Learning portfolio of bioenergy markets and policies

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The role of policy on bioenergy markets

There are different policies affecting production and consumption of bioenergy. From 1998 to lately, Europe had several important policies. For instance, (1.) *Common Agricultural Policy and Rural Development Policy* increased the amount of forest energy production due to its finance to farmers and forest owners. (2.) *Energy performance of building* also increases the demand for energy wood due to the heating system. (3.) *EU Emission Trading Scheme*, because of the cap-and-trade, it reduced the usage amount of fossil fuel. The latest policy was (4.) *Renewable Energies Directive*, which forced EU Member States to increase amount of renewable energy.

Those are the policies that affect bioenergy directly, however, there are other policies which affect bioenergy markets indirectly like climate policy, energy policy, rural development policy and common agriculture policy, and trade policy.

Climate policy: for example, Kyoto Protocol (2008-2012) decreased 8 % of emission below the 1990 ; strategies data showed that 1% out of 8 % has to be done by forestry activities. Later, there was a policy about greenhouse gas which used cap-and-trade system that changed energy types used by companies. In addition, the 2020 targets known nowadays also affects the usage of bioenergy.

Energy policy: EU-RED made the most significant impact on bioenergy from forest. Because it requires 20% of total energy consumption from renewable energy in EU 20-20-20. Unlike climate policy makes impact indirectly, EU-RED made clear requirements and rules. For instance, it excludes protection, high diversity area for using bioenergy.

Rural Development Policy and Common Agriculture Policy: they also affect bioenergy because of the relative policies like *afforestation of agricultural land*, *subsidy of growing food/ plantation,* and *building forestry roads* and so on. There are many policies about rural development and agriculture. But I will only focus on explaining CAP (common agriculture) Reform briefly, which is one of most important (and interesting) policy in Europe.

The aims of CAP are to ensure standard of living of farmer and food safety for people. CAP can be traced back to around 1950. Later, it has different developments around every ten years, but its long-term objectives are (1) viable food production, (2) sustainable management of natural resources (3.) climate action & balanced territorial development. Nowadays, CAP Reform 2014-2020, has new features that jointing provision of public, and to be more efficient and flexible for members.

Trade Policy: mainly about the illegal logging transportation and wood importing for biomass.

It is actually very complicated to make clear definition of role of policy on biomarket because there are various policies, and it involved by private companies, different government sectors, and countries. Apart from policy, we know that using of bioenergy causes different externalities, which also affect policies.

Externalities: The externalities is the action affect the third person. This video explains externalities well at around 5:00. It uses the example of pollution from factory as negative externalities, and good education for positive externalities. Biomass consumption is relative with externalities. For instance, regular management can keep forest away from damage like fire or disease, but also may cause soil degradation.

Positive externalities from using bioenergy (for example, plantation):

- Beautiful view
- Air
- Habitat for animal ; diversity
- Water (Nitrate-nitrogen concentration ↓ ;Surface runoff and soil erosion ↓ ; Groundwater recharge ↑ ; Organic matter ↑)
- Soil (C sequestration ↑ ;soil erosion ↓)
- Economic
- Carbon emission
- Others: education

Negative externalities from using bioenergy

- Competition with food
- Social wellbeing
- Carbon emission
- Air, water, soil etc.

Reference and related links:

Articulation of environmental and socio-economic externalities from bioenergy

http://www.theenergycollective.com/schalk-cloete/264701/energy-subsidies-and-externalities

https://ec.europa.eu/agriculture/sites/agriculture/files/policy-perspectives/policy-briefs/05_en.pdf

Policy instrument for bioenergy

Policy instruments are actions made by government to achieve goals of public policy, which could be tax, subsidy, loan and regulation etc. For example, according to FAO's Bioenergy and Food Security Criteria and Indicators (BEFCI) project established four categories of policy instruments to ensure the sustainable bioenergy development and the food security. They are (1.) Mandates with sustainability requirements (2.) National standards for certification (3.) Financial incentives (4.) Capacity building.

