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

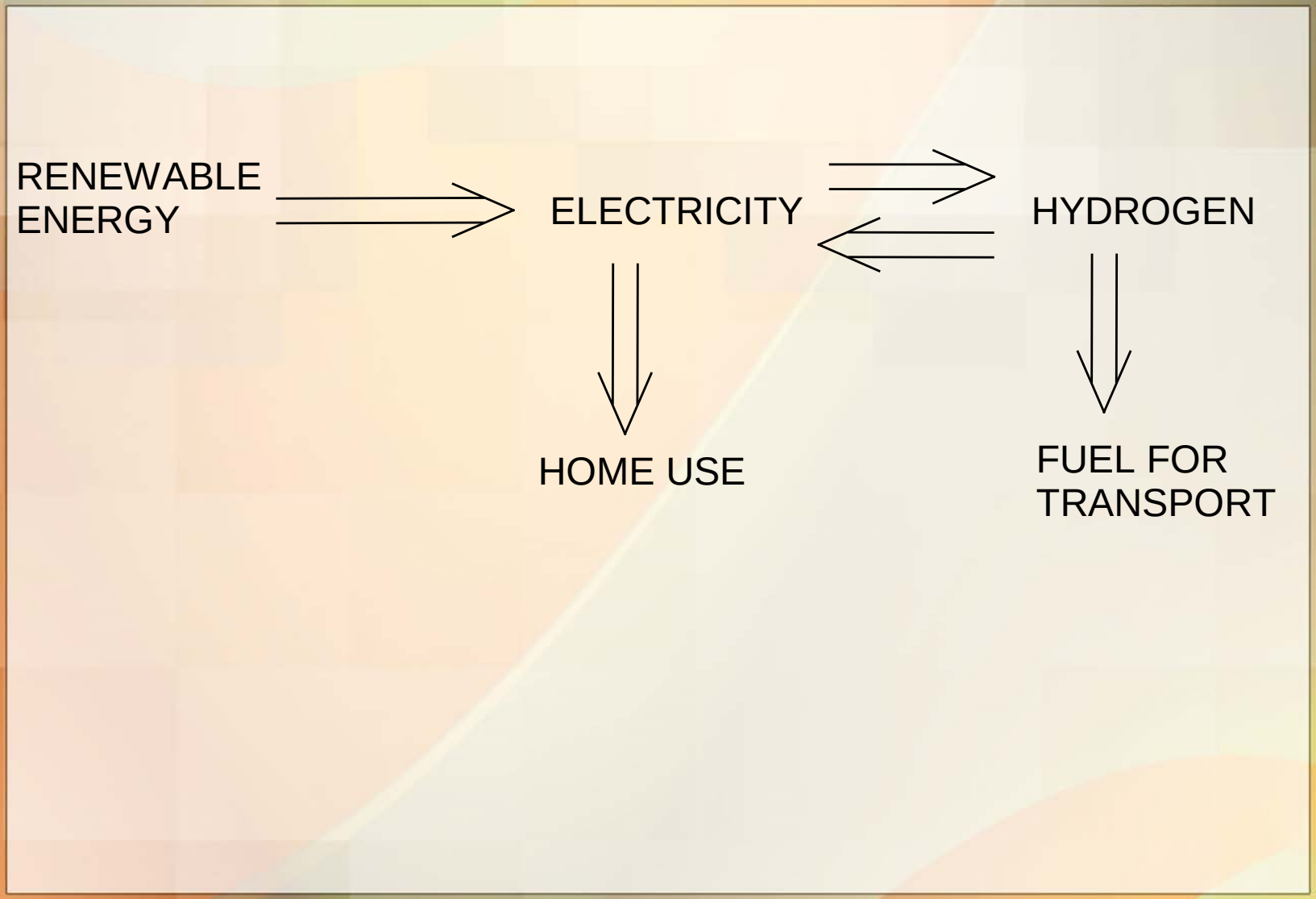
The Hydrogen Economy

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? It seems not!

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, though prices are falling as technology improves.
- 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.

