

SLIDE 1

Introduction

Growing need for more sustainability in our society and better use of natural resources made significant changes in the way our economy operates and those changes will only escalate. New directives are creating different incentives for companies to invest more in a green economy. More and more investors take into consideration non-financial factors while investing, which may be a chance for pro-green firms to stand out.

Eco-education creates an opportunity for people, entrepreneurs to involve more into ecological activities to accelerate social movement towards cleaner world. It also creates an opportunity for companies to open to green sector for both ethical and economic reasons.

This training content has been produced in fulfilment of requirements of the PROGREEN project, financed by ERASMUS+, and it covers the basics of eco-education knowledge.

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Introduction

Green Economy refers to the economy that aims at reducing environmental impact of human actions together with sustainable development. It's based on 3 pillars:

- 1) Economy
- 2) Society
- 3) Environment

In 2018 Green Economy evened the fossil fuel industry and it's now worth around 4 trillion USD with majority of value coming from clean energy, energy efficiency, water, waste and pollution services. According to UN Climate Change organization, if it keeps current course, green economy may represent around 10% of the global market value by 2030.

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Introduction

Green jobs refer to the implementation of manufacturing processes and performance of products and services that have positive impact on the environment.

Fastest growing green jobs:

- 1) Urban grower
- 2) Clean car engineers
- 3) Water quality technicians
- 4) Natural scientists
- 5) Green builders
- 6) Eco-educators
- 7) Green design professionals

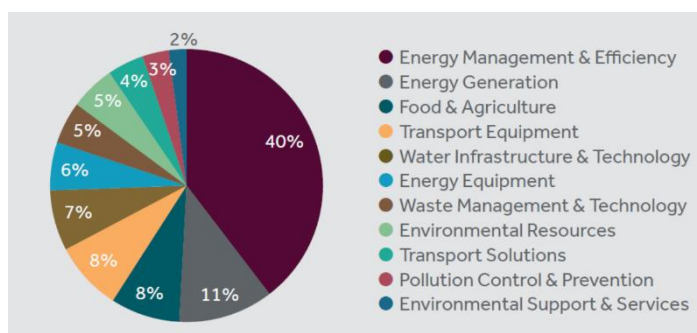


Figure 1. Green economy by sector

Source: FTSE Russell, data as of December 2017

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Introduction

After completing this course, the candidate should gain fundamental knowledge of green economy and opportunities it creates for both companies and society. This module contains 4 lessons:

- LO1: Renewable energy - overview
- LO2: Effective use of resources
- LO3: Sustainable Development Goals
- LO4: Ecological approach in business

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Introduction

Prior to accessing the content of this training, the candidate should get familiar with:

- Methods of teaching adults
- Techniques for m

LO1 Renewable energy – overview

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Introduction to renewable energy

Since 2010 the share of renewable energy consumption and generation increases by 0.7 percentage points according to SDG Energy Indicator report. In 2017 it accounted for over 24% in all energy consumption worldwide. By far the leading region is Asia with almost 40% share.

There are several factors which shape how and where the employment is generated in renewable energy industry. The most common are:

- Government policies
- Trade patterns
- Industry reorganization
- Consolidation trends

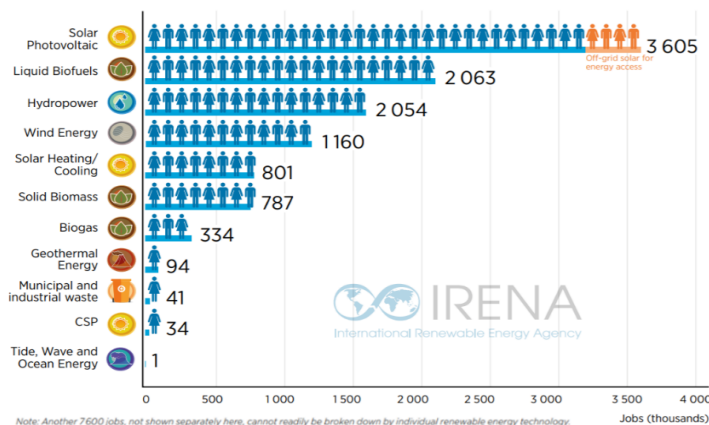


Figure 2. Employment in renewable energy sector
Source: IRENA jobs database

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Hydropower – Description

Early uses of waterpower date back to Mesopotamia and ancient Egypt where irrigation has been used since the 6th millennium BC. Hydropower is derived from the force or energy from moving water.

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Types of hydroelectric power generation²:

- Conventional hydroelectric, referring to hydroelectric dams
- Run-of-the-river hydroelectricity, which captures the kinetic energy in rivers or streams, without the use of dams.

¹ F. Carrasco (2011) Introduction to Hydropower, The English Press, p. 4-7

² Ibid

- Pumped-storage hydroelectricity, to pump up water, and use its head to generate in times of demand.
- Tidal power, which captures energy from the tides in horizontal direction.
 - Tidal stream power, usage of stream generators, somewhat similar to that of a wind turbine.
 - Tidal barrage power, usage of a tidal dam.
 - Dynamic tidal power, utilizing large areas to generate head.