(1.) Mandates with sustainability requirements: setting standard for bioenergy on market can make sure bioenergy development is sustainable usually. For instance, over 50 countries blended biofuel with fuel in 2011, which was successful. When government is making mandates for bioenergy, it is important to consider environment sustainability of bioenergy production, financial capability and social impacts. An opposite example is Taiwanese government required 1-3% of biofuel was blended with normal fuel in 2005,as the consequence, state-owned companies and government sectors had to plan how to achieve the standard. Moreover, private companies started to join the bioenergy market. Although this case of Taiwan failed in the end, we still can see the policy instrument.

(2.) National standards for certification: this policy instrument is aim to certify the sustainability of bioenergy or resources. For instance, palm oil is a common bioenergy resource in Indonesia and Malaysia. To improve sustainability of palm oil production, thus, their government established a system of it which also focus on social sustainability.

(3.) Financial incentives: to promote bioenergy investment, consumption, or production by financial incentives. There are many types of financial incentives like payment for ecosystem service (PES), direct payment, tax credits, and grants.

PES is payment to farmer/landowner who contribute ecosystem service. It is easy to feel confused with subsidy, but PES cover more dimensions for ecosystem service (or some people say subsidy is a tool and PES is the general idea). For instance, rural farmers get paid for GHG emission and high biodiversity because of nice agroforestry practice. PES is more and more popular nowadays, however, it needs sustainable financial support and it is quite difficult to measure some ecosystem service actually.

Direct payment, subsidy (more details about subsidy in next topic), is given to farmers or producer who do specific practices for policy. For instance, farmers who grow bioenergy crop received few hundreds Euro / hectare every year in Taiwan. This encouraged more and more farmers to participate the bioenergy program. However, government usually need to absorb huge amount of money, as the consequence, the program/ policy may not operate long time. Another potential problem is sustainability, farmers/ producers may lake of willingness, when no subsidy.

For industry or big scale investment, government usually use tax credits to stimulate bioenergy development, even can be applied for social or educational situation. Due to various kinds of tax credits, tax credit also can promote the cooperation between factory/ producers and farmer.

Grants is the financial support from government to the working related to defining purposes, for instance, bioenergy research and bioenergy development. Grant and subsidy are very similar, but subsidy is given to direct contribution.

(4.) Capacity building: this is more like policies / program to set up an environment to develop bioenergy, including education, research, training and information. Comparing to other financial expenditure, capacity programs need long-term support from government.

Reference and related links:

http://www.know-hub.eu/knowledge-base/videos/policy-instruments.html

http://www.fao.org/uploads/media/1203_BEFSCI-FAO_Policy_instruments_to_promote_good_practices_in_bioenergy_feedstock_production.pdf

https://www.youtube.com/watch?v=34sS3N7lflM

http://smallbusiness.chron.com/whats-difference-between-grant-subsidy-39285.html

Carbon tax and Emission Trading System (ETS)

This topic can be included in policy structure, but I would like to discuss them separately. Carbon tax and ETS are aim to reduce carbon emission and use of fuel, however, they are different.

- Carbon tax: let the carbon producer/ factory pay for the environmental damage, as the consequence, the producer may use less fuel.
- ETS: by setting a cap, each factory has permit (limit) amount of carbon or GHG to emit. If a factory emit over its limit, it needs buy permit from others. In other words, permit is valuable.

These two ways can be applied to different situation, or as different phrases. Unlike ETS, carbon tax does not has cap, so factories actually can emit as much as they want, but they have to pay the tax. Here are more advantages about carbon tax

- Difficult to measure the real cost of emissions carbon for environment. This feature is similar with PES.
- High tax may reduce investment
- Firms may emit carbon secretly, but this may also happen in ETS
- Spend too much resources on measuring pollution
- Depends on area/ place, some factories may move to new place without carbon tax. I think this is same as ETS.

Seems ETS may be better than carbon tax, however, ETS also has some cons:

- If the permit is cheap, factories will still emit lots of carbon
- May increase energy price, this may same as carbon tax
- Reliable emission outcome? this may same as carbon tax

Reference and related links:

https://www.youtube.com/watch?v=ijf1gCfimIs

http://theconversation.com/explainer-the-difference-between-a-carbon-tax-and-an-ets-1679

