the two main pillars of a sustainable energy policy.



By reducing the overall energy consumption and using energy from renewable sources, the negative environmental impacts energy use can be minimized and the share of renewables in the final energy is increased.

Also, the use of renewable energy systems can be an effective way to reduce energy costs to facilities.

As energy efficiency measures are often cheaper and easier to implement, they should be prioritized over renewable energy systems. Additionally, if a facility is using less energy as a consequence of previous implemented energy efficiency measures, it will later imply a better and more efficient use of energy produced from renewable sources.

# Energy efficiency and Renewable energy

Using non-renewable energy sources combined with low efficiency equipment to convert that energy is the option which has the highest environmental impact. Using an equipment with high efficiency helps to reduce that negative impact, although it is still high.

Alternatively, using energy from renewable sources helps to reduce that impact. Nevertheless combining renewables and low efficiency equipment is not the most effective way to use energy.

Energy source	Energy use	Environmental impact
Non-renewable	Low efficiency equipment	Highest
Non-renewable	High efficiency equipment	High
Renewable	Low efficiency equipment	Medium
Renewable	High efficiency equipment	Lowest

# VI. b) Energy efficiency and Sustainable mobility



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# Energy efficiency and Sustainable mobility

The transportation of persons and goods is very energy intensive specially in islands. Its remoteness implies that imported goods and travel are more expensive and have a higher energy footprint.

The transport sector can greatly benefit from energy efficiency, as it can help to reduce overall costs and consequently decrease the price of goods and improve access to travel.

Also, as most of today's transport systems still rely on fossil fuels, a more energy efficient sector can help to lessen air and noise pollution while improving health and well being, particularly in large urban centers.

In a practical way, a more energy efficient transportation sector can be achieved by:

- Having rational energy using behaviors such as eco-driving;
- Using energy efficient vehicles and modes of transport;
- Using better fleet management systems;
- Implementing energy-conscious mobility plans.

# Energy efficiency and Sustainable mobility

Specific ways to improve energy efficiency in transportation include:

- Electromobility;
- Improving public transport infrastructure;
- Installing bicycle paths;
- Car sharing.

New trends that can potentially improve energy efficiency in transportation include:

- Demand responsive transport - is a form of transport where vehicles alter their routes based on particular transport demand rather than using a fixed route or timetable. These vehicles typically pick-up and drop-off passengers in locations according to passengers needs and can include taxis, buses or other vehicles.
- Mobility-as-a-Service (MaaS) - describes a shift away from personally-owned modes of transportation and towards mobility provided as a service. This is enabled by combining transportation services from public and private transportation providers through a unified gateway, which manages the trip.

# VI. c) Energy efficiency and Sustainable tourism



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# Energy efficiency and Sustainable tourism

Tourism can be a very resource intensive activity. Energy, being a resource with high operational cost and negative environmental impact, should be rationalized in all types of services related to touristic activities.

Energy efficiency can help the tourism sector to become more sustainable mainly by:

- Reducing energy costs in a very important economic sector in island's economies turning the sector more competitive and improving regional economic performance.
- Reducing pollution related to energy use, preserving local environment and improving overall well being.

This also helps to safeguard nature related tourism, in particular.

## Example of an energy efficiency measure applied to the tourism sector



- The EU ecolabel is awarded to **tourist accommodation services** and **campsite services**.
- Criteria to be awarded the label include the use of **energy efficient appliances**, its preventive **maintenance** and **management** in order to reduce energy consumption and carbon emissions.
- Promotes the use of **renewable energy**.
- Other criteria include the use of **environmentally friendly products**, **recycling materials** and **food waste reduction**.

## VII. Real life projects



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# Real life projects in Madeira



Building digitalization and energy management services.



Energy monitoring, energy certificates (buildings), electric mobility and renewable energy systems



Energy auditing and consulting and energy certificates (buildings).



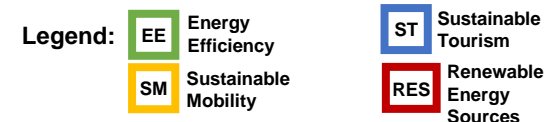
Use of electric vehicles for touristic city tours.



Energy self sufficiency, use of highly efficient equipment and materials and local energy production from renewable sources.



Use of electric buses and fleet management systems.



# Real life projects in Madeira

## Porto Santo Smart Fossil Free Island

The main goal of this project is to eliminate the use of fossil fuels. In order to achieve this ambitious goal, the project is based in energy efficiency, renewable energies, electric mobility and smart grids.

It also has an interest in improving the quality of life island inhabitants and visitors. There is a focus in generating new opportunities for local economy, creating jobs for the residents, reducing external dependencies and promoting its natural resources.

Some specific project measures include:

- Implementation of a smart electric system based on sustainable energy and sustainable mobility;
- Smart metering in households and businesses;
- Introduction of electric vehicles and smart charging;
- Energy efficient street lighting and remote management;
- Increase in length of bike paths.