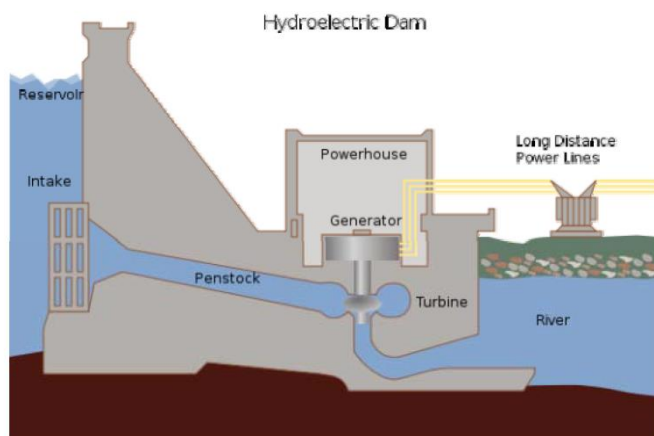


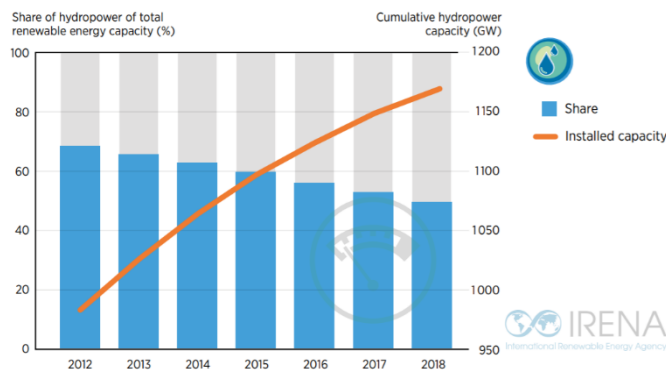
Figure 3. Example of hydroelectric Dam

Source: F. Carrasco, *Introduction to Hydropower* (2011)

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Hydropower - employment and production

Hydropower is the most common type of renewable energy with the highest capacity installed. In 2017 it accounted for 65% of all renewable energy in the world (see figure 5.). Its share lowers as different types like solar or wind systems are installed in higher pace. Based on IRENA database, in 2018 more than 2 million people were directly employed in the hydropower sector worldwide with around 70% of jobs in operations and maintenance.



Source: IRENA, 2019b

Figure 4. Hydropower capacity, total and relative to all renewable electricity capacity, 2012-2018

Source: IRENA

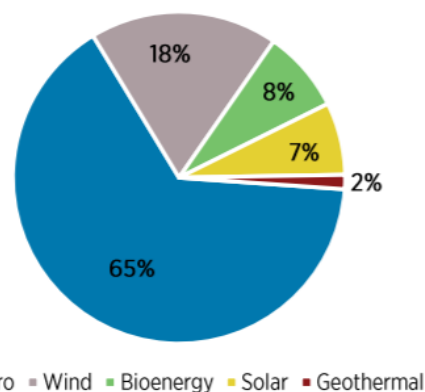


Figure 5. Global share of renewable energy in 2017

Source: IRENA

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Wind power – description

Similar to waterpower, wind power was used by human many centuries BC. It is based on using wind to turn electric generators through wind turbines. Wind turbines can broadly be classified into the following types based on the orientation of the rotor shaft with respect to the oncoming wind:³

- Vertical axis machines – rotor shaft which carries the blades is oriented perpendicular to the ground
- Horizontal axis machines – rotor shaft is mounted on a horizontal axis parallel to the ground

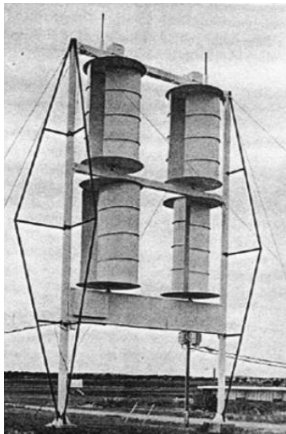


Figure 5. Example of vertical axis machines



Figure 4. Example of horizontal axis machines

Wind farms can be placed on land and offshore. Offshore farms are relatively more expensive, but they are steadier and stronger. Additionally they don't have such visual impact.

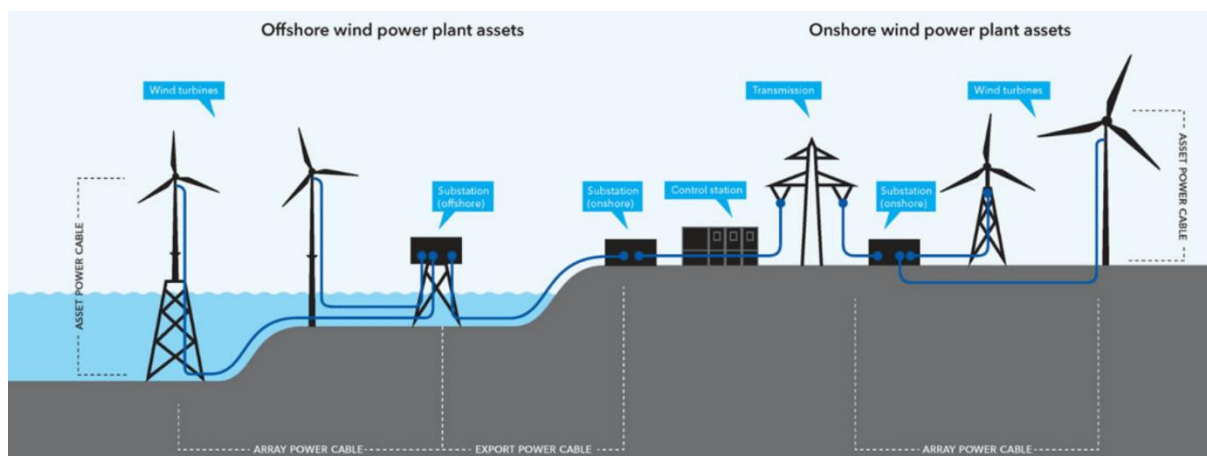


Figure 6. Onshore and Offshore power plant assets

Source: <https://www.dnvgl.com/energy/feature-articles/project-certification.html> (04.11.2019)

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³ A.Roy, S.Bandyopadhyay (2019) Wind Power Based Isolated Energy Systems, Springer, p.25-28

Wind power – employment and production

Wind power is the second most common renewable energy source, in 2017 it constituted 18% to the global renewable energy production. Majority of wind industry is active onshore (540 GW compared to 23 GW offshore based on IRENA 2019 report).

