Models for sustainable living

Unit 13

13.1. VISIONS OF A SUSTAINABLE WORLD

Visions of a sustainable world

13.1.1. AN ECO-ECONOMY

Lester Brown and the WorldWatch Institute

Brown presents his vision*

of a sustainable society,

an "eco-economy" where:

- **"The economy respects the sustainable yield of the ecosystems on which it depends." (from "Eco-economy")**
- **"Sustaining progress depends on shifting from a fossil fuel-based, automobile-centered, economy to a renewable energy-based, diversified transport, reuse/recycle economy."**

*** See the PDF reading provided with Unit 2.**

Picture by Agencia Brasil, from Wikimedia Commons

Switching to an eco-economy

- **Brown accepts that "converting our economy into an eco-economy is a monumental undertaking."**
  - **Energy: Oil, coal & gas => wind, solar.**
  - **Materials: Switch from linear model based on disposal, to a recycling/re-use model.**
  - **Food: Manage natural capital more effectively.**
  - **Transportation: Internal combustion => bicycles, fuel cell vehicles using hydrogen, light rail, etc.**
  - **Forestry: Clear cut => sustainable logging.**

Such an eco-economy will include

- **Careful management of forests, water supplies and other key components of natural capital.**
- **New or expanded industries such as:**
  - **Wind turbine manufacture & support**
  - **Solar panels & photovoltaics**
  - **Fuel cells**
  - **Hydrogen production & distribution**
  - **Expanded public transport (light rail, etc)**
  - **Fish farms**
  - **Increasing use of the internet to allow"virtual conferences" etc, and reduce travel.**

