

## 1. Description of the most common policy instruments to promote bioenergy development & How different types of measures can affect bioenergy markets? (Junginger *et al.* 2016)

**Capital and agricultural subsidies**, which give access of investment for farmers, forest owners, and business unit to establish bioenergy system. This subsidy reduces the risk and cost and incentives to establish bioenergy system, thus promote the development. Agricultural subsidies applied carefully might also help livelihood of rural area, increasing the safety for energy and food.

**Taxes**, if applied carefully can promote the substitution of currently utilized fuel (e.g. fossil fuel, nuclear energy) to renewable energy sources like bioenergy. By disrupting market prices of fossil fuel, which in other words make them less competitive, might lead to increase in bioenergy utilization.

**Regulatory mandates: Consumption mandates and quotas** can be applied to guarantee market share of bioenergy, e.g. mixture mandates of transportation fuel with biofuel. This mandates both might help guarantee production and consumption of biofuel. **Emission mandates and efficiency standards**, limit the amount of emission of system, might promote substitution to lower carbon emission fuel.

**Research**, is necessary to increase the competitiveness of bioenergy by reducing cost in the long run and increase the efficiency of the bioenergy system. Research might also open new possibilities to enhance bioenergy utilization in bigger aspects, i.e. transportation.

**Information, promotion and education**, is essential part of bioenergy promotion. Increasing urge to live in more sustainable way with low carbon emission requires commitment from all humankind. Dissemination of information and promotion is essential to educate people and communities, to always continuously improve their way of living sustainably and safeguard the environment at the same time.

### Reference

Junginger M, Goh CS, Faaij A. 2016. *International Bioenergy Trade*. Springer

## 2. Review of externalities produced by bioenergy utilization (Pelkonen *et al.* 2014)

Bioenergy utilization from forest could have positive and negative at the same time. The externalities mentioned here are related to sustainable yield aspect, environment and biodiversity aspect, energy and carbon balance aspect, plus socio-economic aspect.

**Sustainable yield aspect**. Whole tree utilization is known to export more nutrient compared to stem-only utilization. Important micronutrient located in the branches of the trees, thus by using logging waste as bioenergy feedstock increases the rate of nutrient export, and increase the risk of soil acidification, which in the end compromise the sustainability of the yield in the future. The risk of nutrient deficiency could be minimized by returning the combusted biomass ash to the forest soil.

**Environmental aspect.** Increasing forest management activity due to utilization of biomass could threaten the biodiversity of the forest, e.g. deterioration of species and genes diversity, loss of dead-tree which are key habitat for particular forest biodiversity, conversion and degradation of forest land. Strong awareness, policy and enforcement are required to protect high conservation values. Some proof suggests that Salix plantation could help enhance bird diversity by providing nesting spot for sensitive bird species. There are reports that coppice Salix plantation decrease the risk of nitrogen leaching because of lower fertilizer demand, covering land all-year around, and extensive rooting. Salix plantation could also help removing toxic metal pollutions (Cd) from soil through phytoremediation, and able to help filter processed sludge water and return to the water cycle.

**Energy and Carbon Balances.** EROI (Energy Return on Investment) is the ratio between energy harvested and energy invested. The process is considered positive if the value is bigger than one. Biomass is considered 'carbon neutral', but this assumption is challenged since a lot of national and regional might unintentionally change land uses, which release carbon that would otherwise have been stored in forest. Careful carbon accounting is necessary to analyze carbon balances of bioenergy operations.

**Socio-economic aspect.** It is believed that bioenergy utilization might enhance job and revenue creation. Decentralization of bioenergy plant might also increase energy security. But, various reports available do not provide concrete evidence of the scale of the impact. Careful decision and analysis should be implemented and continuously developed to better understand the impact and better effect in socio-economic aspect.

#### Reference

Pelkonen P, Mustonen M, Asikainen A, Egnell G, Kant P, Leduc S, Pettenella D. 2014. *Forest Bioenergy for Europe: What Science Can Tell Us*. EFI

### 3. Structural factors related to the analysis of wood markets and policies (Pelkonen *et al.* 2014)

Some structural factors are enhancing the complexity of the analysis of wood markets and policies related to wood energy:

**Self-consumption**, is considered as a positive factors in policy analysis, yet at the same time increasing the complexity of data collection and market development monitoring.