Wind power industry employs around 1.16M people around the world. Although wind is a consistent energy source over the year, there are vast discrepancies in a shorter periods, that's why it is used with other sources of energy or batteries to give a reliable supply.

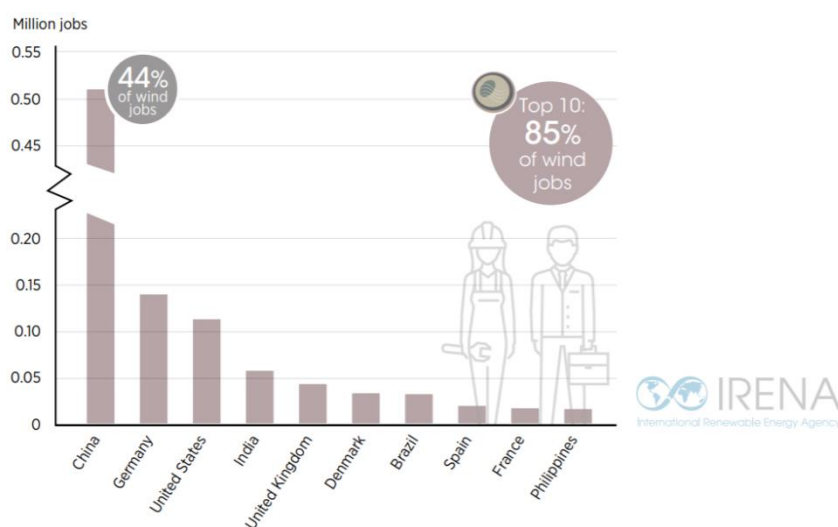


Figure 7. Top 10 countries for wind employment in 2017
Source: IRENA database

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Solar power – description

Solar power is simply converting sunlight into electricity. It might be achieved either by the use of photovoltaics or by concentrated solar power. Photovoltaics cells convert light into an electric current using photovoltaic effect, while concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam.⁴

Solar PV installations can be combined to provide electricity on a commercial scale, or arranged in smaller configurations for mini-grids or personal use. Using solar PV to power mini-grids is an excellent way to bring electricity access to people who do not live near power transmission lines, particularly in developing countries with excellent solar energy resources.⁵

Since 2011, globally solar energy has been the most invested sector of renewable energy (see figure 11), which caused massive drop in solar photovoltaics costs (see figure 10). It's incredibly important in case of poor regions where lack of infrastructure keeps people without access to electricity.

⁴ <https://www.energy.gov/science-innovation/energy-sources/renewable-energy/solar> (04.11.2019)

⁵ <https://www.irena.org/solar> (04.11.2019)

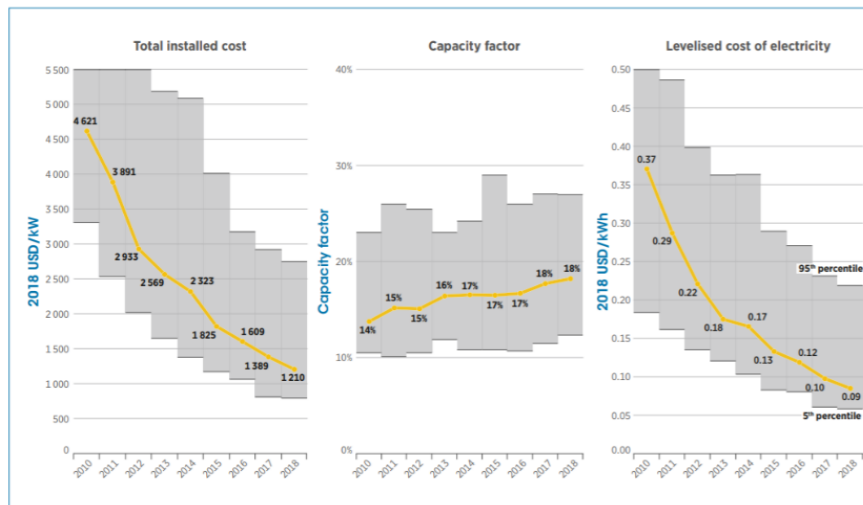


Figure 8. Global weighted average total installed costs, capacity factors and LCOE for solar PV in 2010-2018

Source: IRENA, Renewable power generation costs 2018 report

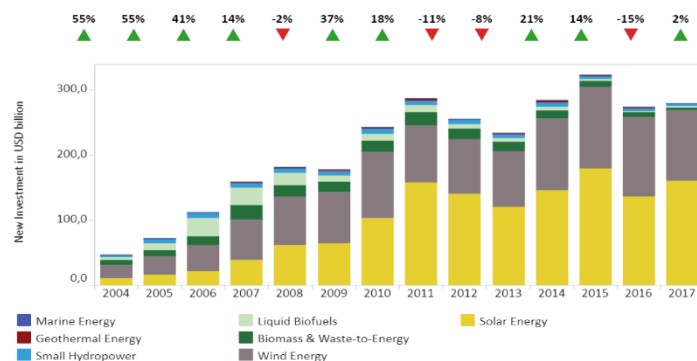


Figure 11. Global trends in renewable energy investment

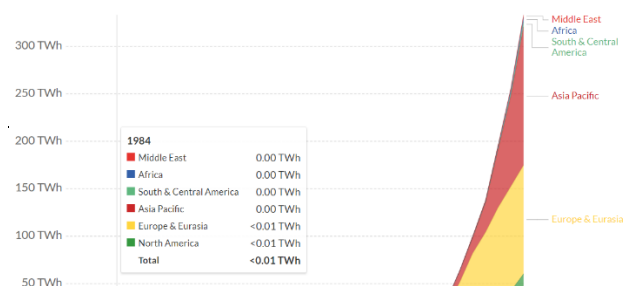
Source: <https://www.irena.org/Statistics/View-Data-by-Topic/Finance-and-Investment/Investment-Trends> (04.11.2019)

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Solar power – employment and production

Solar photovoltaics in 2018 had around 3,6M jobs directly. Again as in different sectors, the biggest employer is China with over 60% of all jobs in solar power worldwide. China is not only world's largest installation market, but also a leading producer of PV equipment.