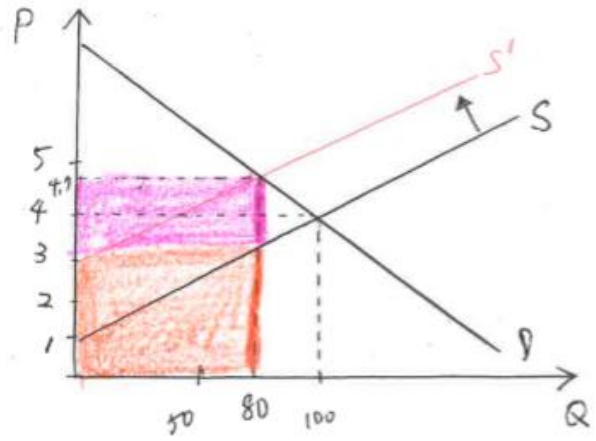
https://ec.europa.eu/clima/policies/ets_en

https://www.carbontax.org/whats-a-carbon-tax/

https://www.economicshelp.org/blog/2207/economics/carbon-tax-pros-and-cons/

Tax, Subsidy, Elastic

The effects of tax, subsidy on market are shown below.



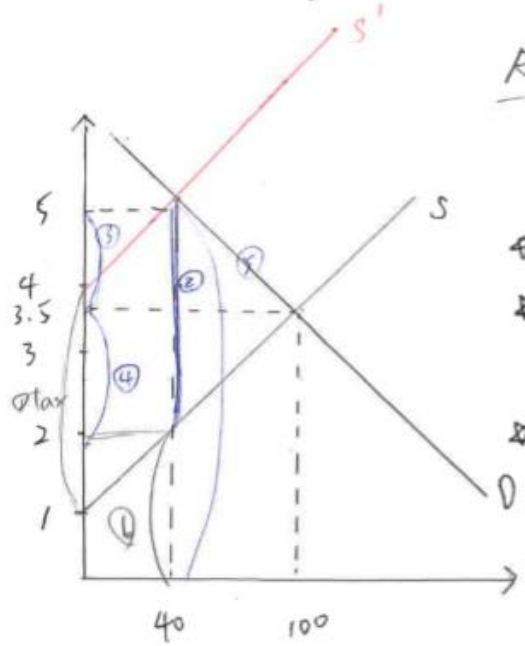
Taxes on Producers.

For example, one unit of oil is 4 euro. Government add 2 euro tax, so supply chain switch to left. However, the price doesn't go up to 5

⇒ ∵ producer & consumer both pay the tax.

When at S', consumer pay 4.7 euro, but producer does not get 4.7 € ∵ the 2 euro tax.

- area go for government ⇒ (4.7-3) × 80 = 136 €
- Total spending is 4.7 × 80 = 376 €
- area is the amount of money producer get from consumer spend. ≒ 3 × 80 = 240 €



Another example.

① Tax per unit: 3€ (5-2)

