

Learning Diary

Xiaoqian Xu

1. Background

Because of energy crisis, bioenergy has been developed. Many kinds of bioenergy products have been produced, such as wood pellets, wood chips and biodiesel. What is biomass and what is bioenergy were discussed in the class as well.

We discussed reasons to support bioenergy production and reasons not to support bioenergy production.

Reasons to support bioenergy production are bioenergy is

- available
- good for local economy
- has existing technology and so on.

Reasons not to support bioenergy production are bioenergy will influence

- energy density
- carbon neutral
- food price and so on.

Before our class, I ignored the shortcoming of bioenergy production. By talking about these two topics in class, I realized that bioenergy production not only has advantages but also has disadvantages. After class, I read some materials about conflicts between bioenergy and land use.

In China, China has huge resources of biomass and has started to develop bioenergy recent years and paid more and more attention to renewable energy. Table 1 shows an assessment

of biomass resources in China. If these biomass resources can be make full use of bioenergy, it will offer big quantity energy for China.

Table 1 Assessment of biomass resources in China (million tons of coal equivalent) ^[1]

	2004/2005	2010	2020	2030	Remarks
Agricultural stalk	62	90	150	200	
Forestry residue	70	80	104	133	At an annual rate of 2.5%
Livestock manure	107	124	159	203	At an annual rate of 2.5%
Industrial organic waste	35	41	52	66	At an annual rate of 2.5%
Municipal organic waste	2.5	4	8	18	At an annual rate of 8%
Energy crop	–	1	10	20	Exploitation rate of reserved cultivable agricultural land and vacant fields in winter stepped up to 50%
Energy forestry	–	2	20	80	Exploitation rate of reserved cultivable forestry land and existing energy forestry stepped up to 50%
Total	276	342	503	720	

2. The role of policy

Both social science and natural science will influence transitions. The externalities produced by bioenergy utilization are changes on climatic conditions in nearby areas, changes on general climatic conditions, soil conservation, water quality, dams, landscape, biodiversity and so on.

Objectives from EU level and national level can promote bioenergy production.

On EU level, UNFCCC (Uniter Nations Framework Convention on Climate Change) and European Climate Change Program (ECCP) make mangy plans for climate change. Different policies are encouraging bioenergy development, such as agricultural policy, energy policy, environmental policy and so on.

On national level, policies on harvesting practices, forestry and environmental policy and some general recommendations can help countries to develop bioenergy.

In China case, China makes three national plans. In the Eleventh Five-Year Plan (2006-2010), China focused on bioenergy industrial demonstration^[2]. In the Twelfth Five-Year Plan (2011-2015), China focused on bioenergy industrial extension^[2]. In the thirteenth Five-Year Plan (2016-2020), China focused on big development of bioenergy^[2]. These targets can help China promote bioenergy industry.

3. Economic instruments

Two common economic instruments are tax and subsidy. Regulations, soft actions, information/promotion campaigns and eco-labelling are economic instruments as well.

In Sweden, energy policies are:

- petrol tax
- energy tax
- carbon tax
- sulphur tax
- tax on nuclear power
- tax on hydro power
- special tax to combat acidification
- environmental tax on domestic air transport

In Finland, financial instruments are:

- tax relief for all fuels used for electricity generation
- feed-in tariff for wood fuel based small scale CHP
- investment subsidy for biomass
- energy taxation for fossil fuels used for heat generation

Regulations are:

In Sweden case, the history of energy policy in Sweden since 1950s has been dominated by energy taxation^[3]. The history of energy policy in Sweden since the 1950s has been dominated by energy taxation^[3]. An energy tax has, for decades, been levied at differential levels on petrol, fuel oil, diesel oil, paraffin, liquefied petroleum gas, natural gas, coal and petroleum coke used for heating or as transport fuels, but not on electricity generators^[3]. Table 2 shows a separate electricity tax applied to electricity consumers^[3].

Table 2 Timeline of key bioenergy policy initiatives in Sweden^[3]

Year	Policy initiative
1991	Carbon tax
1991	Energy tax
1997	Investment subsidies
2000	Tax increases
2003	Green certificates
2004	Tax for home and services
2004	Reduced CHP tax

The important factors in Sweden for willow planting are:

- set-a-side land
- subsidies for planting
- environmental taxes
- forest residues has created a wood fuel market in Sweden
- chips from forest residues can delivered all year around

Farmers who have motivations for planting Salix. were:

- changing the work load on the farm
- good income from sale of chips
- subsidies and expected policies
- land more for suitable for Salix than for cereals