**Solid biomass demand is closely connected to other diverse mutually competitive products.** The competition leads to coordination problem since it requires policy implemented in different sector at the same time. Moreover, policy failure and conflicts are quite frequent

**Biomass consumption is highly associated to lot of externalities, both positive and negative.** Considering the externalities of biomass to the environment and socio-economic aspect is challenging for decision makers. Moreover, analyzing the trade-offs in different scope: local, regional, and international should be carefully considered.

## Reference

Pelkonen P, Mustonen M, Asikainen A, Egnell G, Kant P, Leduc S, Pettenella D. 2014. *Forest Bioenergy for Europe: What Science Can Tell Us*. EFI

## 4. Main policies affecting the production and use of energy wood in Europe (Pelkonen *et al.* 2014)

**Common Agricultural Policy and Rural Development Policy.** Aim at the competitiveness of primary sectors and rural development, by help in financing farmers and forest owners, enhancing availability of forest woody biomass. Includes subsidies for forest operation e.g. thinning, pruning, improvement of road networks and infrastructure.

**EU Directive 2001/91/EC on energy performance on buildings.** Promote higher energy performance efficiency of new and existing buildings, at the same time promoting the utilization of wood for cogeneration of power and heat (district heating).

**EU Directive 2003/87/EC on emission trading scheme.** By putting price to greenhouse gas emission, it promotes substitution of fossil fuel with lower-carbon emission fuel, thus increasing price competitiveness of woody biomass and other renewable energy sources. Emission credits company do not use can be sold to other companies.

**EU Directive 2003/30/EC on Biofuels** promote to increase share of renewable energy sources particularly in transportation sector.

**EU directive 2009/28/EC** promote the use of **renewable energy** by providing a long-term policy framework which is critical to enhance investor's confidence by reducing uncertainties that deter the private sector from investing new technologies. The directive requires every member states to reach national target of at least 20% share of renewable energy consumption from total gross final consumption of energy in 2020. The directive require any chain value of renewable energy system, e.g. production, harvesting, transportation, distribution, and consumption in a sustainable way. Another focus of this directive also promote decentralization of renewable energy production, leads to better energy security, higher utilization of local feedstock, lower cost of transportation, rural development, job and profit generation.

**"20-20-20" Climate and energy Package policy** was adopted by EU in 2009, which set three key objectives: 20% reduction of GHG emission (compared to 1990); 20% share of renewable energy in total energy consumption; and 20% improvement of energy efficiency.

## Reference

Pelkonen P, Mustonen M, Asikainen A, Egnell G, Kant P, Leduc S, Pettenella D. 2014. *Forest Bioenergy for Europe: What Science Can Tell Us*. EFI

## 5. Effects of the subsidies and taxes in the markets as a tool to promote bioenergy

Subsidies imposed to consumer of bioenergy, cuts the price of the bioenergy commodity and increase the competitiveness of bioenergy compared to existing energy system. Subsidies imposed to producers of bioenergy, cuts the cost of production and lower risk of establishment of bioenergy systems and businesses.

Taxes imposed to consumer of fossil-fuel energy will promote the substitution to other energy sources i.e. bioenergy. This might increase the competitiveness of bioenergy compared to fossil fuel.

Import and/or export taxes imposed to producers of bioenergy if carefully implemented can be use as regulation of bioenergy trade and might help to safeguard the availability of biofuel supply locally and regionally.

In the long run, sometimes unintended effect of subsidies and taxes of bioenergy might happen, i.e. deforestation and conversion of forest land; or competition with food production. To avoid that from happen, careful implementation, evaluation, but at the same time rather stable policies are required to successfully promote sustainable bioenergy production and consumption.

## 6. Policy measures implemented in Sweden for the promotion of energy crops: review and assessment (Mola-Yudego *et al.* 2014)

The stages of Salix for energy adoption can be divided into three: start-up period (1986-1991), expansion period (1992-1996) and stagnant period (1996-2006).