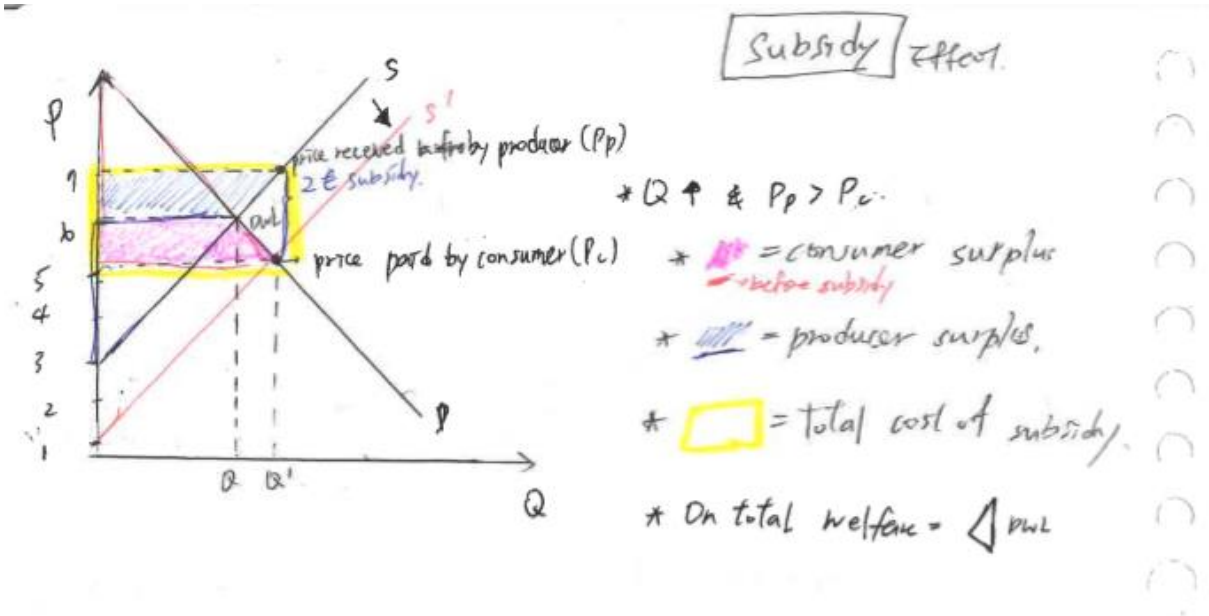
② Total tax revenue: 3 × 40 = 120 €

③ Total amount of tax paid by consumers: (5-3.5) × 40 = 60 €

④ Total amount of tax paid by producers: (3.5-2) × 40 = 60 €

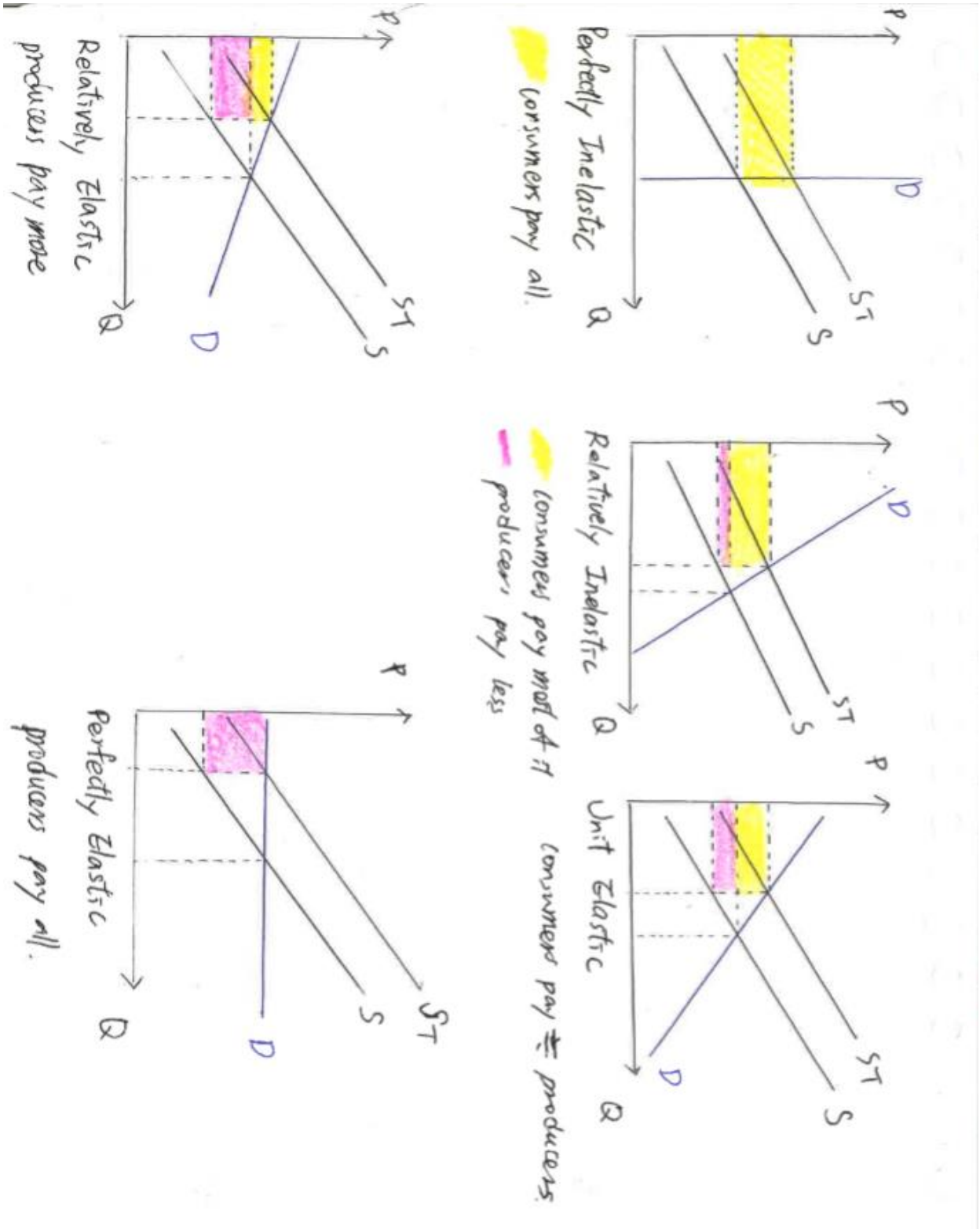
⑤ Total expenditures: 5 × 40 = 200 €

⑥ Total revenue for company: 2 × 40 = 80 €



On the note, we can see the idea of consumers and producers both pay the tax for the product. Depends on the elastic, they may pay equally, or only one side pay all. Next note is about elastic, it is easy to understand how tax affect the market and who pay tax actually.