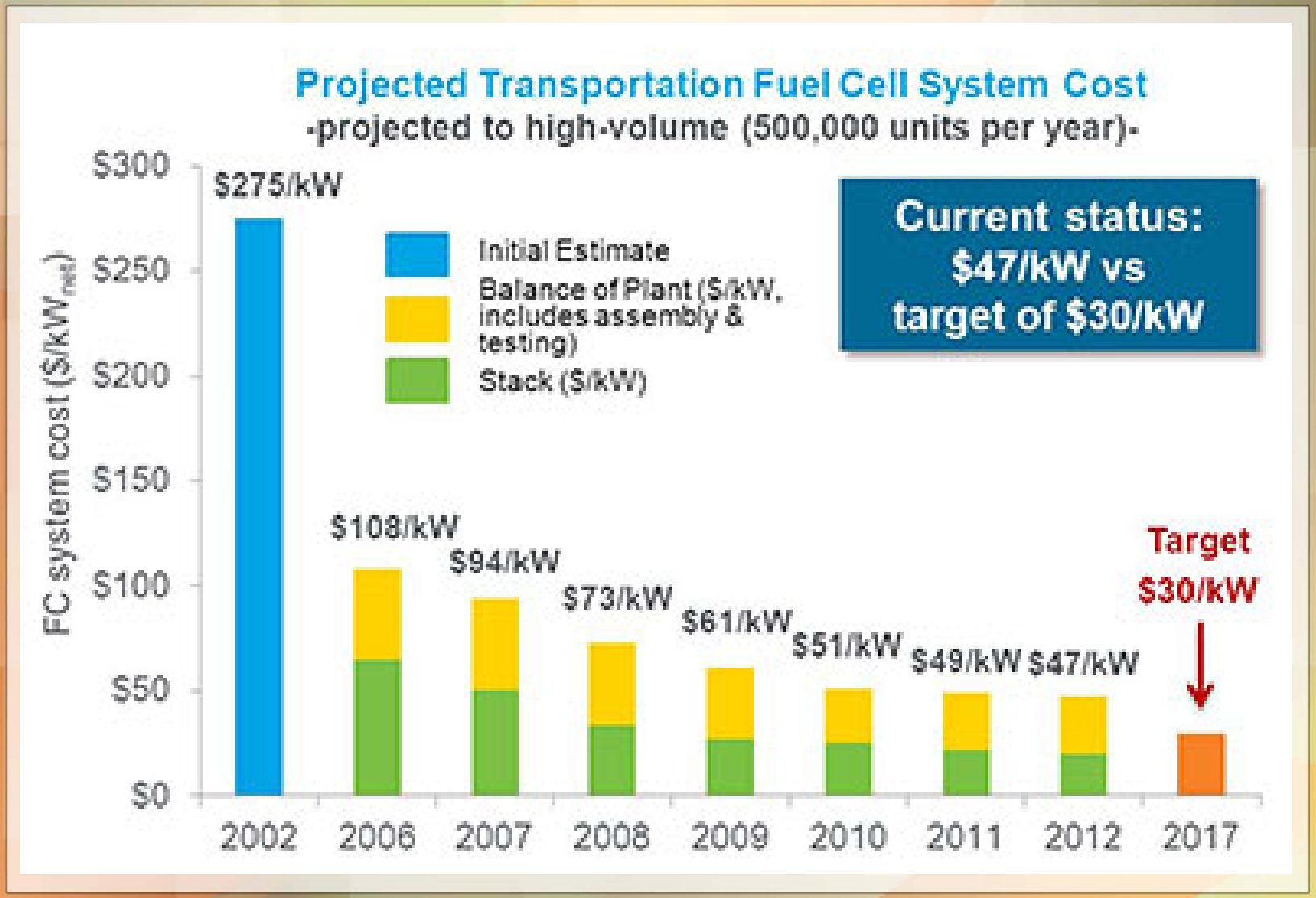
Are hydrogen cars dangerous?

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!

Prices are falling quickly



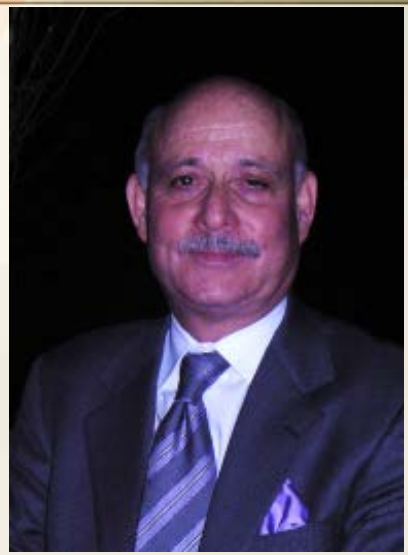
Graph taken from [US Dept of Energy website](), July 2013

Fuel cell power

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

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.



