Module 5:
Renewable Resource Economics 2

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Overview

This module continues to explore the economics of renewable resources. While economic theory is useful for helping people make decisions regarding resource use and allocation, it must be considered in a wider social and political context. Often renewable resources are not privately owned or managed and require government intervention. The module begins with the reindeer economy and then explores the rise in demand for renewable energy followed by the growing economic sector of Arctic tourism. The module then examines the roles governments play in defining property rights and regulating resources used to promote sustainability.

Learning Objectives

Upon completion of this module, you should be able to:

1. Articluate challenges faced by reindeer herding economies among Arctic states.
2. Outline at least three opportunities for developing renewable energy resources in the North.
3. Compare socio-economic effects of various types of tourism in the circumpolar North.
4. Assess the functions and roles of governments in allocating resources.

Required Readings (including web sites)

International Energy Agency. (2002). *Renewable Energy*. **International Energy Agency paper**. 13 pp. Available via: www.iea.org/publications

Sustainable Arctic Tourism. (2016). Accessed via http://www.arctictourism.net/index.htm.

Key Terms and Concepts

- Caribou
- Comparative Advantage
- Competitive Advantage
- Ecotourism
- Externalities
- Incentives
- Land Tenure
- Market Failure
- Nominal Price
- OPEC (Organization of Petroleum Exporting Countries)
- Private Goods
- Property Rights
- Real Price
- Reindeer Husbandry

Learning Material

Introduction

The economic approaches used to manage and allocate renewable resources are similar for different resources whether they are wildlife, forests, fisheries or energy. Economics is the study of choices where there are competing interests for scarce resources so the object is to make the best use of such resources. This entails consideration of the quality and quantity of goods and services produced (including experiences), stock (population or volume) and how it is produced or renewed. It is as important for the producer or operator to consider production costs and selling price. These factors affect profit and well-being.

Producers are subject to market forces and must consider demand (e.g. current and future) and long-term supply including competitors and substitutes. Depending on the resource, producers must work with government to secure allocation of resources or license agreements that provide rights and access. While these factors apply to individuals, it is important for governments to be involved where natural resources are concerned. Often governments allocate rights to resources, regulate resource use and enforce rules of law.

Economic analysis provides an objective view of supply and demand, but cannot be considered out of context. The role of government and how property rights affect production must be considered. This module explores and compares different types of renewable resources and characteristics that lead to sustainable use.

5.1 The Reindeer Economy of Arctic States

Reindeer are an interesting economic resource. Wild reindeer are a common-pool resource subject to the same fate as ocean fish species but domestic reindeer are **private goods** subject to full **property rights**. Therefore, the economic analysis of domestic reindeer is similar to any privately owned natural resources where the goal is to maximize value or profit while considering the health and size of the herd (e.g. productivity), operating costs (e.g. management, husbandry and herding) and the value produced by each animal (e.g. meat, skin, antlers, etc.).

Figure 1. Male Caribou in Alaska
Photo Credit: Dean Biggins

Sámi in Scandinavia, Finland and Russia have controlled herding and hunting by regions where family clans are responsible for land allocation and governance. These regions are traditional family areas. Figure 2 illustrates traditional lands where reindeer herding occurred in northern Europe.

Figure 2. Traditional Reindeer Herding Areas the Barrents Euro Arctic Region

Reindeer management is complicated by access to and use of grazing land. Traditionally reindeer herders had access to vast expanses of summer and winter ranges for forage and birthing. Herding was not restricted by political boundaries and it was common to cross what are now Norway, Sweden, Finland and Russia. Today political boundaries and private property result in conflict as the size of and access to pastures shrink. Problems that have arisen include overgrazing and pressure to decrease herd size as forage areas decrease, ultimately impeding herders' profitability and well-being.

Reindeer herding and **husbandry** are important cultural jobs for Indigenous peoples such as the Sámi and contribute to social, cultural and economic sustainability. Indigenous peoples and rarely other members of society (with strict approval of the government) have the right to herd

and keep reindeer. In 1932, the Finnish Reindeer Herding Act was established based on Sámi peoples herding and hunting practices. The Act was updated in 1990 (Finland Forests, no date).

In Norway reindeer herding is regulated by the Norwegian Reindeer Herding Act, which governs the herding practices of the Sámi people. The Act states reindeer herding and husbandry must be conducted in a manner based on Sámi culture and be economically and ecologically viable (International Centre for Reindeer Husbandry, no date). In Sweden the right to herd reindeer is granted solely to Sámi people and is governed by the Swedish Reindeer Husbandry Act, the rights of which are protected by the Swedish Constitution (Government Offices of Sweden, 2008). Since herding traditionally led the Sámi to cross the border between Norway and Sweden, these countries allow cross-border grazing. An agreement was in place until 2005 and currently negotiations are underway for a new reindeer grazing area agreement between these countries (Finland Forests, no date).