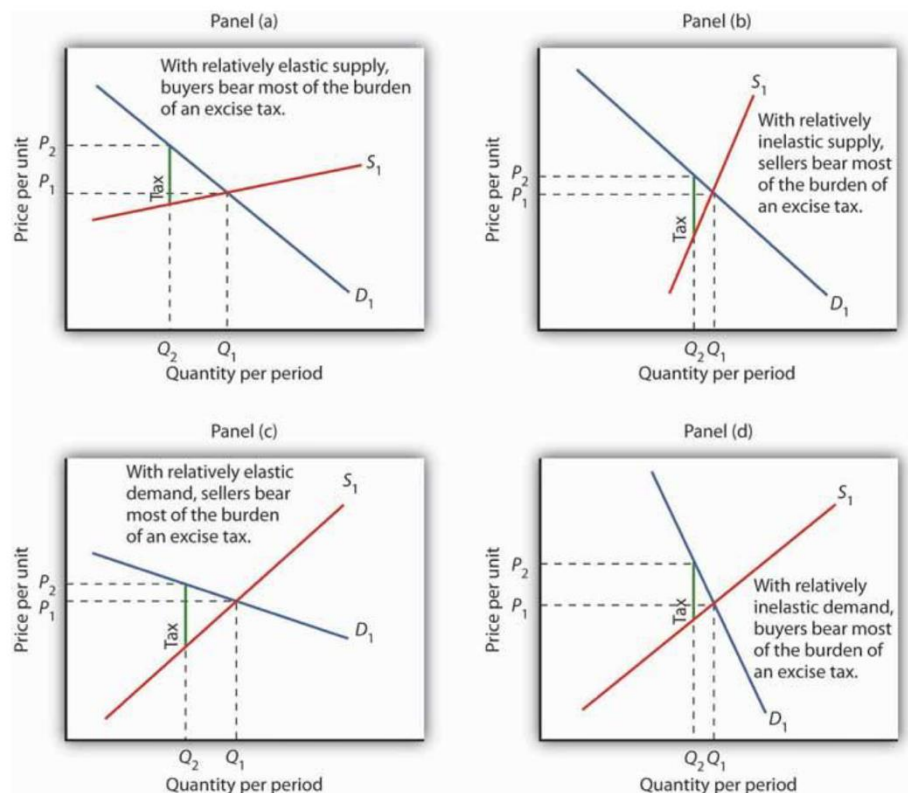
5. Market Behaviour

Bioenergy market is formed by forest owners, biomass, local monopolies and power plants. Policies can guide bioenergy market.

By learning demand curve and supply curve, I know how demand and supply influence bioenergy price and quantity. Actually, I was confused when these two curves were mentioned in class. After class, I searched some information on the internet about this point. As the respect of demand curve, it can show the maximum amount of a good that will be purchased if a given price is charged and the maximum the consumers will pay for a specific amount of a good^[4]. As the respect of supply curve, it can show the maximum amount of a good that will be sold if a given price is charged and the maximum the suppliers will sell for a specific amount of a good.

Figure 2 Effects of the taxes in the markets as a tool to promote bioenergy

Tax



The exercise we did in the class let me think a lot. Firstly, policies are very important. For example, some power plants did not get any biomass at first. Then policy makers made rules about the biomass price, amount and who can buy biomass. This problem was solved finally. Secondly, the quality of traders will affect the supply chain. For instance, before we reduced the quality of traders in second row, almost every trader can get profit. While we reduce the quality of traders in second row, let only 2 traders stay the positions, problem came out. Some traders could not sale their biomass and some could not buy biomass.

6. Governance

I heard about ENGOs, but I did not know much knowledge about it before our class.

What is ENGOs was explained in the class. The full name of this organization is Environmental Non-Governmental Organization. There is no government connections and they focuses on environmental issues.

What they are trying to and their roles in bioenergy and governance also were mentioned in the class. Their main roles are:

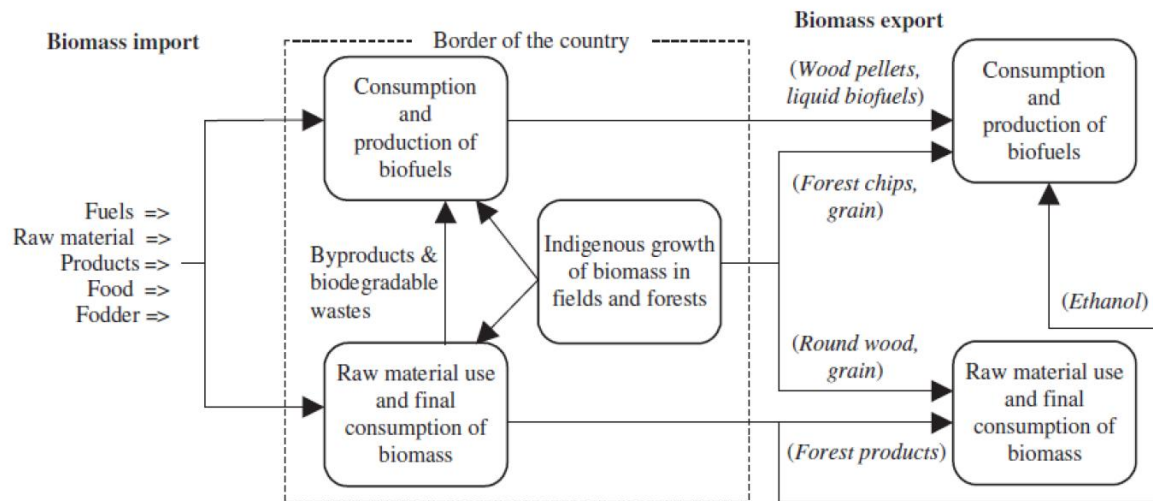
- Monitoring and reviewing environmental legislation
- Input to environmental policy/Lobbying
- Effective dialogues
- Advisory role
- Environmental awareness and education
- Technical services
- Litigation
- Owning and managing environmental resources
- Mouthpiece of voiceless
- Counterbalance