In 2017 solar power accounted for 7% of global renewable energy, but it's rapidly growing due to lower installation and production costs. Leading country in solar PV energy is Asia (see figure 11).



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Bioenergy – description

Bioenergy use falls into two main categories: “traditional” and “modern”. Traditional use refers to the combustion of biomass in such forms as wood, animal waste and traditional charcoal. Modern bioenergy technologies include liquid biofuels produced from bagasse and other plants; bio-refineries; biogas produced through anaerobic digestion of residues; wood pellet heating systems; and other technologies.⁶

Most bioenergy comes from forests, agricultural farms, and waste. The feedstocks are grown by farms specifically for their use as an energy source. Common crops include starch or sugar-based plants, like sugarcane or corn.⁷

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Bioenergy – employment and production

According to IRENA database (see figure 12) the most common bioenergy is solid biomass. Bioenergy sector was responsible for 8% of total renewable energy. Average growth rate since 2011 is kept at the level of 8% annually and it's on pace to achieve Sustainable Development Scenario in 2030 (see figure 13). Globally bioenergy created 8% of total renewable energy according to data from 2017.

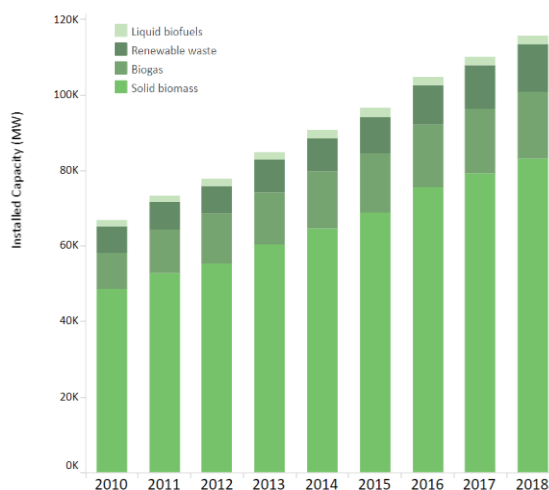


Figure 12. Installed capacity trends in Bioenergy in 2010-2018

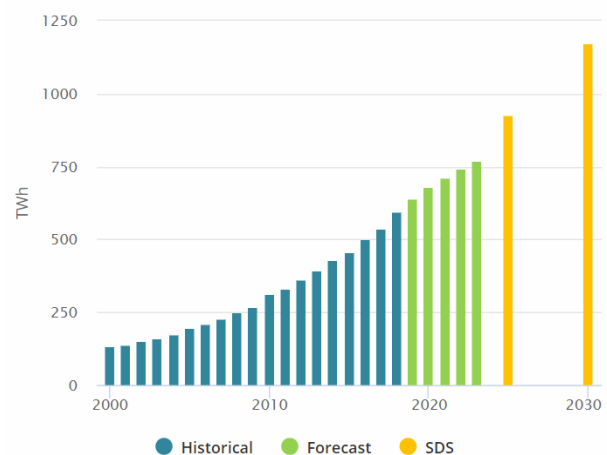


Figure 13. Bioenergy power generation

Source: <https://www.iea.org/tcep/power/renewables/bioenergy/> (05.11.2019)

⁶ <https://www.irena.org/en/bioenergy> (04.11.2019)

⁷ <https://www.thebalance.com/what-is-bioenergy-2941107> (04.11.2019)

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Geothermal energy – description

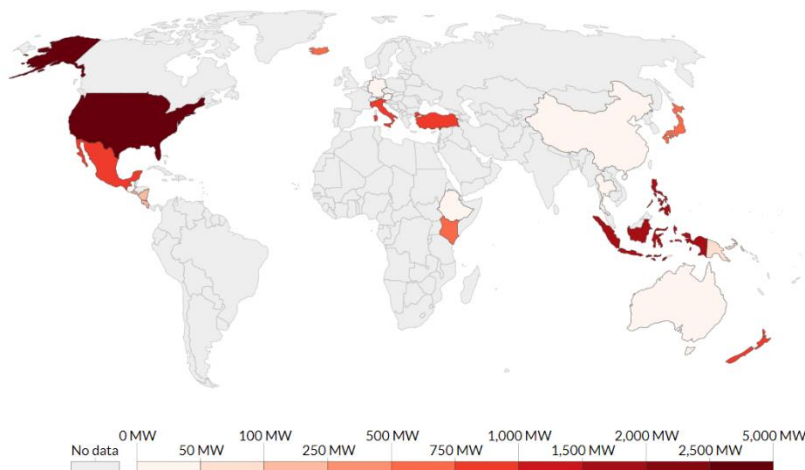
Geothermal resources are reservoirs of hot water that exist at varying temperatures and depths below the Earth's surface. Mile-or-more-deep wells can be drilled into underground reservoirs to tap steam and very hot water that can be brought to the surface for use in a variety of applications, including electricity generation, direct use, and heating and cooling.⁸

Main benefits:⁹

- Renewable – Through proper reservoir management, the rate of energy extraction can be balanced with a reservoir's natural heat recharge rate.
- Baseload - Geothermal power plants produce electricity consistently, running 24 hours per day / 7 days per week, regardless of weather conditions.
- Small footprint – geothermal power plants use less land per GWh than coal, wind and solar power plants
- Clean – modern closed-loop geothermal power plants emit no greenhouse gasses

A geothermal resource requires fluid, heat, and permeability to generate electricity. Conventional hydrothermal resources contain all three components naturally. These geothermal systems can occur in widely diverse geologic settings, sometimes without clear surface manifestations of the underlying resource.¹⁰

The main risk in installation is connected with reliable measure of temperature at depth of the surface, also subsurface characterization is critical for the efficient utilization of geothermal resources. The main player of geothermal energy is US (see figure 14).