Learning Activity 1

Research the experiment to introduce "reindeer ranching" in Canada. Discuss why reindeer herding and husbandry is not today widely practiced in this country.

Russia does not have legislation defining the legal status of reindeer herding. Instead, the government regulates the economics and trade of reindeer. This makes it difficult to protect reindeer herders from lucrative industry and development (i.e., oil and gas, mineral exploration, mining) competing for the same areas. In North America, the reindeer economy is limited to hunting because herding and husbandry are not generally practiced. The situation is similar in Greenland.

Reindeer are largely managed as a private good and reindeer herders do not typically own the lands upon which they graze. Reindeer herders have access to land and grazing rights and often this land has resources in addition to forage. **Land tenure** is a key driver of how resources are used, who benefits and who is responsible or liable for damages. Without secure ownership (i.e., private property), rights to benefit are not secure and often government regulation is necessary to define rights.

Case Study 1: Caribou in Canada

Caribou in Canada declining as a result of exploration and mining: *A Troubling Decline in the Caribou Herds of the Arctic*. Accessed via http://www.reindeerblog.org/2010/09/28/a-troubling-decline-in-the-caribou-herds-of-the-arctic/

Case Study 2: Oil and Gass Development

Oil and gas developments as they affect Nenets reindeer herder: *Russian Arctic tribe at risk from Yamal gas projects*. Accessed via http://www.reindeerblog.org/2009/10/07/russian-arctic-tribe-at-risk-from-yamal-gas-projects-reuters/

Where there is conflict economics can provide objective data regarding prices and values (including non-market values associated with culture, social and environmental importance), but other factors are also at stake. Societies must make tradeoffs when resources are scarce and seeking sustainable resource use. It is important to consider social, cultural and environmental sustainability. Decisions cannot be based on economics alone and must reflect the values of society and the needs of the populace.

5.2 Renewable Energy in the Circumpolar North

The demand for renewable energy is on the rise. There is growing fear the world will run out non-renewable energy such as oil and gas. Many nations are concerned with energy security and self-sufficiency given that most energy is imported. Exporting countries always have the option to restrict supply thereby increasing prices (consider **OPEC**) or withhold the resource.

Renewable energy resources are sought because they are believed to be environmentally sustainable. Energy derived from ocean waves, wind or solar power is infinite and its use does not reduce the supply of the resource. Many new technologies that produce energy from renewable resources purport to emit less carbon into the atmosphere.

What environmental sources produce renewable energy? There has been tremendous investment in new technologies that derive energy from the Sun, wind and water, including solar thermal power, solar photovoltaic cells, hydroelectricity, wind power, geothermal production systems and biomass as a source of biogas.

There is demand for and interest in developing energy alternatives. Given the interest in renewable energy, why is the majority of our energy derived from non-renewable resources?

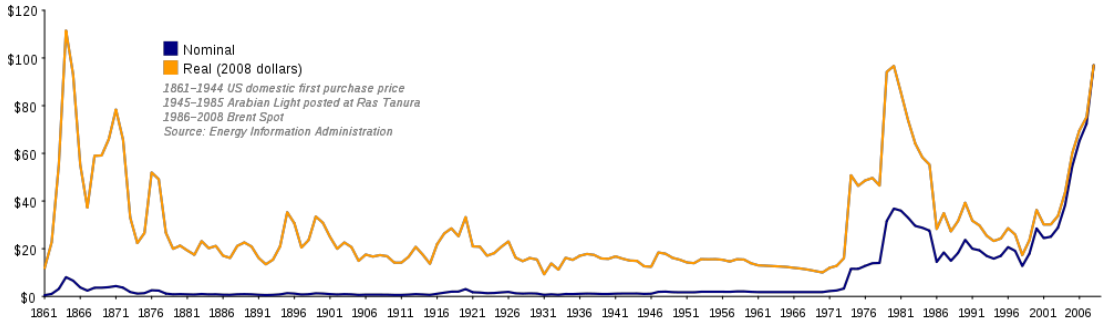

Figure 3. Real and Nominal Oil Prices 1861 – 2006.

Oil remains relatively inexpensive by historical standards so there are insufficient **incentives** to fully develop alternatives. Although there is concern the world's oil supply is running out, technology is rapidly advancing enabling reserves not previously accessible to be tapped. The USGS estimates that 25 percent of the world's oil supply remains untapped under the Arctic ice cap.