**Start-up period** started when short rotation plantation of Salix for energy in Sweden introduced in commercial scale in mid 1980s. Adoption of this plantation system by farmers is highly related to the existence of local demand and market, local perception of the management, cost, and risk of the management. Policies to develop this sector has been implemented since the beginning of the establishment. Capital subsidies are given to the farmers who is willing to try to establish willow plantation and for wood fueled district heating plan. At the same time, taxation is used to demote the use of existing competitive fuel, i.e. fossil fuel. Investment in research has been done also to increase yield performance and better management practices. Yet, the expansion grew slowly and localized in central Sweden.

**Expansion period** characterized as rapid expansion of Salix plantation due to favorable subsidy by the government of 10.000 SEK/ha during 1991-1996 for Salix farmer. Increased tax for carbon and Sulphur emission also boosted the substitution from fossil fuel to wood-based fuel for heating and electricity generation. The planted area increased exponentially at the same time increase demand for wood by district heating.

**Stagnant period** happened in 1996, while the government reduced planting subsidy significantly. This is due to inclusion of Sweden in EU Common Agricultural Policy, which limits maximum subsidy to 50% from total cost. Although subsidy increased again in 1999, the total area planted with Salix remained constant

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around 14.000 ha, since the rate of Salix removal is almost the same with the rate of Salix new establishment in 1990s.

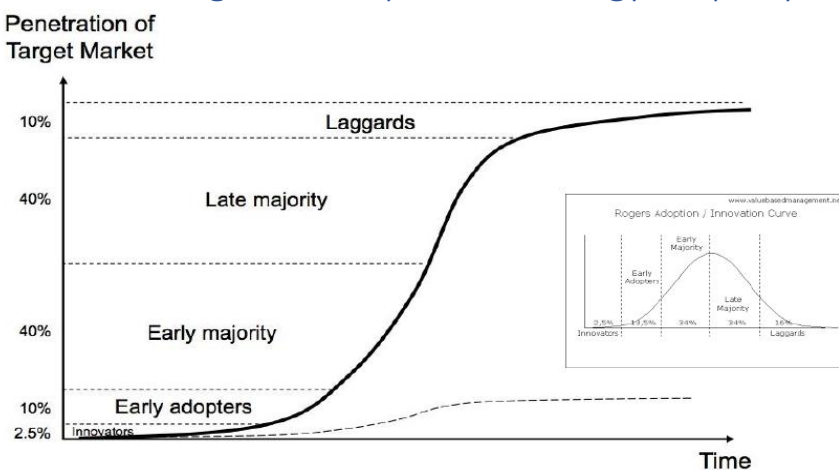
The expansion resulted in wide distribution of the plantation inside Sweden, leads to expansion to wood-based district heating almost all over central and southern Sweden. Shorter rotation also implemented nowadays due to higher knowledge, better productivity, and lower cost.

The price competitiveness of biofuel from Salix plantation compared to fossil fuel in Sweden was low, but successfully promoted through subsidy, taxes, and research. The government let the demand of Salix based on market forces. Any decrease in price of fossil fuel for electricity and heat increase the risk of low competitiveness of biofuel.

## Reference

Mola-Yudego B, Dimitriou I, Gonzalez-Garcia S, Gritten D, Aronsson P. 2014. A conceptual framework for the introduction of energy crops. *Renewable Energy* 72:29-38.

## 7. Main stages of adoption of energy crops by farmers



Figure

source:

<https://wiki.uef.fi/download/attachments/41911213/S4%20Adoption.pdf?version=1&modificationDate=1516700753000&api=v2>

Stages in adoption of energy crops by farmer follow the curve presented above. They are classified by the penetration of target market along time. Innovators and early adopters or (start-up period) stages are the first stages that could only penetrate small amount of target market because high cost of development and high risk. Along time more and more people adopt the system until majority of the population adopted the system. In early majority, the rate of adoption is increasing while in late majority stage, the rate decreases, until it reaches stagnant period.

## 8. Main barriers to the implementation of bioenergy technology

Bioenergy for electricity and heat system technology require intensive investment. Compatible biomass feedstock, and technology to manage them (planting to harvesting) to make them price competitive require technology and machinery which require rather big investment. Wood-based biofuel technologies

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nowadays able to produce heat, but not efficient enough to only produce electricity. Examples from Sweden and Finland which able to efficiently utilize biomass from forest residues and short rotation plantation might not be suitable for places where there is no heat demand.

Current technologies of bioenergy limit the utilization fully in transportation sector. Biofuel like bioethanol and biodiesel cannot completely substitute fossil fuel for engine fuel. This means that the production and consumption of biofuel still dependent to fossil fuel.