Elasticity is a measure that we can know how much the demand changes related to the price. In general, **inelastic product** means the demand does not change much when there is a change in price. For instance, water, energy, basic food, and clothes. These are the things that people are still willing to buy no matter how much the price. **Elastic product** means a change in price causes big change in demand. For instance, **bioenergy in most of countries**, vehicles, transportation services, and coke. If these products price increase, people will chose cheaper alternatives.



Reference and related link :

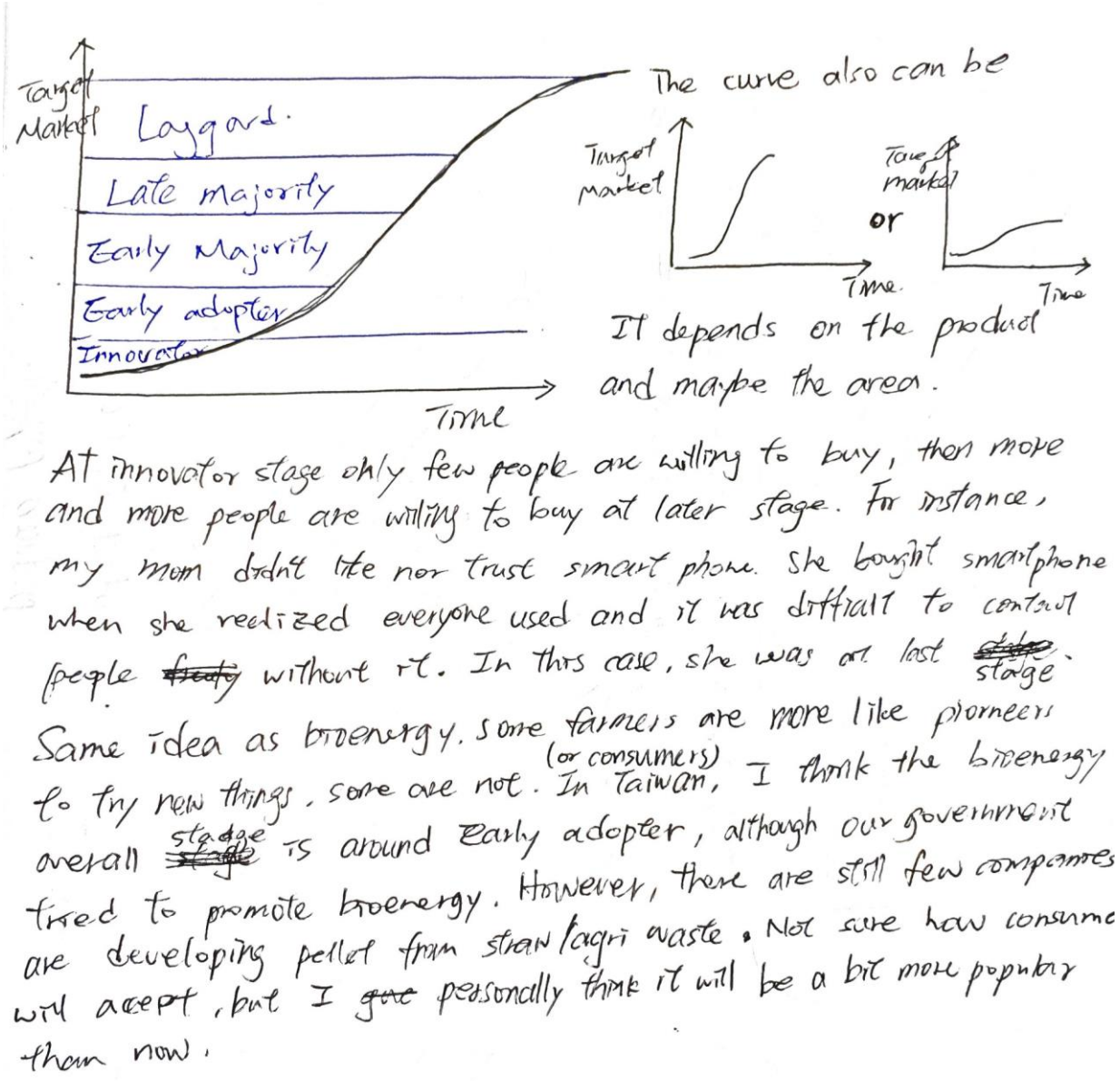
https://www.economicshelp.org/blog/7019/economics/examples-of-elasticity/