In 1978, China has set up an society named Chinese Society For Environmental Sciences (Chinese name is 中国环境科学学会), CSES^[5]. CSES has an official background^[5]. In 1991, China has formed another society named Saunders' Gull Conservation Society of Panjin City (Chinese name is 盘锦市黑嘴鸥保护协会)^[5]. It is a Grass-roots organization^[5]. Ju-Han Zoe Wang and John Connell said that responding to China's major environmental challenges, researchers are increasingly exploring dynamics between international non-governmental organizations, the nation-state, and local communities^[6]. The practices of ENGOs in China are influenced by interactions at various scales^[6]. Rather than being directly influenced by international partners and simply constrained by state regulations, Chinese ENGOs are embedded in more complex power relations^[6]. These interrelationships are exemplified in the operations of Green Watershed, a domestic ENGO working in Yunnan Province^[6].

7. International markets

In many European countries such as Belgium, Finland, the Netherlands, Sweden and the UK, imported biomass contributes already significantly (between 21% and 43%) to total biomass use. Wood pellets are currently exported by Canada, Finland and (to a small extent) Brazil and Norway, and imported by Sweden, Belgium, the Netherlands, and the UK^[7]. In the Netherlands and Belgium, pellet imports nowadays contribute to a major share to total renewable electricity production^[7]. Trade in bio-ethanol is another example of a rapidly growing international market^[7]. With the EU-wide target of 5.75% biofuels for transportation in 2010 (and 10% in 2020), exports from Brazil and other countries to Europe are likely to rise as well^[7]. Major drivers for international bioenergy trade in general are the large resource potentials and relatively low production costs in producing countries such as Canada and Brazil, and high fossil fuel prices and various policy incentives to stimulate biomass use in importing countries^[7]. However, the logistic infrastructure both in exporting and importing countries needs to be developed to access larger physical biomass volumes and to reach other (i.e. smaller) end-consumers^[7].

Figure 3 Biomass import roadmap



8. Bioenergy regions

Germany and Norway cases were used to talk about bioenergy policy. Coercive governance, voluntary governance, empty governance space and mutation can be used to make bioenergy policy.

It was the first time I heard about the concept of translation in bioenergy field. When we use biomass to produce heat, it will cause environment impacts and socio-economic impacts. Forestry, acceptance, international policy, state policy, local infrastructure, business environment, social aspects, local aspects, knowledge/experience and bio-physical aspects will influence the producing. This is the translation framework for bioenergy materialization.

In EU level, general aims are:

- Development/ low-carbon energy
- Security of supply
- Rural development
- Energy union

In Germany case, Germany's general aims are:

Increase of bioenergy within sustainable limits

- climate protection
- security of supply
- economic of development
- network creation

The point Moritz mentioned how to encourage the public to use bioenergy is interesting. Since I have known bioenergy, this question is in my mind until now. If the price of bioenergy is too high, public will not buy bioenergy actively. So we need to consider both the price of bioenergy and the promotion of bioenergy.

9. Models for energy system

Carbon tax is

- a tax levied on carbon emissions from coal, oil and natural gas,
- can encourage alternative energy and reduce fossil fuel use and CO2 emissions,
- offers an incentive to the alternate energy,
- increases the energy efficiency.

The Swedish energy system underwent reform in 1991^[8]. during the 1980s, the focus had been on oil substitution and the taxation system therefore was designed to discourage oil use^[8]. The new taxation system was based on a carbon tax and a energy tax on fuels^[8].

Table 3 shows a summary of of current taxes and changes applied on energy in Sweden^[8].