The high cost of procurement is the most serious barrier to large-scale use of forest energy. Wood energy is competitive only when promoted by fiscal or legislative actions. Thus, careful implementation of policies is necessary when establishing bioenergy technology system.

## 9. Provide a case of the policy incentives that have been used to develop pellet markets, overview and evaluation (Selkimäki M *et al.* 2010)

In Sweden, pellets have become increasingly popular due to energy policy framework concerning fuel taxation and subsidies. Not only large power plant, the Swedish government gives subsidies to promote the establishment of small local heating power plant, which enhance wood pellet demand. The policies promote primary wood product producers to utilize their excess wood waste for pellet production, adding more value and income.

The increasing demand for wood pellet is increasing beyond production level. Sweden nowadays, requires to import wood pellet from other countries, for its consumption. Sweden can improve the production level by maintaining and increasing the standards of their pellet through research. Substitution of other woody-biomass, i.e. from bark, could also possible through investment in research and development of the wood pellet's production and consumption system.

Selkimäki M, Mola-Yudego B, Röser D, Prinz R, Sikanen L. 2010. Present and future trends in pellet markets, raw materials, and supply logistics in Sweden and Finland. *Renewable and Sustainable Energy Reviews* 14(9):3068-75.

## 10. Provide a case of the policy incentives that have been used to develop biodiesel, overview and evaluation

Regulations to promote biofuel start developed since 2006, where they targeted 2% of biofuel energy mix share in 2010 and 5% in 2025. In 2006 the government established biofuels task force to promote and established biofuel industry in Indonesia. Munthe (2018) reported that since September 1st 2018, all subsidized diesel engine vehicles and heavy machinery are compulsory to use biodiesel blended fuels.

To increase crop plantation area, the government give farmer and companies access to credit and land lease for plantation. The allowable area for the lease is doubled for those located in Papua. Conversion of forest is allowable while ensuring the remaining forest cover is sufficient. Conversion for conservation and protected forest is also allowable if they no longer meet the biophysical condition.

Incentives in form of subsidized financing is given primarily for oil palm, sugarcane, corn, sorghum, and cassava farmer. Their income tax is reduced and the government guarantee against operational losses.

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Foreign investor are allowed to hold 95% of the shares in oil palm plantations. They are encourage and guided to produce, purchase, sell, export, and import biofuels. By 2020, heavy industries and other commercial sectors are required to use at least 12% biodiesel from their total energy consumption.

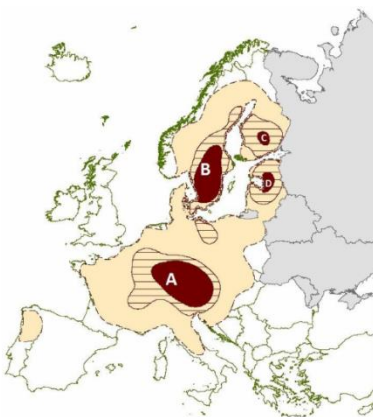
Subsidies and taxes is used to control and promote biofuel consumption and production. Subsidies for consumer to use biofuels have been increased from 1000 IDR/liter in 2009 to 3000 IDR/liter in 2012 and the trends is still increasing to promote consumption. (Taylor 2013) Export taxes is used to control domestic supplies of CPO for domestic biofuel production (it was 9% as of 2013).

Rising CPO price encouraged producers in Indonesia to export rather than to produce biodiesel because of the profitability. The high export tax (25%) was not enough to discourage the export. I believe taxation is not a good option for Indonesia the law enforcement for those to evade taxes and corruption level is never enough. In 2018 Perkasa (2018) reported that Indonesian Corruption Eradication Commission found approximately 63.000 cases of tax evasion and un-optimal payment in palm oil sectors. The rising CPO price has also led to increase in domestic biodiesel cost production, making the subsidies for biodiesel consumer ineffective. The regulations also has been concerned as one driver of deforestation and forest degradation by promoting expansion of oil palm plantation.