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

VISIONS FOR SUSTAINABLE NATIONS

Switzerland

- Switzerland often comes top of environmental league tables, such as Yale's Environmental Performance Index (EPI, 2012). It scores very well on general environmental health and biodiversity.
- Yale also ascribes this partly to strong controls on air pollution

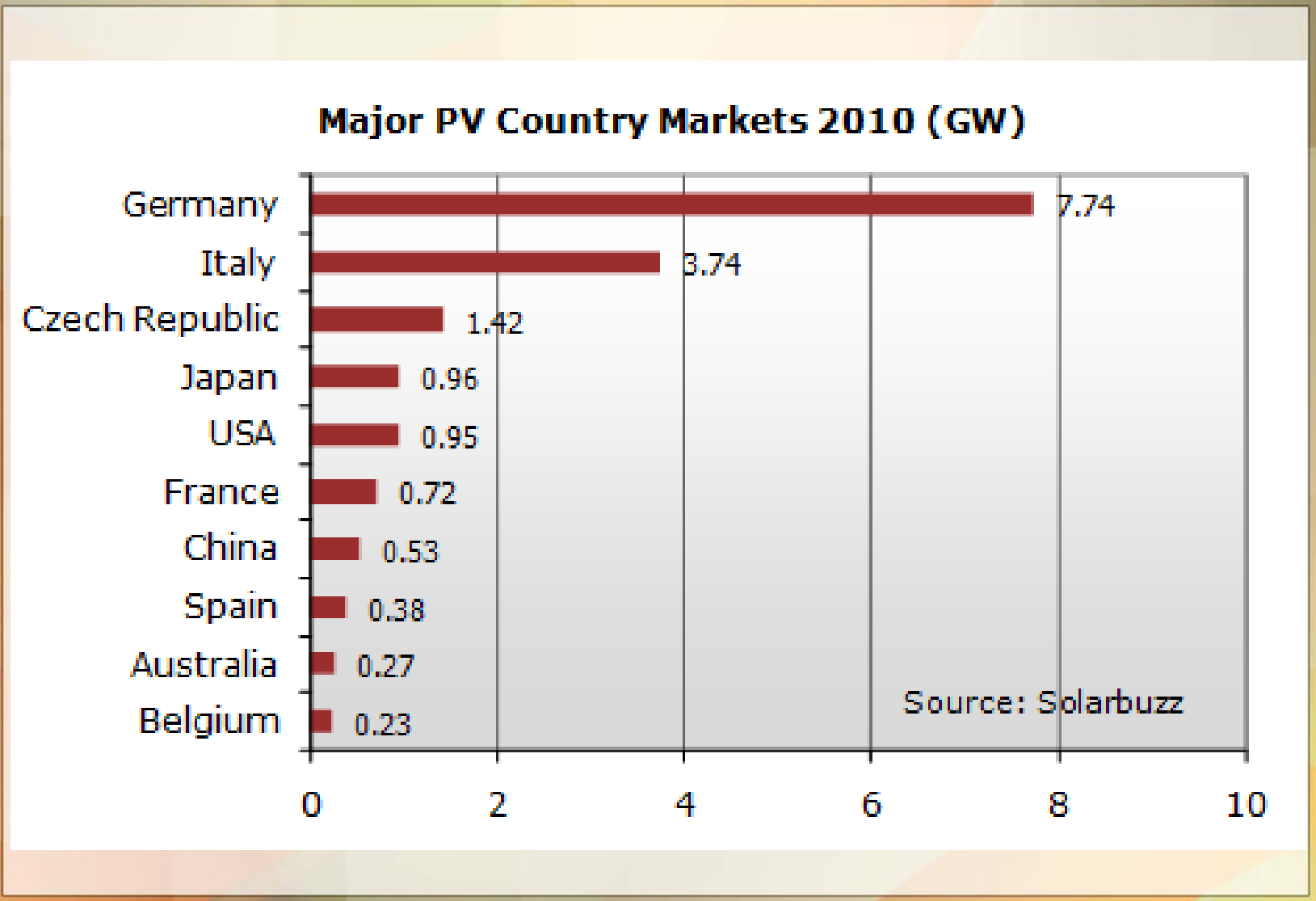
Diessenhofen, Switzerland. Picture by Hansueli Krapf CC license

Germany

- Among the world's major nations, Germany is leading the way towards sustainability. See this article.
  - Renewable energy provides 24% of Germany's electricity needs, as well as huge numbers of jobs.(US & UK are 12.5%)
  - 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 installed capacity now exceeds 28 GW, almost half of the world's total. In May 2012, 22 GW was recorded as being produced, a world record for any nation.

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

Germany leads the way in solar PV power



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 helped to make Sweden the world's #1 green nation in 2007.
- 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. Renewables supply 57% of electricity.

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.

Workers’ homes in “Port Sunlight”, an Edwardian model village near Liverpool Picture by Rich Daley CC license.