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⁸ <https://www.energy.gov/eere/geothermal/geothermal-basics> (05.11.2019)

⁹ Ibid

¹⁰ <https://www.energy.gov/eere/geothermal/hydrothermal-resources> (05.11.2019)

Geothermal energy – employment and production

In 2017 geothermal energy was responsible for only 2% of global renewable energy production. Also job market is quite small in comparison to other renewable energy sectors and it accounted only for 94 thousands job places.

LO2 Efficiency in the use of resources

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Plastic waste

To describe the past periods we often use names as - the stone age, the bronze age, the iron age – future generation will definitely name current period as a plastic age as it is definitely the most dominant material used today. Researchers claim that since 1950s there have been produced more than 8.3 billion metric tonnes of plastic. What's more scary is that around 60% of this ended up in landfill or polluting the environment.¹¹

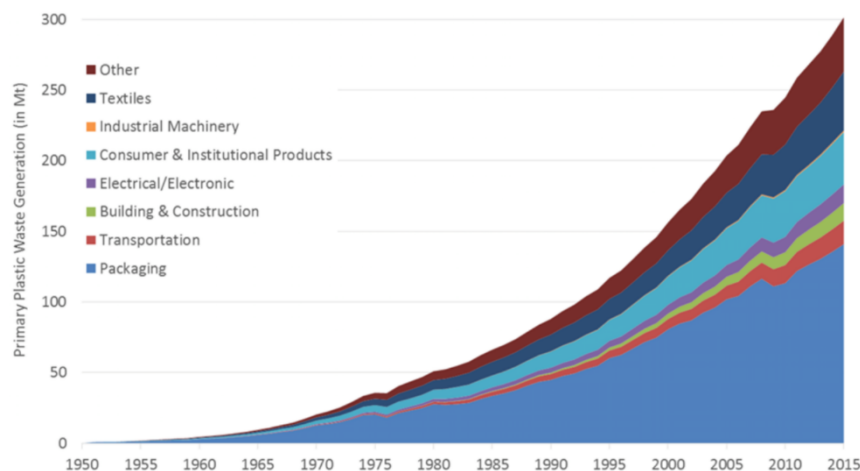
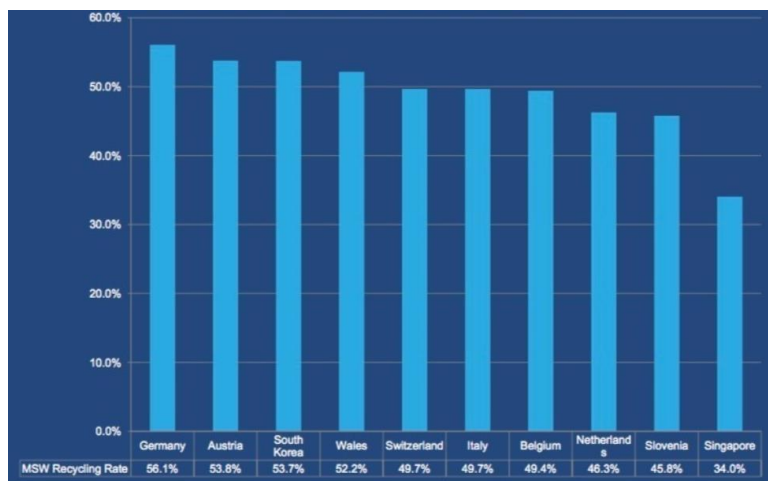


Figure 11. Global primary plastics waste generation (in million metric tons) according to industrial use sector from 1950 to 2015. Source: R. Geyer, J.R. Jambeck, K.L. Law (2017), *Production, use, and fate of all plastics ever made*.

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Recycling

Recycling is the process of converting waste materials into new materials and objects. Plastic recycling started being implemented in 1980s. To prevent plastic from ending up on landfill historically we needed to subject it to heat treatment which causes obviously environmental and health issues. With current technologies like pyrolysis (extracting fuel from plastic waste) and biodigestion (using polymer-digesting organisms), it's possible to mitigate



¹¹ R.Geyer, J.R.Jambeck, K.L.Law (2017), *Production, use, and fate of all plastics ever made*. Science Advances

the amount of waste in the future.¹²

Figure 12. Top 10 countries by recycled rates in 2017

Source: <https://www.weforum.org/agenda/2017/12/germany-recycles-more-than-any-other-country/> (05.11.2019)

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Water management

Water is fundamental. Nearly every other substance or material that's part of everyday life can be substituted, but there's no replacement for water. Entire industries, from agriculture to commodities to manufacturing everyday goods depend on it absolutely.¹³

Water crisis is in making for decades. Poor water management may be one of the biggest challenges entire population has ever faced. The most risk exposed industry is agriculture, which consumes around 70% of global fresh water. Agriculture water crisis not only impacts food and beverage sectors, but also clothing with high reliability of cotton prices.

Water is used in 90% of global power production (raw materials extraction, power turbines, cooling thermal processes and cleaning emissions).¹⁴

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Climate crisis

Climate change is listed as the biggest challenge people face today. Growing temperature's mean over the last century (see figure 17) is serious, although still some people debate human impact on climate changes, IPCC (Intergovernmental Panel on Climate Change) and all major economies support claim that human actions caused majority of those changes due to greenhouse gasses production.