https://www.youtube.com/watch?v=9gwTH4Yme8I

https://www.youtube.com/watch?v=13JOGWzY8kE

Dynamic of Adoption

Dynamic of adoption shows the development and consumer's behavior of new product.



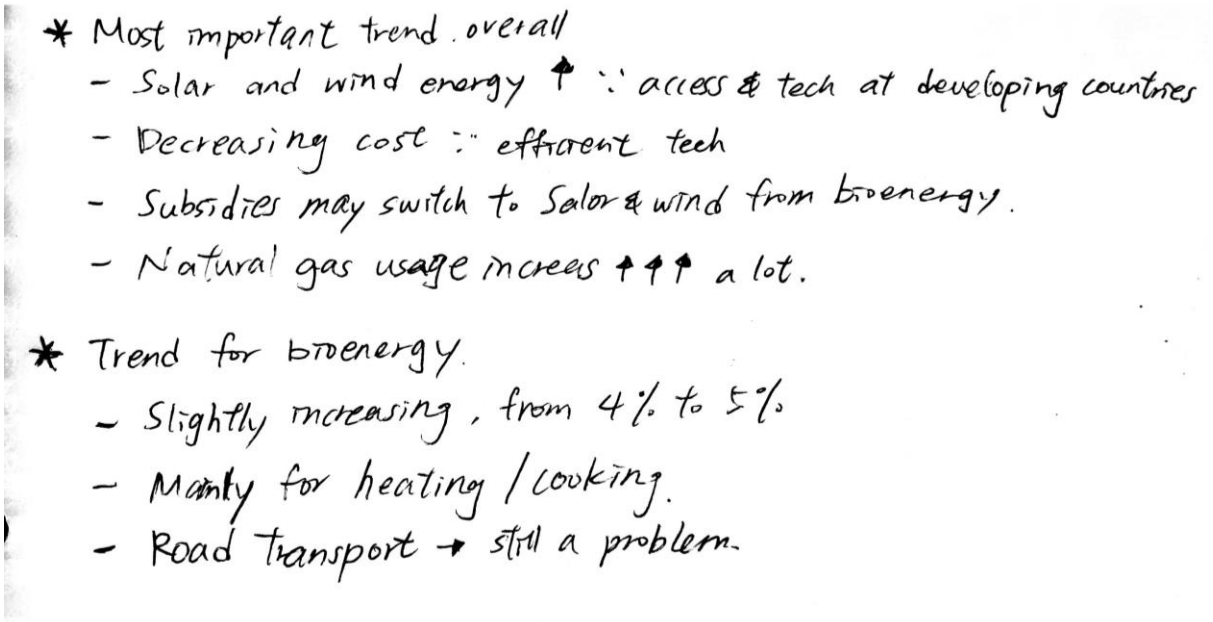
As the blog link in reference, dynamic of adoption reflects to market life cycle, growth market, mature market, declining market, end of life (market). Mature market also means indefinitely elastic middle period.