From WM Commons

By Calivin Teo, from WM Commons, CC license

Visions of a sustainable world

13.1.2. THE HYDROGEN ECONOMY

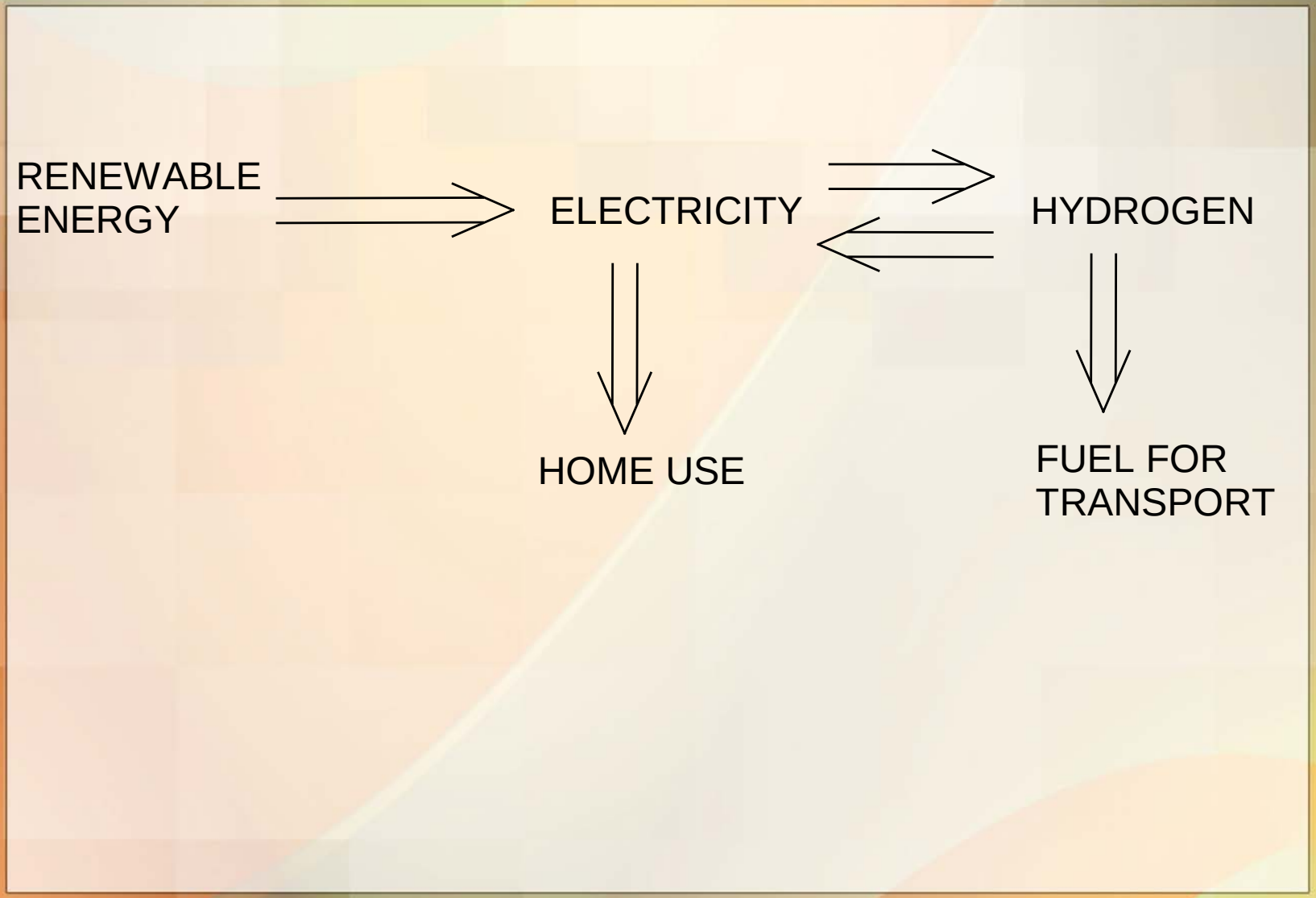
The Hydrogen Economy

Hydrogen filling station near Frankfurt, Germany. Picture in public domain.

The Hydrogen Economy

- **Based on hydrogen as the means of energy storage instead of oil.**
- **Requires an energy source to provide the hydrogen- initially natural gas, later solar & other renewables.**
- **Best if done in a decentralized way.**
- **Will Iceland provide a model?**

The Hydrogen Economy



Hydrogen

- **Flammable gas, hard to liquefy, but produces a lot of energy for a low weight.**
- **The only combustion product is water.**
- **It can be burned either like natural gas, or in a fuel cell to produce electricity directly.**
- **Can be made by passing electricity (may be renewable) through water, or from natural gas (non-renewable).**

Problems

- **Cost: Fuel cells are still very expensive.**
- **Hydrogen production: It has to be made.**
- **Storage: It is flammable, difficult to store.**
- **Distribution: No existing network, hard to transport in bulk.**

An aside: Are hydrogen cars dangerous?

In 2001, Dr. Michael Swain (University of Miami at Coral Gables) attempted to simulate two car fires, one created by a 1/16th inch puncture in a gasoline fuel line, the other by a leaking hydrogen connector.

Photo 1 - Time: 0 min, 0 sec – Hydrogen powered vehicle on the left. Gasoline powered vehicle on the right.

Photo 2 - Time 0 min, 3 seconds – Ignition of both fuels occur. Hydrogen flow rate 2100 SCFM. Gasoline flow rate 680 cc/min.

Are hydrogen cars dangerous?

Photo 3 - Time: 1 min, 0 sec – Hydrogen flow is subsiding, view of gasoline vehicle begins to enlarge.

Photo 4 - Time: 1 min, 30 sec – Hydrogen flow almost finished. After this, the gasoline powered vehicle burns violently

Story from http://evworld.com/view.cfm?section=article&storyid=482. However, other research suggests that hydrogen can still be dangerous in confined spaces, and the debate continues!

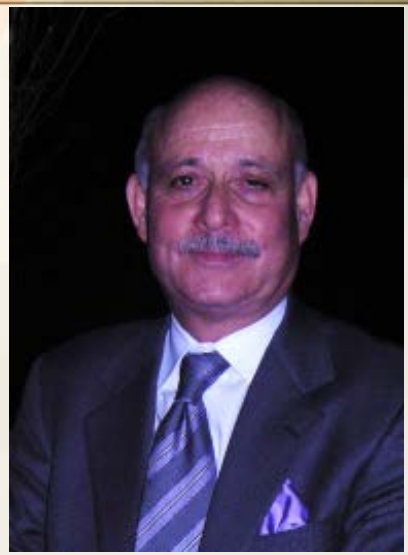
Fuel cell power

Fuel cells can use hydrogen to power a car, or to generate electricity for domestic or industrial use.

Dorf has excellent coverage on this topic in chapter 22.

The Hydrogen Energy Web (HEW)

- **In his book, "The Hydrogen Economy," Jeremy Rifkin describes his view for distributed energy production called the Hydrogen Energy Web. This is based on local renewable energy sources and hydrogen as the energy medium. Fuel cells would allow stored hydrogen to generate energy.**
- **See the video for unit 13.**



Jeremy Rifkin. Picture by Andreas Pahl on WM Commons, CC License.

