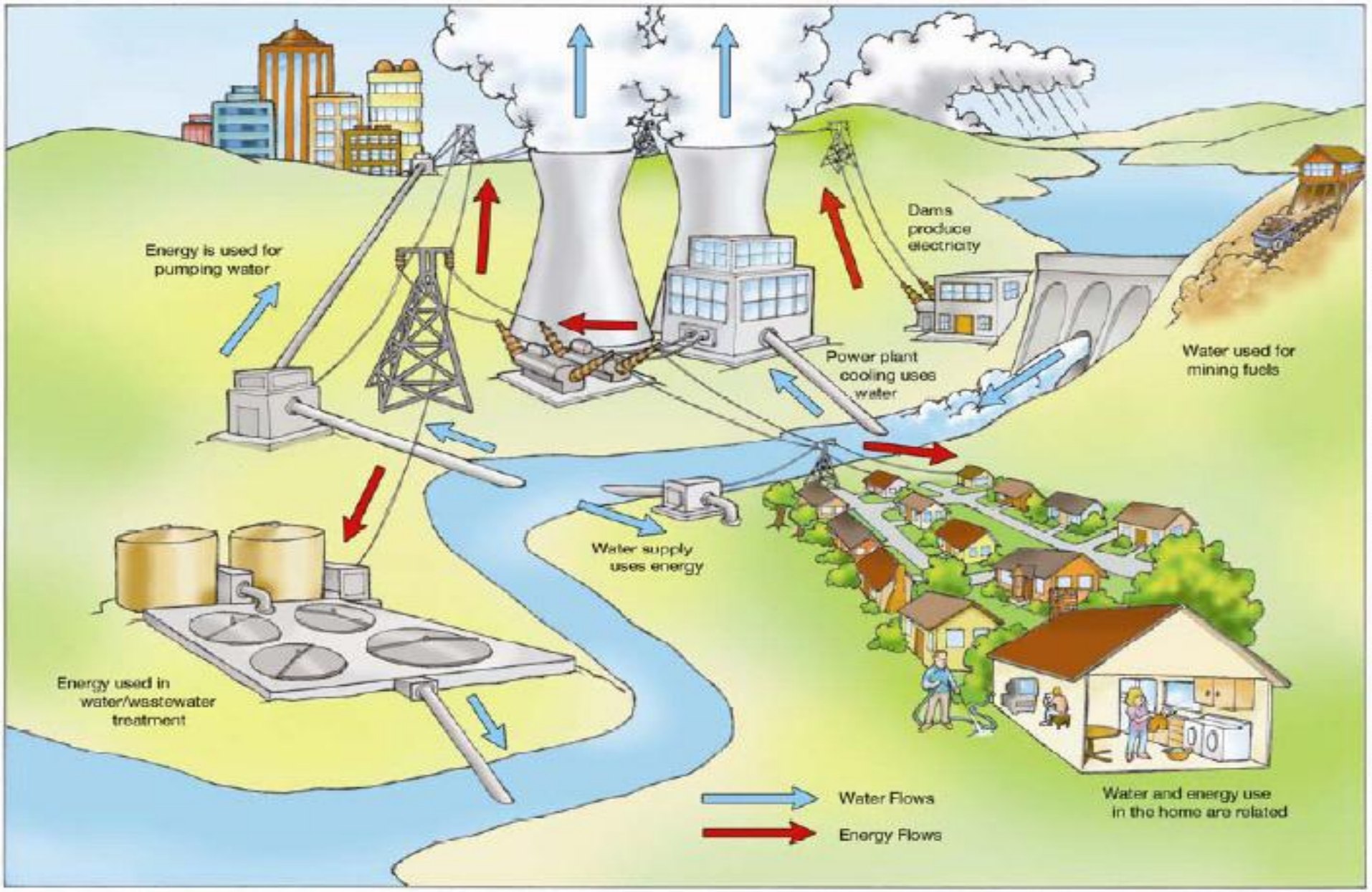
Water for Energy, Energy for Water

- an important aspect of the climate debate

Water and Climate Change in Southeastern Europe
Tirana, 25 June, 2008

Henrik Larsen

Water & Traditional Energy



Water Footprints

A ”water footprint” is the amount of water consumed to provide a good or service.