There are currently no strong incentives to switch to more expensive renewable energy because prices are low and effective supply (i.e., supply available to society) is rising. Figure 3 shows the **nominal price** of oil has risen since 1861, but the **real price** of oil peaked in the 1860s. This means that when adjusted for inflation oil was actually more expensive in the 1800s than today. On October 10, 2010, the nominal price of oil was $82.84, slightly lower than the price in 2006 (see http://www.oil-price.net/).

Solar heating
For the IEA as a whole, the market for solar thermal energy has expanded in recent years, although it is stable or decreasing in the United States. In Europe, the market has grown by 18 percent per year throughout the 1990s. There are about 178 manufacturers in Europe and the United States. The companies are generally not large. For example, only 26 companies in Europe have more than 30 employees.

Solar thermal power
The market for high-temperature solar thermal power systems appears ready for major advances. The technologies are cost-effective and ready for commercial application in regions with the best solar resources. Plants built in the 1980s have proven to be highly reliable and competitive. They also have the advantage of providing dispatchable power when hybridized. While there are few commercial applications to date, forecasts show 700 MW of capacity by 2003 and 5,000 MW by 2010.

Solar photovoltaics
In 1998, total production globally increased 20.4 percent compared to 1997, reaching 151.7 MW. The United States leads with total production of 53.7 MW, followed by Japan with 49.2 MW. Since 1992, the global market has expanded by over 17 percent annually.

Wind turbines
Total installed capacity globally increased 35 percent to a total of over 9,600 MW between 1997 and 1998. This amounted to a total of 2,100 MW of new installed capacity in 1998. Most of the new installations were in Europe. The average size of installed wind turbines increased to more than 500 kW in the major markets. By the end of 1997 almost 130 turbines of 1 MW capacity or more were in operation. Danish companies command about 60 percent of the global market.

Biomass
Biomass makes a significant contribution to the energy balance of the IEA, representing about 3 percent of total primary energy supply (TPES). For a number of IEA countries, biomass is one of the major inputs to TPES. Globally, biomass contributes about 14 percent of total final energy demand. For many IEA countries, wood for heating is the major use of biomass, although there is an increasing use of urban and industrial waste to produce electricity and heat as well as biofuels for transport. Increasingly, the use of solid fuels or biogas is expanding in modern combustion systems, such as for cogeneration or industrial processes.

Small hydro
There is tremendous interest in small hydro applications, where there is good potential and few negative environmental impacts. While data are sketchy throughout the IEA, small hydro capacity in Europe expanded by 709 MW between 1993 and 1996 to reach 9,643 MW.

Geothermal
Geothermal capacity is increasing. In the United States, the world's leader in geothermal energy, capacity reached 2,850 MW in 1998 and Italy has 558 MW for the same period. Japan increased capacity by 116 MW since 1995 and New Zealand its capacity by 59 MW. Total capacity globally stood at 8,240 MW in 1998.

Excerpt from Janssen, Rodney. 2009. The Evolving Renewable Energy Market. International Energy Agency's Renewable Energy Working Party. Novem BV, SITTARD: The Netherlands. 56 pp. Page 5

Today's relatively low energy price mean companies have less incentive to invest in research and development to produce innovate solutions because they will not recoup their costs until oil prices are high enough to compel consumers to switch to new energy sources. In many countries, governments believe finding new energy alternatives is sufficiently important to warrant subsidies, which are not necessarily economically or socially desirable.

Renewable energy is social desirable for non-economic reasons such as energy security and self-sufficiency as well as a means to wean society off carbon producing energy. Therefore, governments subsidize innovation and production of alternative energies, although this may not be the best use of financial resources.

Governments must pay attention to **comparative advantage** and **competitive advantage**. Subsidies provide unfair advantages enabling companies to compete in the marketplace where they inefficiently produce products of lesser quality. For example, governments subsidize ethanol production in the name of sustainability and clean energy. Research has shown that ethanol increases specific pollutants including pesticides used for growing crops and does not lead to significant reductions in carbon dioxide emissions (Lieberman, 2007).

5.3 Economics of Northern Circumpolar Tourism

Tourism in the North is a growing business as a result of falling transportation costs and marketing of new and exotic Northern experiences. The North has always been appealing as one of the last frontiers and is rich in material resources. The USGS recently estimated that 25 percent of the world's oil reserves lie under the Arctic Ocean.