# VIII. Employment opportunities/business ideas in energy efficiency



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# Energy Efficiency

## Business opportunities

- **Technology** – Need to develop new technologies and improve on existing ones to push new energy efficient products to the market.
- **Data analysis** – Need to implement energy monitoring and data analysis systems.
- **Management** – Needs to develop solutions to better plan and manage energy consumption.
- **Architecture** – Need to develop and apply ecodesign techniques and promote the use of energy efficient materials and equipment in buildings.
- **Sales and labor** – Need for equipment resellers and skilled labor for its installation and maintenance.
- **Consulting** – Need to increase the offer and quality related to energy efficiency consulting such as energy planning and auditing for all kinds of entities.
- **Law and policies** – Need to streamline and simplify existing laws and policies and develop new ones in order to make energy efficiency a preponderant theme in all society's activities and economic sectors.
- **Finance** – Need to develop robust financial models related with energy efficiency projects and lower its risk in order to attract public and private investment.
- **Training and education** – Need for training in energy efficiency matters for a wide range entities and demographics in order change energy-using behaviors.

- **Technological**
- **Political**
- **Economical**
- **Socio-cultural**

# Employment opportunities in energy efficiency

Examples of activities, occupations and fields:

- **Technicians**
  - Equipment installation and maintenance (HVAC, building insulation, appliances, etc...)
  - Energy audits
  - Electric grid maintenance
  - Energy planning
- **Entrepreneurs**
  - Any innovative business model that aims to implement energy efficiency related products and services to a particular demographic or sector.
- **University-degree holders**
  - Energy managers and auditors
  - Building energy performance certification experts
  - ICT for energy management applications (software, electronics)
  - Software specialists and data analysts
  - Architecture (sustainable building design and NZEBs)
  - Engineering careers (civil, electronics, software, mechanical, energy, etc)
  - Policy and finance experts
  - Electric grid managers
  - HVAC experts
  - Ecodesign of products
  - Educators and trainers

# Examples of tasks/jobs related to energy efficiency

- Installation, operation and maintenance of energy efficiency systems;
- Energy audits;
- Energy monitoring and management;
- Installation of thermal insulation solutions in new and rehabilitation buildings (thermal insulation of facades, floors and roofs, glazing, shading);
- Energy certification of buildings (simulation of thermal behavior of buildings and design of thermal envelope of buildings);
- Development of software for data acquisition and management of production, storage and use of energy;
- Awareness and training to acquire more efficient equipment and sustainable use of energy.
- Development of energy efficiency projects: proposal and design of equipment and solutions for the thermal envelope of buildings and data acquisition and management systems.

# IX. Conclusions



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# Conclusions

- High energy waste is a reality that is inherent to our current technologies and energy using behaviour which has great implications for the economy and environment.
- Energy efficiency comes as an effective solution to this problem, which implies using less energy to satisfy our needs.
- In particular, islands can benefit from energy efficiency by reducing its energy dependence, preserving the local environment and boost their economies.
- The EU considers EE a main player in achieving its energy strategy. This places EE in a privileged position to improve the energetic, environmental, economic and social conditions of EU countries.
- The energy management process is a systematic and practical method to implement energy efficiency measures in a wide range of entities and systems.
- ICTs have a potential to be a catalyst in increasing energy efficiency across the board.
- EE is not only a necessary ingredient for energy sustainability, but also to other human activities such as mobility and economic activities such as tourism.
- Energy efficiency employment positions are diverse and can supply opportunities for technicians, university-degree holders and entrepreneurs.
- Because there are current challenges in energy efficiency, this makes it a field craving innovative solutions.

- Suur energia raiskamine on reaalsus, mis on omane meie praegustele tehnoloogiatele ja energiatarbimise käitumisele, ja sellel on suur mõju majandusele ja keskkonnale.
- Energiatõhususe (EE) parandamine on sellele probleemile õige lahendus, mis tähendab, et meie vajaduste rahuldamiseks tuleb kasutada vähem energiat, ressursse üldse.
- Eelkõige saavad saared energiatõhususe suurendamisest kasu, see aitab vähendada energiasõltuvust, säilitada kohalikku keskkonda ja edendada kohalikku majandust.
- EL peab EEd oma energiasstrateegia saavutamisel peamiseks osaliseks. See annab EEle eelisseisundi, et parandada ELi riikide energeetilisi, keskkonnaalaseid, majanduslikke ja sotsiaalseid tingimusi.
- Energiahaldusprotsess (energiamajanduse juhtimine) on süsteemne ja praktiline meetod energiatõhususe meetmete rakendamiseks paljudes üksustes ja süsteemides kuni riigi tasandini välja.
- IKT-l on potentsiaali olla katalüsaatoriks energiatõhususe suurendamisel üldiselt.
- EE pole mitte ainult energia säästliku kasutamise vajalik koostisosa, vaid ka muude inimtegevuste, näiteks liikuvuse ja majandustegevuse, näiteks turismi jaoks.
- Energiatõhusate töökohtade positsioonid on mitmekesised ja pakuvad tehnikutele, kõrgharidusega töötajatele ja ettevõtjatele võimalusi.

# Thank you

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