¹² <https://cosmosmagazine.com/society/global-plastic-waste-totals-4-9-billion-tonnes> (05.11.2019)

¹³ <https://www.morganstanley.com/ideas/the-worlds-water-crisis-and-industries-at-risk> (05.11.2019)

¹⁴ <https://www.unwater.org/water-facts/water-food-and-energy/> (05.11.2019)

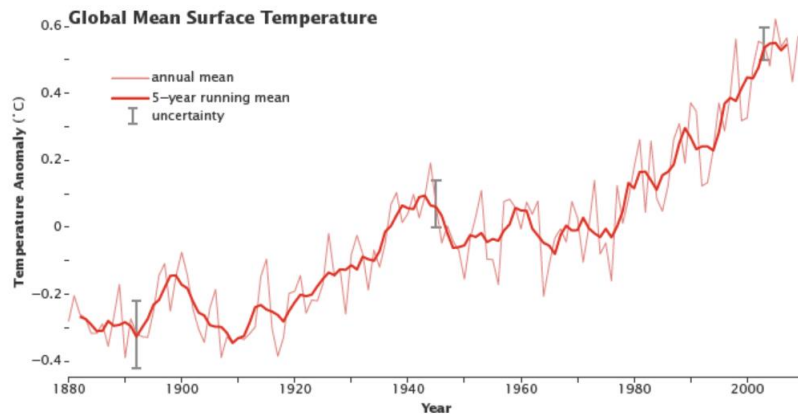


Figure 13. Global mean surface temperature

Source: <https://earthobservatory.nasa.gov/features/GlobalWarming/page2.php> (05.11.2019)

According to the last available full report from IPCC (2014) there are couple of different scenarios for CO₂ (see figure 18) and therefore temperature changes (see figure 19).

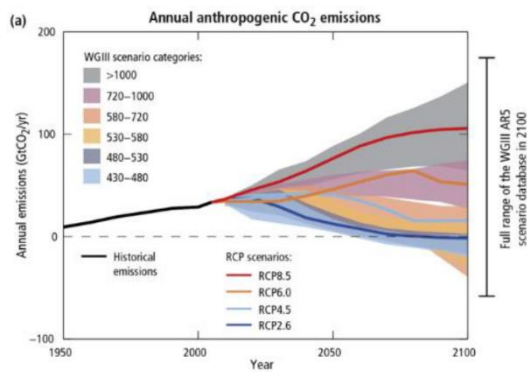


Figure 18. Source: IPCC

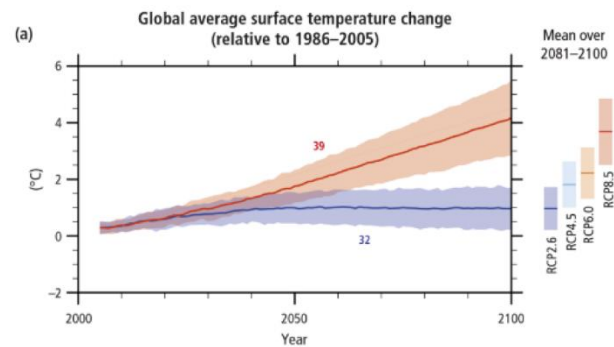


Figure 19. Source: IPCC

In the most pessimistic scenario (highest emissions) average surface temperature would increase by 4°C by 2100. Scenarios with the lowest emissions would increase surface temperature by 1°C by 2100.

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Efficient energy use

Efficient energy use, sometimes simply called energy efficiency, is using less energy to provide the same level of energy service. Energy efficient buildings, industrial processes and transportation could reduce the world's energy needs in 2050 by one third, and help controlling global emissions of greenhouse gases, according to the International Energy Agency.

Making homes, vehicles, and businesses more energy efficient is seen as a largely untapped solution to addressing the problems of pollution, global warming, energy security, and fossil fuel depletion.¹⁵

Modern appliances, such as, freezers, ovens, stoves, dishwashers, and clothes washers and dryers, use significantly less energy than older appliances. Installing a clothesline will significantly reduce one's energy consumption as their dryer will be used less. Current energy-efficient refrigerators, for example, use 40 percent less energy than conventional models did in 2001.¹⁶

¹⁵ <http://definedelectric.com/efficient-energy-use/> (05.11.2019)

¹⁶ https://en.wikipedia.org/wiki/Efficient_energy_use (05.11.2019)

LO3 Sustainable Development Goals

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Sustainable Development Goals

Sustainable Development Goals were set by United Nations in New York in 2015. Organization created 17 goals and each goal has its own targets with appropriate measurement techniques. According to UN, World should accomplish those goals till 2030. There is a total number of 169 targets with each target having 1-3 indicators.



Figure 20. Sustainable Development Goals

Source: <https://sustainabledevelopment.un.org/?menu=1300> (05.11.2019)

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Corporate Social Responsibility

Corporate Social Responsibility practices are getting more popular each day as consumers require more impact from business to change the world for better. In S&P 500 index (biggest US companies) sustainability report becomes a standard even though those firms are not obliged to prepare one (see figure 21).

Sustainability means adopting business strategies and activities that meet the needs of the enterprise and its different stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.¹⁷

It's important for consumers to reward good outcomes as it is the strongest channel that influences corporates' decisions.