Figure 4. Via Rail Station in Churchill, Manitoba.
Photo Credit: Peter Van den Bossche

The North is served by many airlines specializing in passenger and freight transport (e.g. Buffalo Airways in the Canadian Northwest Territories, Aeroflot Nord in Russia), railways and ships including cruise liners. There is a myriad of organized excursions to the most remote locations to view wildlife (e.g. polar bears in Churchill, Manitoba), fish and hunt, and engage in cultural experiences. It is possible to travel by dogsled in the Yukon or ride in a sleigh pulled by Santa's reindeer at Christmas (Figure 5).

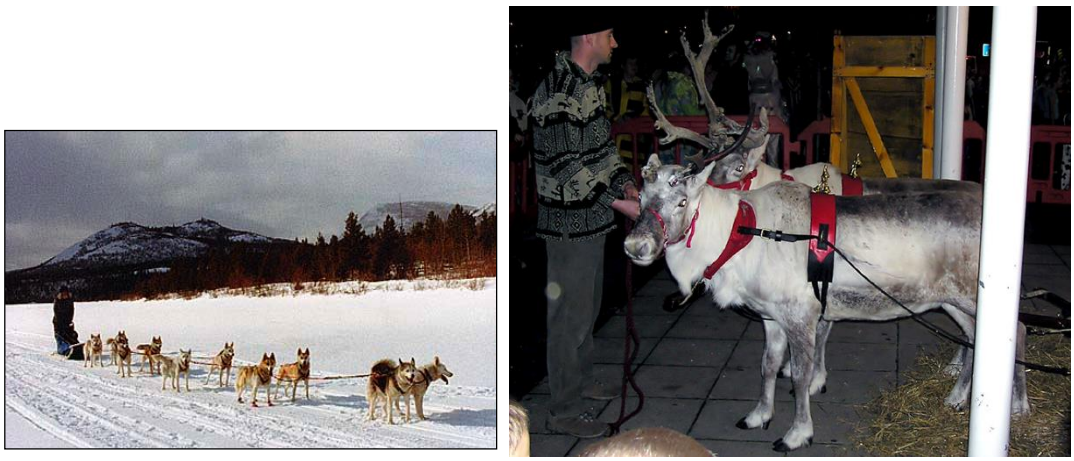

Figure 5. Ten-dog team of Seppala Siberian Sleddogs driven by J. Jeffrey Bragg of the Yukon
Photo Credits: Isa Boucher and Adrian Pingstone

Tourism is important to northern communities as a means of economic diversification. Tourism can also be a boon to the environment because people learn about northern ecosystems, their fragility and challenges brought about by changes in the climate. Tourism (also known as **ecotourism**) often combines a deep understanding of the natural environment and can be conducted to sustain ecosystems rather than alter them for material gain.

Sustainable Arctic Tourism (SAT) (http://www.arctictourism.net) recommends key principles that address all aspects of sustainability. Economically, SAT suggests tourism businesses support local economies and focus on providing high quality experiences., SAT addresses social or cultural sustainability by recommending respect for local communities and educating visitors about nature and culture. Good business practices should be concerned with conservation of local nature and operating in an environmentally friendly manner.

Standard economic analysis applies to ecotourism where operators are concerned with the environment in which they operate because it is the physical basis for production; the cost of operations including marketing, financing and operations; and revenues that depend on the number of customers and prices.

Learning Activity 2

Develope an itinerary for an adventure vacation in one of the countries of the circumpolar North. Discuss “ecotourism” with your class.

Learning Activity 3

Choose three renewable resources and discuss the role of government in their allocation and the assignment of property rights.

There is growing literature on tourism and recreation and many colleges and universities provide training for the business. Tourism courses focus on economics, marketing, finance, investment, business and management strategy, customer service, and the environmental or ecological impacts of tourism. This latter point is important given tourists can negatively affect the environment from which people derive their livelihoods. Environmental degradation will eventually lead to a reduction in profit. Therefore, it is important to manage the business with a view to the future.

Much of the industry relies on government regulation and access to resources. Outfitters and tour guides must often secure operating licenses or access to wilderness areas. Wilderness areas or public lands may have restricted access because government agencies must balance economic development with environmental sustainability.