Reference and related link:

http://www.kilkku.com/blog/2014/07/moore's-category-maturity-life-cycle-and-innovation-types/

Bioenergy nowadays and future

The two short lists below were the general discussion from class.



I personally agree most of them, but in some other articles indicate pellet will be popular in China or other countries in Asia. First, the heating demand is not high in Asia as Europe. Second, high food demand in Asia due to the population. Thus, I think solar and wind energy will be more popular than bioenergy in some decades.

There are some voice about algae, which not popular as chip and pellet. Marine algae are mainly for food and chemical prduct nowadays. The total production of seaweed is 8 million tons in 2003; the potential production could be ten times more. However, the technology and market of if are not mature yet.

Reference and related link:

http://www.ieabioenergy.com/wp-content/uploads/2013/10/ExCo64-Algae-The-Future-for-Bioenergy-summary-and-conclusions.pdf

Pellet in Sweden and Finland:

In this part, I will give brief info about pellet, and compare main features of it between Sweden and Finland. One of the common thing is both of them are in using pellet top 10 countries, however, the feature, production and consumption are quite different. Most of bioenergy in both of them is using for heating, and most of consumers are small scale like private house.

Sweden is the biggest using pellet country because of (1.) the available of raw material (2.) good taxation system for biofuel (3.) high demand of heating. However, as the table shown below, although Sweden produce a lot of pellet, for instance, around 1.4 million tons in 2007, it still needed to import pellet from Finland and other countries. In addition, the production capacity is not at maximum due to its shortage of raw material.

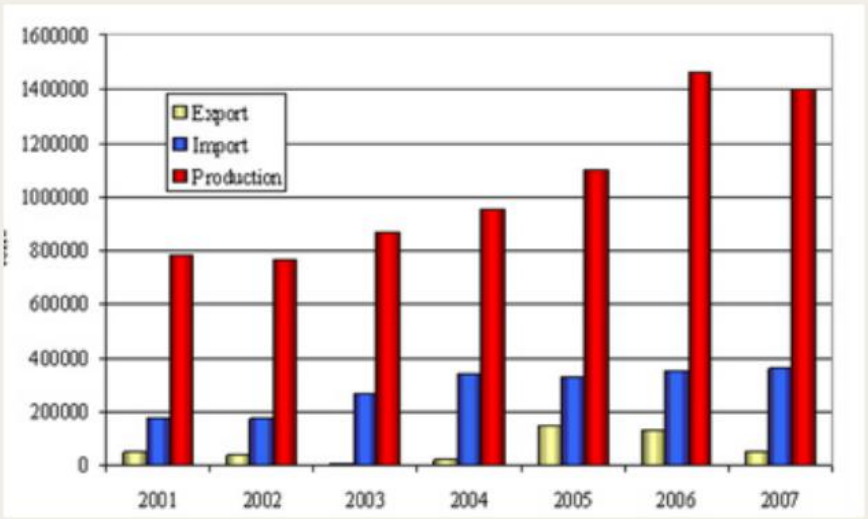


Figure 2. Production, export and import of pellets in Sweden.

(Metla publication, 2013)

The biggest reason makes pellet market in Sweden better than Finland is subsidy. In 2004-2006 Swedish state gave **subsidy** to small and medium scale heating system, at the same time, it also used **fuel tax**. As the consequence, pellet users also increased. It increased 50 thousands private houses (from 80 thousands to 120

thousands) using pellet from 2005 to 2009, and it could be 700 thousands household in future. For medium scale user. There were over 4000 at that time.

- Total consumption of pellet was 1,715,000 ton in Sweden, and 117,000 ton in Finland in 2007.
- Around 100 pellet producers in Sweden, 24 in Finland in 2007.

In future, production and consumption will increase in both countries, but Finland has more potential than Sweden because of the higher price of electricity and old oil heated house system. Moreover, subsidy for new heating system nowadays could increase more pellet user in Finland.

Reference and related link:

https://www.sciencedirect.com/science/article/pii/S1364032110001565
https://www.sciencedirect.com/science/article/pii/S0960148113004369
http://www.northernperiphery.eu/files/archive/Downloads/Project_Publications/10/Study_Reports/Pellet_markets_Sweden_2009.pdf