VISIONS FOR SUSTAINABLE NATIONS

Iceland

- **Iceland plans to be the world's first country to move towards a hydrogen economy.**
- **Currently most electricity production is from renewable sources. These can be switched to manufacture "green" hydrogen.**
- **Buses in Iceland switching over to fuel cells, the fishing fleet is to follow.**
- **Greenhouse gas emissions per capita are currently very high, but set to fall by around 50%.**
- **Can Iceland become the first sustainable nation?**

Germany

- **Among the world's major nations, Germany is leading the way towards sustainability. See this article.**
  - **Renewable energy provides 12% of Germany's energy needs, as well as 250,000 jobs.**
  - **The "feed-in tariff" means anyone generating electricity from solar PV, wind or hydro is paid four times the market rate (currently about 70c/unit) for 20 years.**
  - **Solar energy production in Germany has created a market worth $13bn/yr, and production now exceeds 9.8 GW, almost half of the world's total.**

Ulm, a German city that is the solar energy "capital "of the world. Picture by Candidus, from WM Commons, GFDL.

Sweden

- **Sweden's approach has been to use a carbon tax since 1991. This translates to $1.50 per gallon at the gas pump.**
- **This has helped to make Sweden the world's #1 green nation.**
- **All Swedish cities use district heating, mainly with heat from biomass (using waste from the forestry and farming industries), or waste heat from power stations.**

This railroad station in Stockholm aims to capture body heat from commuters and use it to heat a nearby office block!

Picture by Jorges, WM Commons, GFDL.

VISIONS FOR SUSTAINABLE COMMUNITIES

Sustainable communities

- **In the 19th century, enlightened factory owners built "model villages" for their workers to live in pleasant communities.**
- **Today, some enlightened cities or groups are seeking to create places where people can live together sustainably.**

Portland, Oregon

- **Since 2000, the Portland Office of Sustainable Development has sought to "to provide leadership and contribute practical solutions to ensure a prosperous community where people and nature thrive, now and in the future.**
- **A government body, it works with local communities & businesses to promote sustainability initiatives. It has helped to make Portland one of the "greenest" cities in the US.**

Picture from Wikimedia Commons

Portland vs. Atlanta

Table 9–3. *Changes in Portland and Atlanta Regions from Mid-1980s to Mid-1990s*

Indicator	Portland, OR	Atlanta, GA
	(percent change)	
Population growth	+ 26	+ 32
Job growth	+ 43	+ 37
Income	+ 72	+ 60
Property tax	– 29	+ 22
Vehicle miles traveled	+ 2	+ 17
Single occupant vehicle	– 13	+ 15
Commute time	– 9	+ 1
Air pollution (ozone)	– 86	+ 5
Energy consumption	– 8	+ 11
Neighborhood quality	+ 19	– 11

Source: See endnote 20.

From Brown, “Eco-economy.”

Arcata, California

- **A progressive city, population 17,000, the first US city where the majority of councilors are from the Green Party.**
- **An old lumber town, it survived where other lumber towns failed, because it switched to recycling & reprocessing wood by-products & other materials.**
- **"We live resourcefully. Sustainability is a way of life. We reduce, reuse, and recycle, continually relearning and redefining as we better understand our local resource base. We are committed to living well, and within Arcata's resource base." (from council website)**

In 1979, it began to treat the city's wastewater using a manmade marsh and wildlife sanctuary (see picture) rather than a conventional treatment plant.

Picture from earthisland.org

Sherwood Energy Village, UK

- **A former coal mining site is being converted into a sustainable community.**
- **Now that the non-renewable energy source is exhausted, the village's new industry will be renewable energy.**
- **Housing units meet or exceed the top ratings for "eco-houses."**

Pictures from http://www.sev.org.uk/

VISIONS FOR SUSTAINABLE BUILDINGS

Sustainable Housing

- **Sustainable housing is promoted by nonprofit groups like Architecture for Humanity, as well as some businesses such as LivingHomes.**
- **In the US, the government promotes green housing through the LEED program, which rates green buildings. In the UK, there is the comparable Code for Sustainable Homes.**
- **Likewise for offices and factories.**

An energy-efficient house in Austria. Picture from Wikimedia Commons.

WHAT IS YOUR VISION?