5.4 Role of Government in Resource Allocation

Government plays several resource allocation roles and is guided by diverse policy goals that are not necessarily economic. The allocative role focuses on resource allocation, the nature of goods and services produced, and efficiency. Allocative mechanisms include (Rideout and Hesseln, 2001):

- Force, where governments allocate goods according to quantity rather than prices and values. Quotas are an example where producers must accept a prescribed amount or forgo economic opportunities. This method is neither fair nor efficient.
- Market mechanisms governed by prices and are generally considered efficient when consumers who value goods, services and resources the most highly will pay higher prices.
- Queuing allocates resources on a first-come, first-served basis. This method does not result in efficiency where resources are allocated to their most valuable use, but is deemed to be fair or equitable.
- Random selection by lottery such as that used to allocate game licenses. This method is not considered efficient, but is fair given that everyone has the same chance of accessing a resource.
- Tradition is also commonly used to allocate resources where precedence is recognized by government. For example, reindeer herders in Scandinavia are given access to pastures and grazing areas based on their history in the area.

Many renewable resources discussed in Modules 3 and 4 have characteristics of common goods meaning that harvesting and management results in market failure. **Market failure** occurs when goods and services are allocated in a way that results in waste. Another example of market failure is an **externality**, which occurs when costs are imposed on groups who have not been party to how decisions were made. An example of a negative externality is carbon emitted into the atmosphere as pollution. The atmosphere is considered an open access resource and companies do not often pay for the right to use the resource as a dumping ground.

Market failure leads to calls for government intervention to correct situations where costs and benefits are not accounted for in the price of a good or service, or where common property leads to inefficient use and management of resources. This regulatory role is important because often

government is the only agent with the authority to impose regulations and enforce them. Governments are also able to define property rights where they do not exist or are unclear.

Conclusion

The economics of renewable resources are based on standard economic theory that considers supply and demand. Resources are often not privately owned or managed giving governments a substantial role in resource allocation, regulation and law enforcement. Resources may often be allocated according to non-market forces such as equity goals that consider fairness rather than best economic use because governments must consider social factors in addition to economics. Further, since many resources are common-pool goods, governments are necessary to impose and enforce regulations that ensure such resources are not degraded.

Discussion Questions

1. Discuss management challenges for common property resources.
2. Evaluate economic factors that make viable a renewable energy source of your choosing in the country in which you reside.
3. Develop a case study that explores new business opportunities for tourism related to wildlife species in a northern community.
4. The role of government is varied. Present your opinion of government involvement in providing subsidies to develop renewable and/or alternative energy technologies.

Study Questions

1. Evaluate the role of property rights and land tenure for sustainable reindeer husbandry.
2. Outline three opportunities for developing renewable energy resources in the North *(*e.g., hydroelectric, thermal, wind and sun power*).*
3. Compare socio-economic effects of various types of tourism in the circumpolar North.
4. Assess the functions and roles of government in allocating fisheries resources. Be sure to consider the role of law enforcement, institutional mechanisms and environmental sustainability

Glossary of Terms

Caribou: Wild reindeer (*Rangifer tarandus*) in North America dwelling in the Arctic and subarctic.

Competitive Advantage: Conditions enabling a company to operate in a more efficient or otherwise higher-quality manner than companies with which it competes resulting in benefits accruing to that company.

Comparative Advantage: A country has comparative advantage over another country in the production of a good if it can produce it at lower opportunity cost (i.e., it has to give up less labor and resources in other goods in order to produce the good).

Ecotourism: Tourism designed to contribute to the protection of the environment or ecosystem often involving travel to areas of natural interest for the purpose of observing wildlife and learning about the environment.

Externality: The spillover of an economic transaction affecting a party not directly involved in the transaction. As a result prices do not reflect full costs or benefits in production or consumption of a product or service.

Incentives: Inducement or supplemental reward that motivates a desired action. For example, a coupon or rebate that reduces a good's price is an incentive to purchase that good. Alternatively, an increase in price is a disincentive to purchase that good and an incentive to purchase a substitute good.

Land Tenure: The right to exclusively occupy and use a specified area of land. Tenure may also be limited to certain resources ("resource tenure") such as timber but not all resources in a given area. Individuals, communities, government or corporations may hold tenure.

Market Failure: A situation where a market does not efficiently allocate resources to achieve the greatest possible good.

Nominal Price: The sticker price of a good or service not adjusted for inflation.

OPEC: Organization of the Petroleum Exporting Countries founded in Iraq in 1960 by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela. Current membership also includes Qatar, Indonesia, Libya, the United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon and Angola.

Private Goods: Goods characterized by very high levels of subtractability and excludability. Subtractability means that one person's consumption of a good reduces the quantity available to others. Excludability means a producer can restrict use of a product to those consumers willing to pay for it, while excluding those who do not meet this or other criteria.

Real Price: Price of a good or service adjusted for inflation. This price considers the purchasing power of money thereby stripping out the effects of inflation.

Reindeer Husbandry: Practice of breeding and raising livestock. It has been practiced for thousands of years since the first domestication of animals.

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