Table 3 Summary of current taxes and changes applied on energy in Sweden^[8]

Type of tax	Tax level	Comments
Energy tax	Differs among the fossil fuels, see Figure 1	Applied on all fossil fuels. No tax on fuels used in industry or for power generation
Carbon tax	General level 0.36 SEK/kg CO ₂ (USD 150/tonne C)	No tax is applied to fuels used for power generation and 50% of the general level on fuels used in industry
Sulphur tax	30 SEK/kg S (USD 3.3 /kg S)	Applied on heavy fuel oils, coal and peat. If sulphur is removed from the exhaust gases the tax could be refunded in accordance with that
Nitrogen oxides charge	40 SEK/kg NO ₂ (USD 4.4/kg)	Applied on heat and power plants which use more than 25 GWh/yr. The charge is refunded to the group in proportion to their energy use
Tax on nuclear electricity production	2.7 öre/kWh (USD 0.003/KWh)	
Electricity consumer tax	11-16 öre/kWh (USD 0.012-0.017/kWh)	No tax on electricity used in the industrial sector
Value added tax		Applied on all energy consumed

10. Bioenergy EU systems

Tahamina explained many details and economic principles of bioenergy. Such as mechanisms behind carbon taxes and some future targets of UE level.

EU's targets for 2020 are:

- 20 % reduction of GHG emissions
- 20 % share of renewable energy in the energy consumption
- 20 % Improvement in the energy efficiency

In production sectors, investment support, aside lands, producer incentives, authorized quota system for producers are applied for developing bioenergy. In supply chains, fuel standards, tax reduction, mandates for fuel suppliers and filling stations are applied. In end use, vehicle compatibility and user intensives are applied. In Nordic energy market, Sweden and Norway have common green certificates, Finland and Sweden have national feed-in-tariffs.

Some exercises in the class let us review the lectures content. Tahamina gave us two cases and some questions to let us think in the first class. In the second class, we exercised by true or false.

11. Future trends

In the class, we discussed the future trend of bioenergy. In the first session, three main questions and some ideas were:

- I. Most important trends?
 - Renewable growth and decreasing costs
 - Subsidies
 - Auctions
 - Natural gas
 - Phase out of diesel cars
- II. Consequence for bioenergy?
 - Africa users and Brazil producers are two example
- III. Explanation background reasons/ factors?
 - During last 10 years, China's change is an example

In the second session, three main questions and some ideas were:

- I. Which factors might have the strongest impact on the future of bioenergy?
 - Geopolitics resources
 - Super- tech
- II. What is the role of bioenergy in the future?
 - The options for this question are GOOD/BAD/DIFFERENT. In our class, most of students vote GOOD for this question.

Jakob mentioned that price level of other forms of energy production, price level of feedback, the efficient of the production technology and the volume of

public/state support and the political incentive structures will influence the investment in bioenergy.

III. Describe the future

- Heap bioenergy
- Different rule

By reading International Energy Agency (IEA) and other related materials, I found that most countries have already made efforts for bioenergy. As IEA mentioned that China is the undisputed renewable growth leader. The United States and India have large bioenergy market as well.

This kind of discussion as Jakob mentioned did not have a correct answer, but it was a good way to let us think a lot. Before the class, we read the materials and had our own opinions. Then when we communicated in the class, we shared our ideas.

References

[1]C.Z.Wu, X.L.Yin, Z.H.Yuan, Z.Q.ZhouX, S.Zhuang. The development of bioenergy technology in China[J]. Energy.2010.35(11):4445-4450.

[2]Shaojun Zeng, Hualin Li. Current status and recommendations for biodiesel development in China[J].Chemical Industry and Engineering Progress,2008,27(10):1485-1489.

[3 Patricia Thornley, Deborah Cooper. The effectiveness of policy instruments in promoting bioenergy[J]. Biomass and Bioenergy.2008.32(10):903-913.

[4]Demand Curve.

<<https://baike.baidu.com/item/%E9%9C%80%E6%B1%82%E6%9B%B2%E7%BA%BF/3351682?fr=aladdin>>

[5] The Development of ENGO in China.

<<https://wenku.baidu.com/view/e2a6faf001f69e3142329427.htmlb>>.

[6] Ju-Han Zoe Wang, John Connell. Green Watershed in Yunnan: a multi-scalar analysis of environmental non-governmental organisation (eNGO) relationships in China[J]. Journal Australian Geographer. 2016.47(2):215-232.

[7] MartinJunginger, TorjusBolkesjø, DouglasBradley, et al..Developments in international bioenergy trade[J]. Biomass and Bioenergy.2008.32(8):717-729.

[8] B Johansson. Innovation and the Environment, 2000.

<https://books.google.fi/books?hl=en&lr=&id=5YIHp5F_LWoC&oi=fnd&pg=PA85&dq=carbon+tax+bioenergy&ots=rKIPISVB4_&sig=IcJn3z7VSrl90njP1ImghRmELFY&redir_esc=y#v=onepage&q&f=false>