#### References:

- Munthe BC. 1 August 2018. Indonesia to make biodiesel use compulsory from September 1: official. Reuters News. [available from: <https://www.reuters.com/article/us-indonesia-biodiesel/indonesia-to-make-biodiesel-use-compulsory-from-september-1-official-idUSKBN1KM4WK>]
- Taylor M. 26 April 2013. Indonesia cuts crude palm oil tax to 9% for May. Reuters News. [available from: [http:// in.reuters.com/article/2013/04/26/indonesiapalm-tax-idINJ9N09F01120130426](http://in.reuters.com/article/2013/04/26/indonesiapalm-tax-idINJ9N09F01120130426)]

### 11. Locate and describe the main pellet production areas in Europe & Current development of pellet markets in Europe. Describe situation, main threats and future trends (Mola-Yudego *et al.* 2014)



**Figure left:** Pellet capacity concentration in Europe for bandwidth radius of 231 km (h100, right). Dark areas concentrate 30% of the total pellet capacity estimated for Europe. Striped areas concentrate 50% of the total capacity, and lighter areas would include 90% of the total capacity. Based on the higher concentrations, four main areas are defined: **A: Central Europe, B: Scandinavia, C: Finland, D: Baltic.**

Source: Mola-Yudego *et al.* (2014)



Based on Mola-Yudego et al. (2014), main pellet production areas in Europe can be divided into four major producers: Central Europe region, Scandinavia region, Finland, and Baltic region. The classification is based on the concentration of location and productivity of pellet production. Almost all of classified areas are both large producers and consumers of pellet, except Baltic region where these countries established pellet mill to fulfill demand from other neighboring countries. The development of local market in Baltic areas is relatively low, due to reduction of sawmill production, leads to high risk raw material shortage.

Market saturations of pellet were found in central Europe region and Finland, where the productions growth were rather stagnant, and numerous unutilized pellet mill capacity unutilized.

**Reference:**

Mola-Yudego B, Selkimäki M, González-Olabarria JR. 2014. Spatial analysis of the wood pellet production for energy in Europe. *Renewable Energy* 63:76-83.

## 12. Ethical analysis in forest conflicts associated to bioenergy: description, objectives, examples; Provide a case of bioenergy related conflict, describing the main stakeholders including a brief analysis of the framework situation

**Generic information about the conflict:** Crude Palm Oil (CPO) is important raw material for food, industry, international trade commodity, and energy for Indonesia. Indonesia has adopted an ambitious biofuel policy with increased but differentiated targets by fuel and sector. The target for biodiesel was set at 20% blend by 2016 for the transport and industry sector, and 30% in the power generation sector, leads to even more demand in CPO (Khatiwada, Palmen, & Silveria, 2018).

Favorable governmental incentives made the country as one of the largest producers of CPO in the world. But the traditional strategy used to meet increased CPO demand in Indonesia has been to expand the plantation area (Khatiwada, Palmen, & Silveria, 2018), which damages the environment and socio-economic aspect of local communities. Since the implementation of these incentives in 1950s, numerous conflicts related to CPO productions has been escalating, especially between large-scale oil palm producers with local communities.

This article tries to discuss on conflict between farmers and palm oil company PT Sandabi Indah Lestari (PT SIL), located in Bengkulu, Indonesia, that happened in September 2014.

**Conflict type:** The case featured land grabbing, violence, dispossession of local communities, and criminalization.

**Resources involved:** Land and palm oil crops (for CPO production).

**Main Issues and descriptions:** On September 12th, 2014, hundreds of people of Lunjuk Village, Bengkulu, Sumatra, demonstrate around PT SIL factory area. This happened after two farmers, members of the village were arrested by paramilitary force -who acted as security in PT SIL (TRIBUNnews, 2014).

According to farmers in Lunjuk, the company destroyed farms and homes, forcibly displaced families, and had villagers arrested on dubious charges (Madan, 2019).



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Criminalization strategy is used by the company, by accuses villagers of stealing when they are harvesting palm oil in certain disputed areas near village area. Furthermore, police threatened suspected villagers with arrest in an attempt to force them to hand over their land to the company (Madan, 2019).

**Main stakeholders** involved includes, PT Sandabi Indah Lestari (PT SIL), local community of Lunjuk Village, paramilitary force (Mobile Brigade Corps), civil society organizations.

**Analysis of the stakeholder's values and interests:** (TRIBUNnews, 2014) mentioned that PT SIL own the rights of 1200 ha land of palm oil plantation, which is disputed by the local communities. The local communities believe that they also own rights to manage the land.