For energy: based on water consumed for:

- **Production/extraction of raw materials**
- **Refining raw fuels**
- **Producing energy at a power plant**

Water Footprints: some everyday examples

Product	Water consumed (liters)
1 glass beer	75*
1 cup coffee	140
1 glass milk	200
1 liter bio-ethanol	1200**
1 cotton T-shirt	2000
1 hamburger	2400
1 pair leather shoes	8000

** The good news: drink beer!*

*** A critical water – energy issue*

Water footprints for energy: Water consumed by energy type

Energy Type	Water consumed (m3/MWh)
Wind	~0
Nuclear	0.3
Gas	0.4
Coal	0.6
Oil/Petrol	4
Hydropower	80
Bio-fuel (1st gen.)	66-90

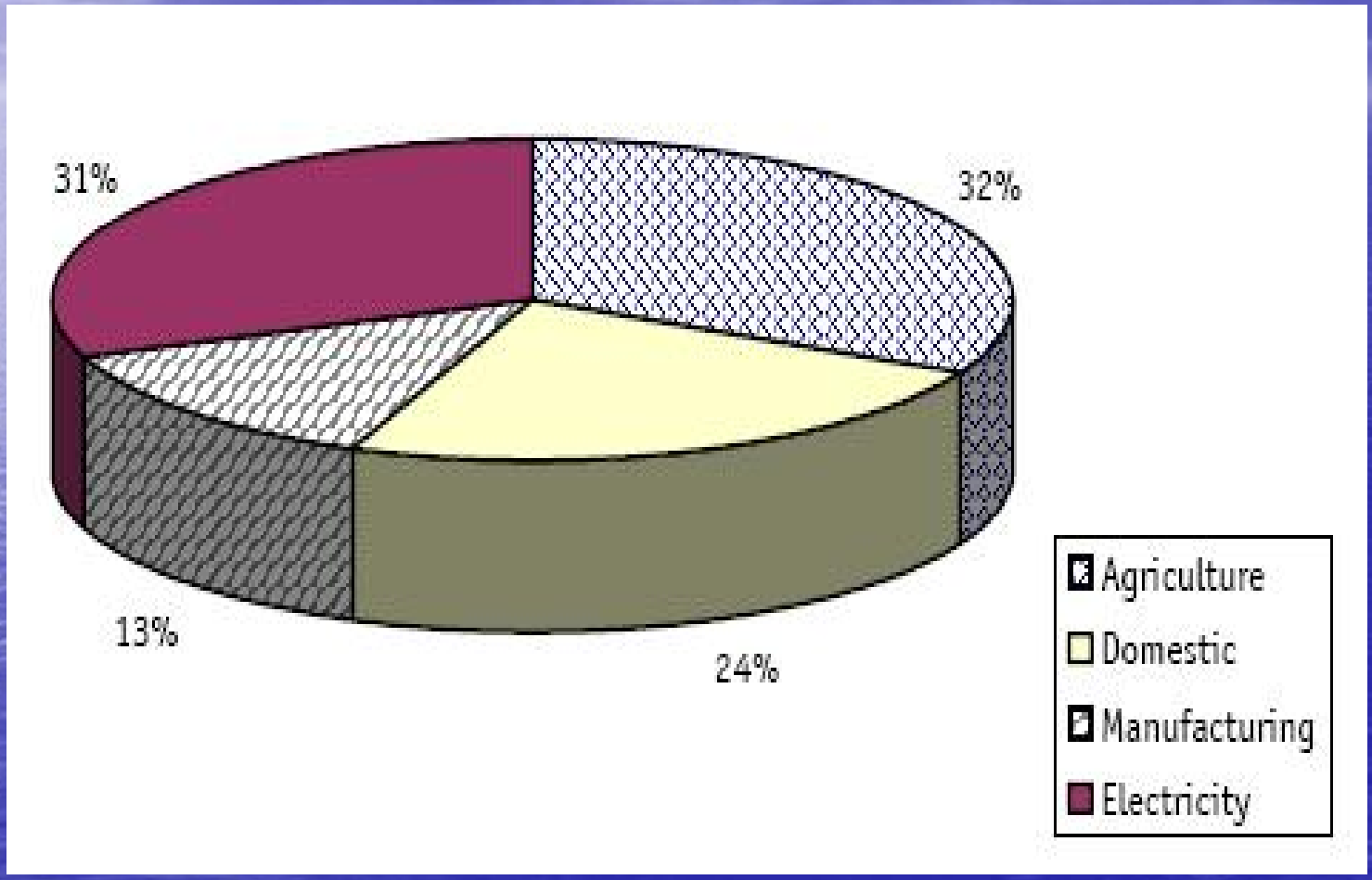
Source: UNESCO-IHE

U.S. Dept. of Energy Concerned About Climate Change

"Climate change and climate variability can have a dramatic impact on water supplies, with the most obvious impact being drought. But even high precipitation provides no guarantee of adequate water if the inflow from precipitation does not come at the right time."

From: U.S. Department of Energy (December 2006), Energy Demands on Water Resources: Report to Congress on the Interdependency of Energy & Water, p.31

Freshwater Withdrawals in EU-30 Countries



Source: Flörke, M. & Alcamo, J. (2004); European Outlook on Water Use, Center for Environmental Systems Research, University of Kassel p.4

EU-30 from 2000-2030: Thermoelectric energy production

- **Thermal energy production up 54%***
- **Freshwater withdrawals down 65%***
- **Freshwater consumption up 130%**

*Source: Flörke, M. & Alcamo, J. (2004); European Outlook on Water Use, Center for Environmental Systems Research, University of Kassel

**Source: Lloyd, G & Larsen, H (2007); Report for Vestas: A Water For Energy Crisis?

Examples:
Energy problems of 2005-6

- Spain: Dams for hydroelectric production and irrigation were at about 40 per cent of their capacity due to lack of water inflow. Hydroelectric power generation fell to its lowest in 48 years during the drought of 2005.

- France, Spain, and Germany were forced to take some nuclear plants offline and reduce operations at others.

Examples:
Energy problems of 2005-6

- Across Western Europe, nuclear plants also had to secure exemptions from regulations in order to discharge overheated water into the environment.

The role of climate change in EU-30?

- Temperature increases above global average
- Northern Europe becoming wetter
- More frequent droughts in Southern and Central Europe
- From yesterday - Albania:
  -20% runoff
  -60% hydropower generation!!

Source: IPCC (2007) Work Group 1

Water for Energy:

Some findings and possible recommendations

Some key findings

- Traditional forms of energy production are heavily reliant on water availability
- Water consumption for energy production will increase 130% in the EU-30 (2000-30)
- Climate change introduces complications for water and energy management
- With 20% wind energy the EU-30 could save enough water for some 20 million people per day, respectively

Some key findings

- Need to reduce reliance of energy production on water supply
- Water footprints can be used to support decision-making
- Wind energy is one of the least water-sensitive forms of energy production

Some possible recommendations

- Need to factor increasing water demands - and the complications of climate change - into energy source choices.
- Introduce more forms of energy production that have limited needs for water supply (and are non-polluting).
- Given the long term horizon for energy-infrastructure planning and investment, it is important to begin to consider alternatives sooner rather than later.

Energy for Water

- the other side of the coin

Energy and Water Development

Water for energy

Energy and power production requires water:

- Ø *Thermoelectric cooling*
- Ø *Hydropower*
- Ø *Minerals extraction and mining*
- Ø *Fuel production (fossil, non-fossil and bio-fuels)*
- Ø *Emission controls*

Energy for water

Water production, processing, distribution, and end-use requires energy:

- Ø *Pumping*
- Ø *Transport*
- Ø *Treatment*
- Ø *Raw water (GW,SW)*
- Ø *Desalination*

Water footprints **for energy development**

Energy footprints **for water development**

Energy footprints from water

Examples:

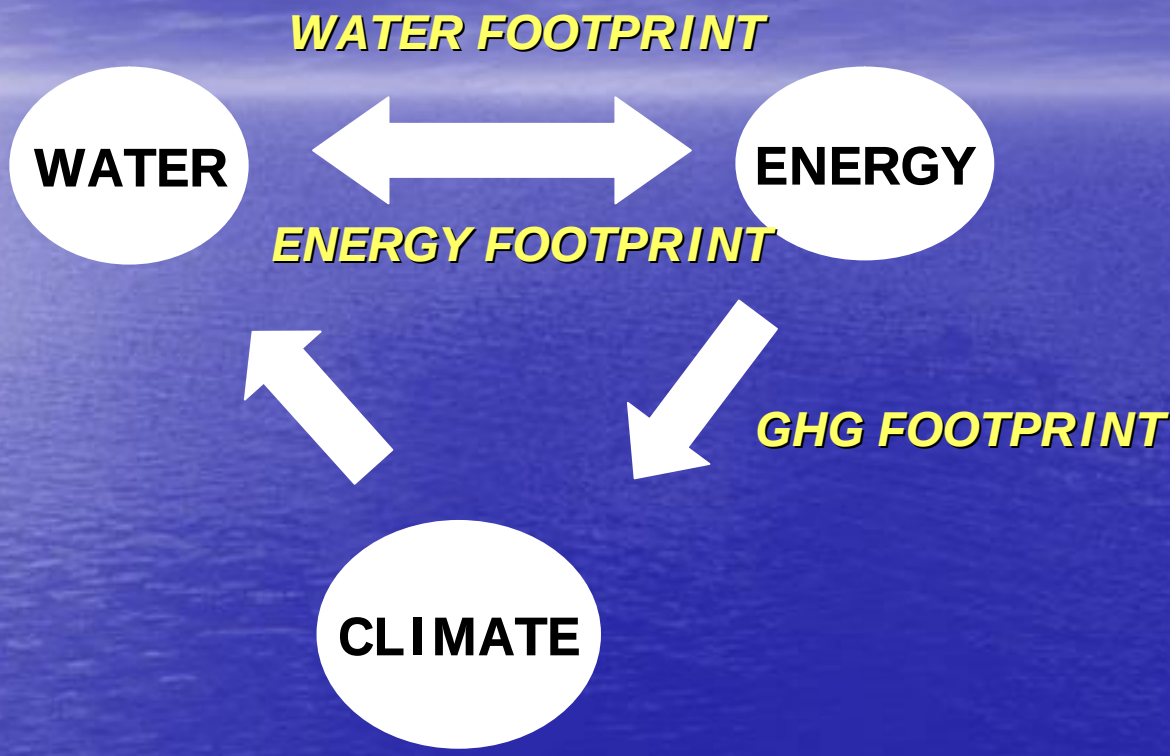
- ***Desalination of seawater for water supply***
- ***Large scale pumping for irrigation***
- ***Large scale pumping for inter-basin transfers***

Only anecdotal figures as of yet

Water for Energy,
Energy for Water

Link to climate change

Water => energy => GHG footprints



- an inter-related system!

Developing a “water, energy and climate initiative”

Examples of outcome:

The US example:
Recommendations to a 2006 Congressional Hearing

Overall recommendations

- *Decision makers should better integrate energy issues into water policy*
- *Water conservation and efficiency should be given a higher priority by both water and energy planners*
- *The greenhouse gas implications of both water and energy policy may be significant, with opportunities for fast, cost-effective reductions*

Federal recommendations

- *Perform energy intensity studies of water systems*
- *Manufacturers should report energy information on heating, recirculation, pressurization, and other Functions separately*
- *Environmental assessments for water supply should address energy and associated air quality effects*
- *Implement water conservation planning*
- *Phase out irrigation, energy and crop subsidies that lead to waste of water and energy*
- *Pursue smart labeling of water efficient appliances that also save energy*
- *Examine the climate implications of federal water policies*

Country studies – water footprints

- Review of national policies and plans for energy production and for water management
- Definition of scope for water footprints
- Field studies
- Calculation of water footprints for different types and technologies for energy production

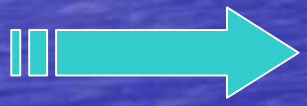
Country studies – water footprints 2

- Assessment and ranking of technologies; comparison with international figures
- Outlook for water demands from future energy production scenarios
- Preparation of national policy recommendations
- National workshop to discuss findings and recommendations

=> Policy recommendations

Major challenges and actions?

- Awareness of the issue?
- Knowledge / data about footprint figures?
- Financial resources?
- …?



Actions?