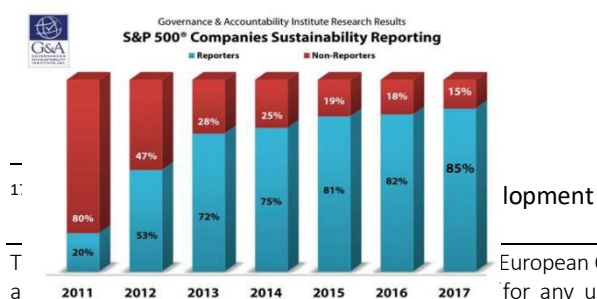


Figure 21. S&P 500 Companies Sustainability Reporting

Source: <https://www.ga-institute.com/press-releases/article/flash-report-85-of-sp-500-indexR-companies-publish-sustainability-reports-in-2017.html> (05.11.2019)

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Barriers for mobilizing capital for green economy

G20 Green Finance Study Group highlighted a number of barriers that exists on the way of green economy:¹⁸

- Weakness in project pipelines
- Significant incremental costs to 'greening' infrastructure
- Poor commercial opportunities for financing the realization of national development priorities
- Climate goals or the SDGs
- Scarcity or poor use of available public resources
- Inadequate enabling environment for private investments

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How to encourage companies to more socially responsible investing?

Positive environmental changes can only be achieved by collective actions in all industries worldwide. People have different motivation in business decisions, but all companies strive for greater profits that's why it's so important to educate society that sustainability doesn't mean to give up profits in a long-term (see figure 22).

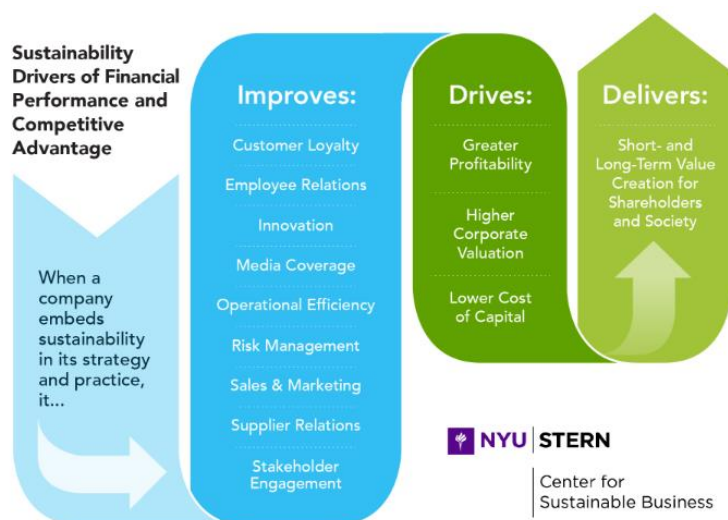


Figure 22. Sustainability Drivers of Financial Performance and Competitive Advantage

Source: <https://www.stern.nyu.edu/experience-stern/about/departments-centers-initiatives/centers-of-research/center-sustainable-business/research/csb-monetization-methodology> (05.11.2019)

¹⁸ <https://www.mainstreamingclimate.org/sfsg/> (05.11.2019)

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ESG criteria for sustainable investors

Environmental	Social	Governance
<ul style="list-style-type: none"> • Impact on climate/greenhouse gas emissions • Sustainability • Climate change risks • Energy efficiency • Air and water pollution • Water scarcity and waste management • Site rehabilitation • Biodiversity and habitat protection 	<ul style="list-style-type: none"> • Human rights • Community impact • Respect for Indigenous peoples • Employee relations • Working conditions • Discrimination • Gender diversity • Child and forced labour • Health and safety • Consumer relations 	<ul style="list-style-type: none"> • Alignment of interests between executives and shareholders • Executive compensation • Board independence and composition • Board accountability • Board diversity • Shareholder rights • Transparency and disclosure • Anti-corruption measures • Financial policies • Protection of property rights

Figure 23. Examples of ESG criteria used by Sustainable Investors

Source: <https://www.ussif.org/sribasics> (05.11.2019)

LO4 CSR approach in investment decisions

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Growing movement of eco-focused consumers

Times where price was the main factor in consumer decisions are gone, nowadays companies have to focus not only on product per se, but also on overall impact it has on environment and society. Growing trends like “zero waste” create opportunities for new brands and should be taken into consideration by decision makers in production and distribution strategy. According to Morgan Stanley’s report (2019), 85% individual investors were interested in sustainable investing and 95% in a group of Millennials.¹⁹ Although consumers claim they want to invest in sustainable firms, they rarely do according to recent study.²⁰

In the same study authors share which actions companies should consider in order to convince more consumers to sustainable consumption:

- 1) Use social influence
- 2) Shape good habits
- 3) Leverage the domino effect
- 4) Decide whether to talk to the heart or to brain
- 5) Favour experience over ownership

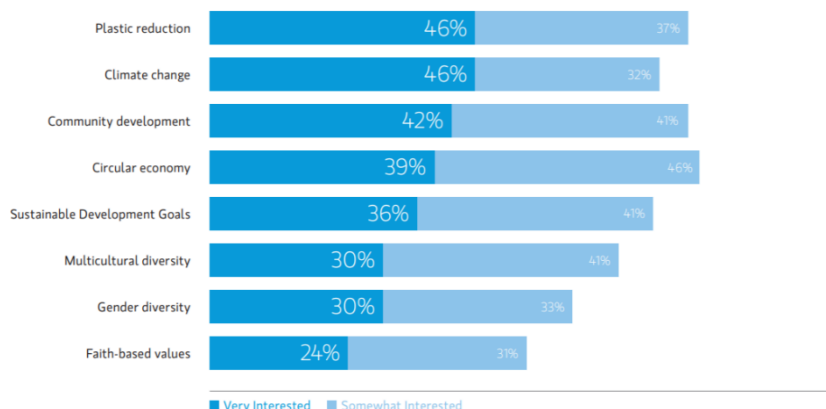


Figure 24. Investor's sustainable interests themes

Source: <https://www.morganstanley.com/ideas/sustainable-investing-growing-interest-and-adoption> (05.11.2019)

