2nd World Council on Renewable Energy, Bonn

The growing potential of bioenergy for future decades.

"Back to the Future"

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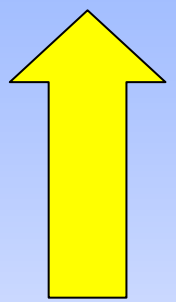
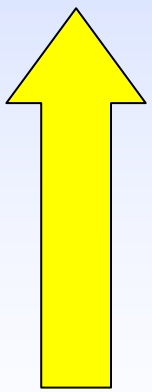
My aim today is to stimulate some visionary thinking…….

- What *global energy supply changes* are likely to occur within the next few decades when the world moves closer towards more secure energy supplies, equity and sustainable development?
- How will Bioenergy systems be able to contribute to these changes?
- Can the global Biomass industry contribute to other future trends including production of biomaterials?

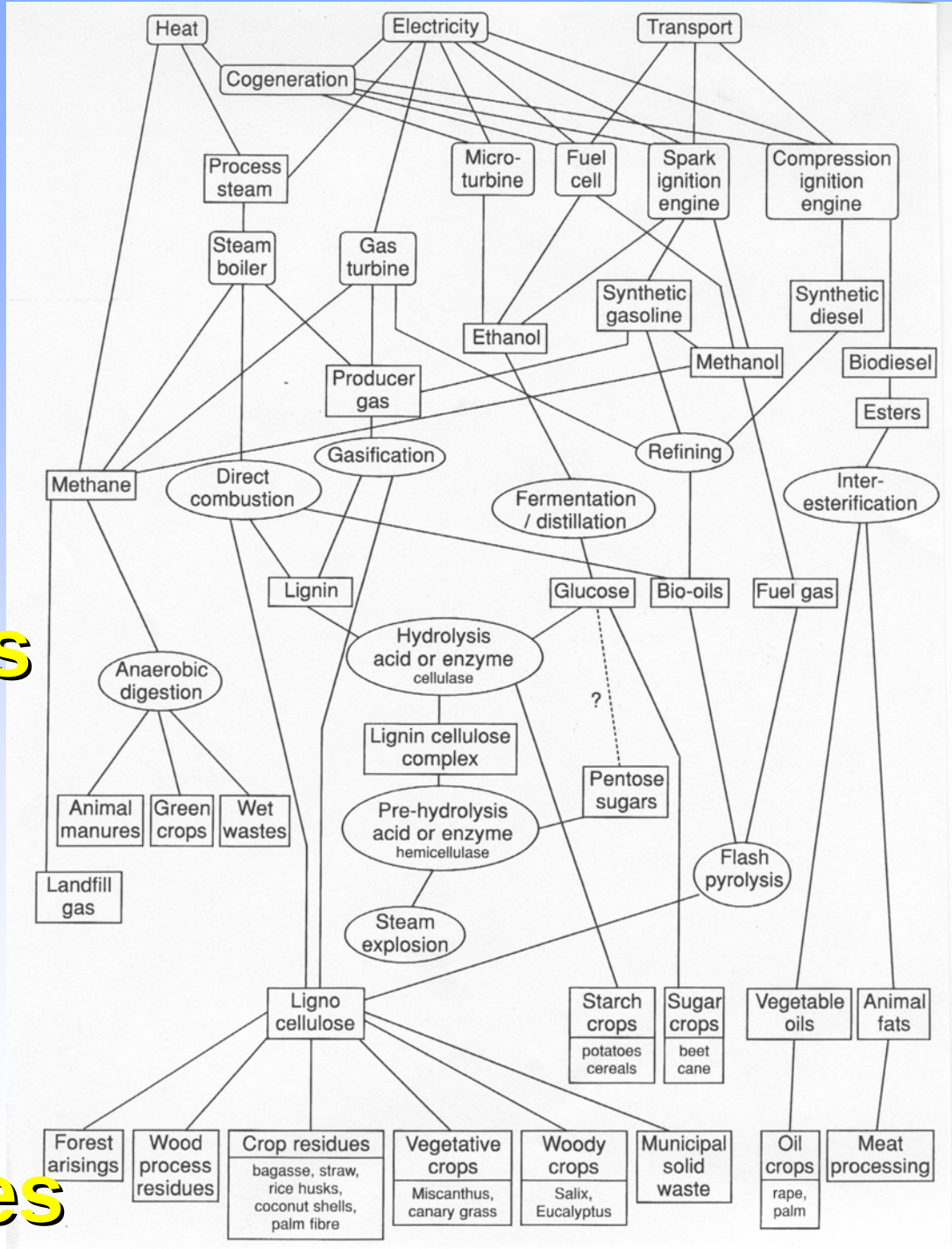
Bioenergy, Biomaterials and Biochemicals



Conversion routes



Biomass resources



What will be the future drivers and opportunities for Bioenergy?