St Lawrence Co., New York

The "Local Living Venture" (formerly the Sustainable Living Project) aims to encourage:

"sharing and life-long learning for regional self-reliance, energy independence, environmentally friendly living, and a regionally-oriented community "

The group organizes:

- *An annual "Local Living Festival"*
- *Workshops teaching skills such as composting, beekeeping, organic farming*
- *Tours of solar houses, etc.*

Local Living Festival
Picture by the Watertown Daily Times

For example, they promote local agriculture

The Melbourne Principles

- In 2002, the UN Environment Program (UNEP) and the ICLEI - Local Governments for Sustainability developed ten principles for sustainable cities, called the "Melbourne Principles".

The Melbourne Principles (abridged)

1. A long-term vision for cities based on sustainability, equity and individuality.
2. Achieve long-term economic and social security.
3. Value biodiversity and natural ecosystems
4. Enable communities to minimize their ecological footprint.
5. Build on the characteristics of ecosystems in developing sustainable cities
6. Recognize and build on the distinctive characteristics of cities
7. Empower people and foster participation
8. Expand and enable cooperative networks to work towards a common, sustainable future
9. Promote sustainable production and consumption
10. Enable continual improvement, based on accountability, transparency and good governance.

Penrith, New South Wales

- A suburb of Sydney, Penrith, has tried to base its environmental plan on the Melbourne Principles. It publishes a "scorecard" showing its success (or lack thereof!)

Picture by saberwyn, CC license

Principle 4: Enable communities to minimise their ecological footprint

City Indicators

Indicator	State 2006-2007	State 2007-2008	State 2008-2009	State 2009-2010	State 2010-2011
PC10 Reduction in the size of the City's ecological footprint	O	O	O	N/R	N/R
PC11 Increased use of public transport	O	O	O	O	X
PC12 Water and energy consumption per person	O	O	>	O	✓
PC13 Percentage of domestic waste diverted from landfill	>	✓	>	✓	✓

Council Indicators

Indicator	State 2006-2007	State 2007-2008	State 2008-2009	State 2009-2010	State 2010-2011
EN1 Materials used by weight or volume	O	>	>	✓	✓
EN2 Percentage of materials used that are recycled input materials	O	>	>	✓	✓
EN3 Direct energy consumption by primary energy source	X	X	>	✓	✓
EN4 Indirect energy consumption by primary source	X	✓	>	N/R	N/R
EN8 Total water withdrawal by source	O	O	O	✓	✓
EN10 Percentage and total	O	O	✓	✓	X

Melbourne, Victoria, Australia

- Australia's second largest city (4 million people in the metro area)
- In 2007, it adopted the "Future Melbourne Strategy" which aimed to make Melbourne one of the top ten most livable and sustainable cities in the world by 2020.

Southern Cross Station, by Evan C, CC license

Collins St, Melbourne, Picture by Bidgee, CC license

Melbourne's goals for 2020:

There are five themes:

- To become a zero net greenhouse gas emissions city
- To be proactively adapting to climate change impacts
- To be a resource efficient city
- To increase urban density
- To treat the city as a water catchment area.

Picture by Donaldytong, Public Domain

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

Progress in Portland

Picture showing Mt. Hood by USGS, public domain

- Portland's carbon dioxide emissions per person (carbon intensity) are now (as of 2012) 26% below 1990 levels.
- Portland is now home to more than 130 green, LEED-certified buildings.
- 8% of commuters bike to work – the highest in the US, 10 times the national average.
- However, some initiatives come at a cost!

An example from Portland: Ecoroofs program

"*Ecoroofs replace conventional roofing with a living, breathing vegetated roof system.*"

Portland now has 355 ecoroofs, totalling 17.7 acres.

Louisa Apartments, Portland. Picture from portlandonline.com

Masdar City, United Arab Emirates

- Designed by world-renowned architect Norman Foster, Masdar City is being built from scratch as a “sustainable city” specializing in clean technologies.
- Building began in 2008, with Phase 1 due for completion in 2015.

Masdar City construction as of Jan 2012

Picture by Jan Seifert, CC licence

Masdar City

- Cars are mostly banned (other than a few electric cars) with most people traveling by public “podcars”
- The International Renewable Energy Agency is to have its headquarters in Masdar
- The city will also feature the Masdar Institute of Science & Technology

Picture by Jan Seifert, CC licence

Picture by Jan Seifert, CC licence

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

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.
- See the assigned videos for an example from Potsdam:
  - Exterior of the house
  - Interior of the house

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

WHAT IS YOUR VISION?