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Economy's requirements for sustainable development

1. Circular economy – Enhancing resource efficiency and waste reduction
2. Water – improving access to quality water supply and preservation of the resource
3. Food security – ensuring a sustainable food supply and productive farmlands for future generations

¹⁹ <https://www.morganstanley.com/ideas/sustainable-investing-growing-interest-and-adoption> (05.11.2019)

²⁰ <https://hbr.org/2019/07/the-elusive-green-consumer> (05.11.2019)

4. Health and wellbeing – improving life expectancy and quality
5. Education – providing opportunities for all – irrespective of wealth, geographical location or ability
6. Financial inclusion – providing financial services to underserved population
7. Future mobility – improving vehicle efficiency to increase low-carbon transportation
8. Impact enablers – providing crucial solutions and services to impactful companies directly involved in the various themes
9. Energy transition – transforming the energy system to power a low-carbon economy

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Responsible investing

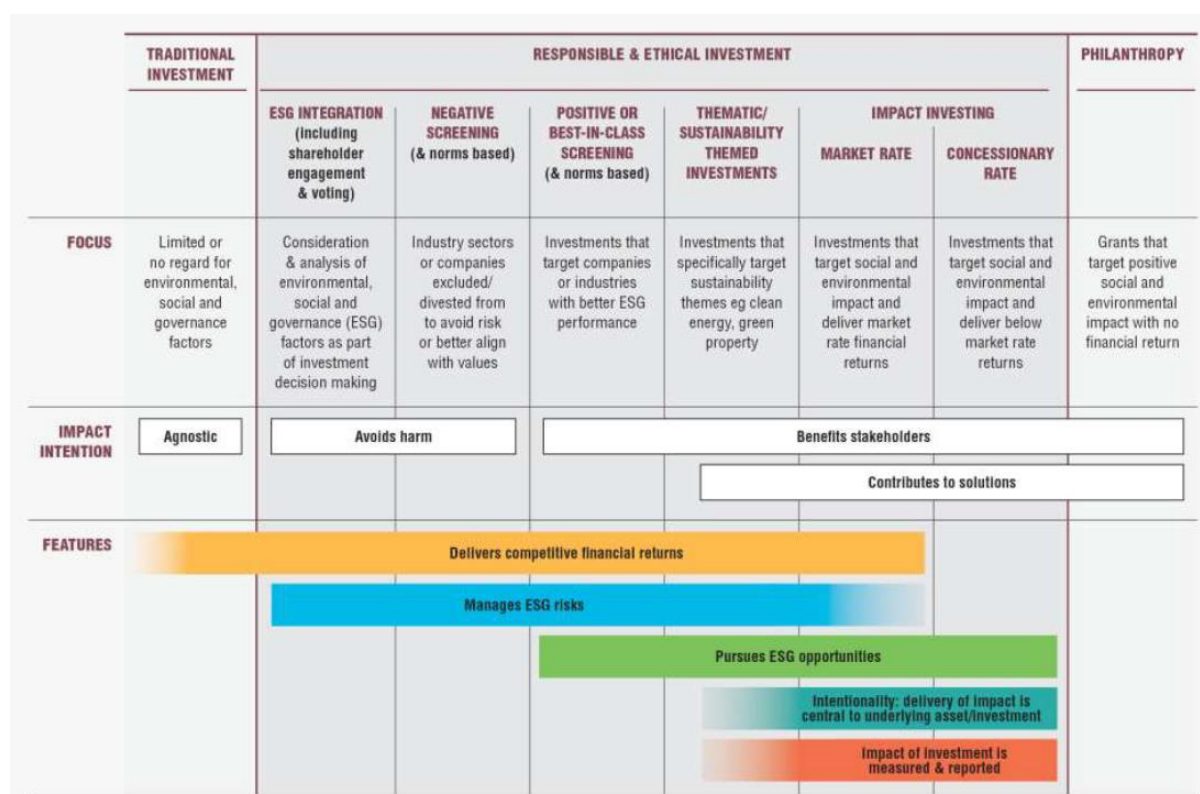


Figure 25. RIAA's responsible and ethical investment spectrum

Source: <https://responsibleinvestment.org/what-is-ri/ri-explained/> (05.11.2019)

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Impact of CSR actions on the company's value

Over the years there was a debate whether CSR (Corporate Social Responsibility) activities are a waste of corporate's money from economic standpoint or not. Recent research (Barnett and Salomon, 2012) suggests that both sides might be truth over some range. Authors argue that whether it pays to be good depends upon how well firms are able to capitalize on their social responsibility efforts.

In the study on over 1,2k companies, authors found out that as firm's overall net score across the 13 social performance criteria in the Kinder, Lydenberg, and Domini (KLD) ratings database increases, its return on assets and net income decline at first, reaching a low point at moderate levels of social performance, and increase thereafter.

Those results are crucial for companies as they should view CSP (Corporate Social Performance) as a long-term investment in creating the capacity to influence stakeholders.

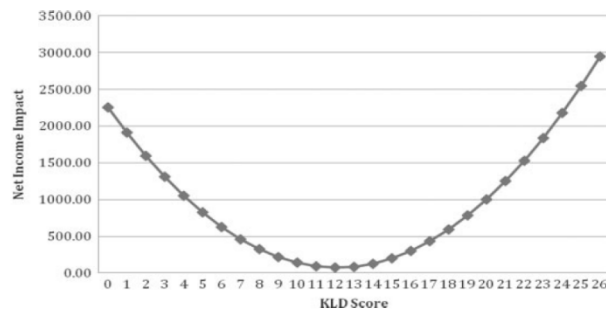


Figure 26. M.L. Barnett; R.M. Salomon (2012), Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. Strategic Management Journal