- Growing demand for a more sustainable future.
- Reduction of greenhouse gas emissions.
- Waste minimisation and disposal cost avoidance.
- Increased awareness by energy consumers of the value of a cleaner environment.
- Business opportunities arising from carbon trading.
- Energy market liberalisation leading to local solutions for energy supply and demand.
- Increased security and quality of electricity supply, particularly in rural areas.
- Multi-product bio-refineries and biomaterials.

What will be the future drivers and opportunities for Bioenergy?

- Diversification of land use to provide additional farm revenue.
- Improved social values including health benefits.
- Increased local employment, reduced urban drift, and introduction of new skills through training and education.
- Co-benefits arising from related tourism and recreational activities.
- Providing local communities with a sense of pride, community, independence, and ownership.
- Delivering energy services to those without them.

For many developing countries modern bioenergy solutions must be the future.

But before we look to the future we should first look back…….

What forms of bioenergy and technologies are in common use worldwide today, but did not exist commercially 30 years ago?

- Bioethanol and biodiesel
- Fluidised bed combustors
- Community biogas plants
- MSW – to – energy plants
- Combined heat and power plants
- Landfill gas plants
- Mobile chippers
- Pellet burners
- Policy mechanisms

Also IEA Bioenergy

The “Biomass and Bioenergy” journal

Before we look to the future we should first look to the present…

What topics were discussed at Biomass international conferences in 1980 but are not yet widely deployed and are still being discussed 25 years later?

- Mapping of biomass resource
- Ethanol from ligno-cellulose
- Short rotation forests
- Fermentation from micro-algae
- Genetic engineering of yeast
- Hydrogen production from biomass
- Wood gasification
- Flash pyrolysis
- Charcoal in Africa
- Fischer Tropsch

etc.

So now let us look forward to the next 30 years or more……..

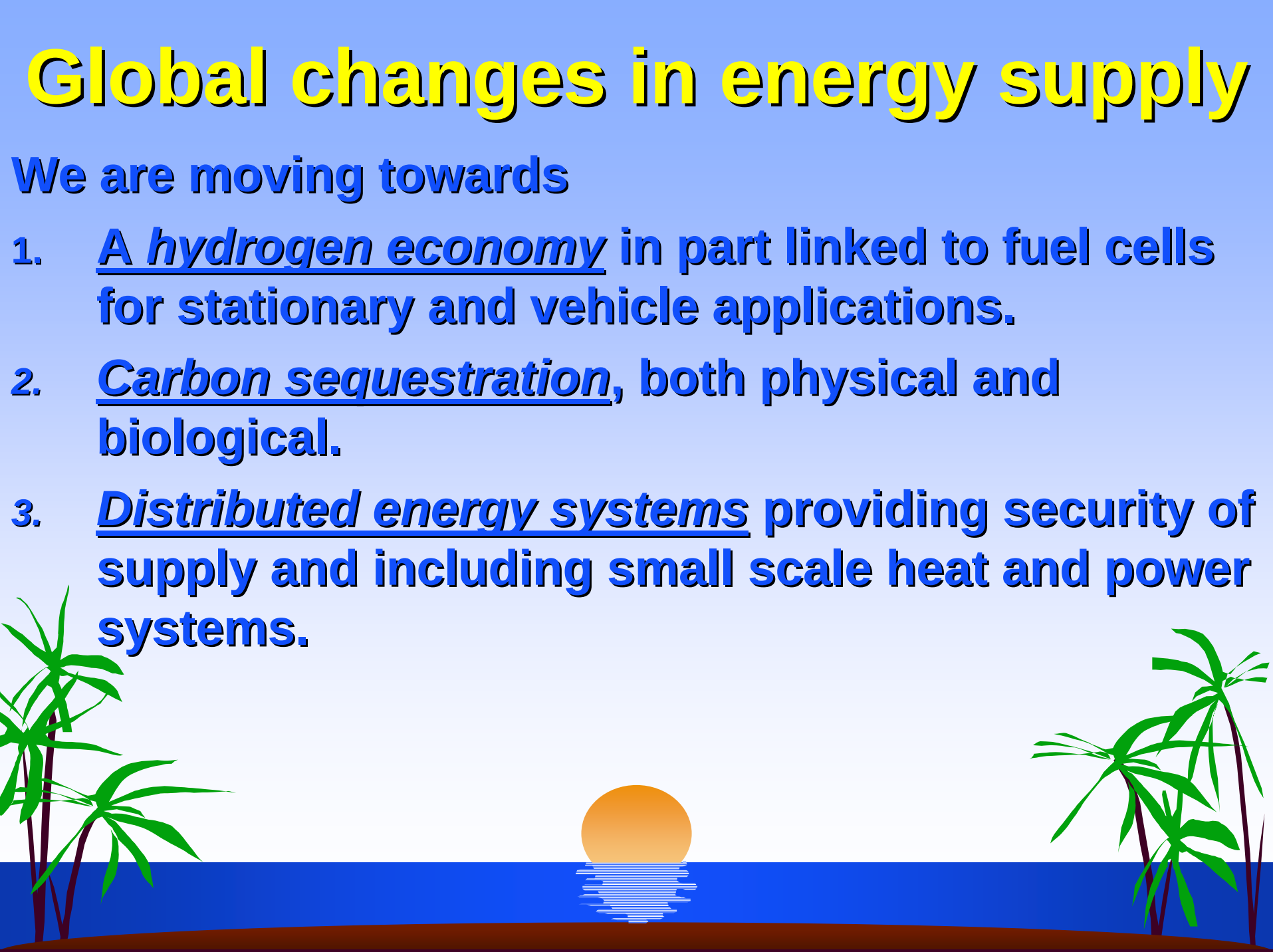
What forms of biomass and bioenergy technologies will be widely deployed globally after 2030, but only exist today as research or demonstration projects?