**Evaluation of the intensity of the conflict:** The intensity of the conflict escalates from 2011 to 2019. Started from disagreement, violence, increase frequency of criminalization, and land grabbing.

**Evaluation of the possible causes of the conflict:** One of the plausible causes of the conflicts is low enforcement in tenurial rights. Police and court decision could be bought easily by whom have access to money. The prolonged conflict is the result of the weak law enforcement.

**Main elements that may preclude conflict resolution:** Education about tenurial rights for the local communities should be increased. Since corruption in law enforcement is so prominent, the most important solution must be eradication of corruption and strengthening justice and law enforcement.

**Main elements that may encourage conflict escalation:** The widening economic gap between companies and local communities will escalates the conflict, since corruption in law enforcement is very common in Indonesia.

## References

- Conant, J. (2014, September). Arrests and displacement rock villages in palm oil landgrab in Bengkulu, Indonesia. Retrieved from Friends of The Earth Web site: <https://foe.org/2014-09-arrests-and-displacement-rock-villages-in-palm-oil-l/>
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## 13. Explain the green certificate mechanism

Green certificate mechanism by third party gives written assurance that a product, process, or service is in conformity with certain standards. These certificates give incentives for the producers, since with extra cost, they can maintain production in more sustainable way. Consumers on the other hand could also become more responsible consumers by consuming certified products.

## 14. Carbon tax: mechanism, effects on the markets, advantages and disadvantages

Carbon tax is imposed to the consumer of energy system. It sets limitation of entity to emit carbon using permits per mass unit. This permit is tradeable. There are two systems: baseline and cap system. **Baseline system** allows entities to sell the carbon credit to other entities if they emit carbon lower than the baseline; where **cap system** requires entity to buy credit from government if they emit more than the capped amount. Carbon tax system is advantageous in developed country where carbon accounting and monitoring system is well developed, since it requires commitment both from government and the people. But, the implementation of carbon tax in developing countries might face challenges, since this policy is very dependent to the ability of law enforcement and good governance.

## 15. How do recent developments in global energy production challenge some established views concerning the role of bio-based energy in the future?

**Cost of production of bioenergy** hasn't improved very well compared to other renewable energy systems, e.g. wind, solar, hydroelectric.

**Price of fossil fuel decreases** since 2014 and increase in efficiency of fossil fuel production and consumption decrease competitiveness of bio-based energy system.

**Uncertainties concerning policies** regarding of bioenergy production and consumption.

**Carbon trade** effect hasn't given any incentives.

**Increasing trends of conflicts** regarding bioenergy production and increasing issues that bioenergy production might damage **sustainability** of the forest.

## 16. What is the role of ENGO's in bioenergy policy and governance?

In bioenergy policy and governance, Environmental Non-Government Organizations (ENGO) have roles in educating stakeholders, monitoring projects, involved in conflict resolutions, and provide law advocacy.

## 17. Describe how policy has influenced the wood-based bioenergy market in Finland & The role of Finland on the international bioenergy market

After the oil crises in 1970s, Finland has boosted their forestry sector for energy generation. Actively managed forest increases the wood growing stock along the year. More than 90% of production forest in Finland are certified. Research and development allows forestry sector to increase productivity, efficiency, and open possibilities to create added value to logging waste. Well developed and well maintained forest infrastructure, lower the cost of wood for bioenergy procurement. The production of wood-based energy is highly related to production of saw-mill and other primary products of the forest. Investment subsidies in cutting edge pilot projects in Bioenergy, and international and regional cooperation boosted the bioenergy sector. The policies guarantee the dissemination of profit from energy forest activity, thus gives

incentives to land owner to increase productivity. Finland has become exporter of wood pellet to surrounding countries, enhancing international trade and relationship.

## 18. Oil crisis: conditions and effects on the energy markets.

Oil crises in 1970's happened because of geopolitical conflict. This crisis disrupt livelihood of almost every country who was dependent of oil import from middle-eastern countries. This event increases awareness of the importance of energy security almost in all country. This matter was one of the drivers of expansion and development of renewable energy in Europe. Sustainability and environmental aspects of energy generation were a minor driver, nevertheless their importance is getting recognized more and more nowadays.