(How we get there is not covered today but see the Canadian "Road Map" and Holland's "Biomass Transition" for some good concepts).

Global changes in energy supply

We are moving towards

1. **A *hydrogen economy* in part linked to fuel cells for stationary and vehicle applications.**
2. ***Carbon sequestration*, both physical and biological.**
3. ***Distributed energy systems* providing security of supply and including small scale heat and power systems.**



Global changes in energy supply

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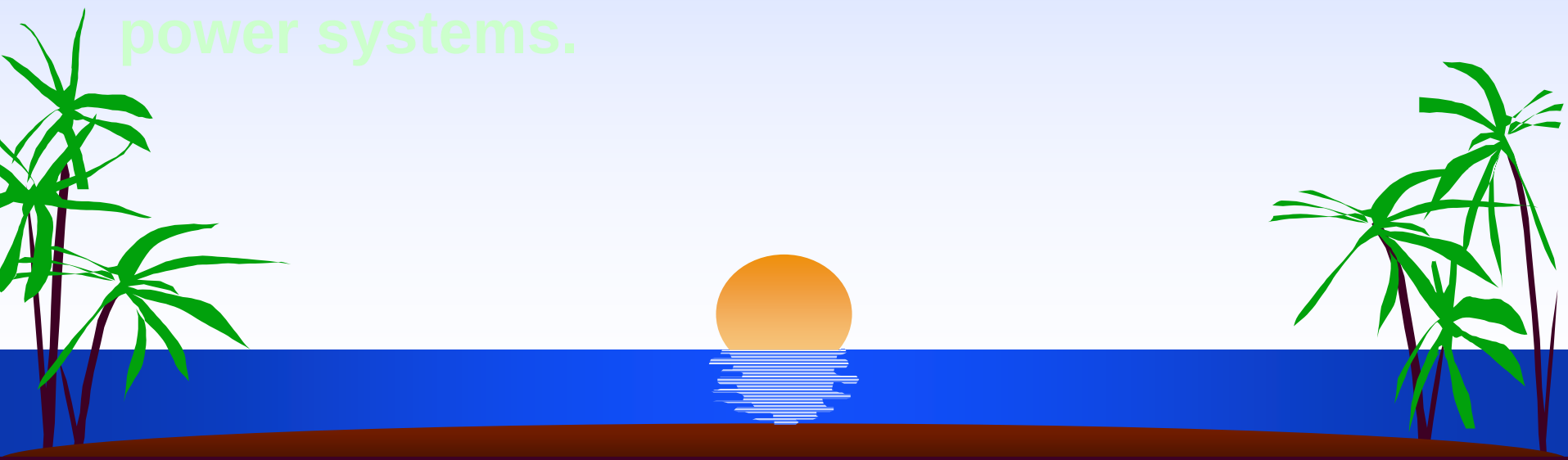

Where will the hydrogen come from?

Various systems include:

- Electrolysis – but is perhaps little sense in generating electricity then using it to produce hydrogen, which is another energy carrier.
- Photo-biological production through micro algae.
- Thermal processing of biomass e.g via gasification or supercritical water.
- Biomethane and biomethanol reforming.
- Natural gas.
- Coal gasification - preferably linked with carbon sequestration.

Global changes in energy supply

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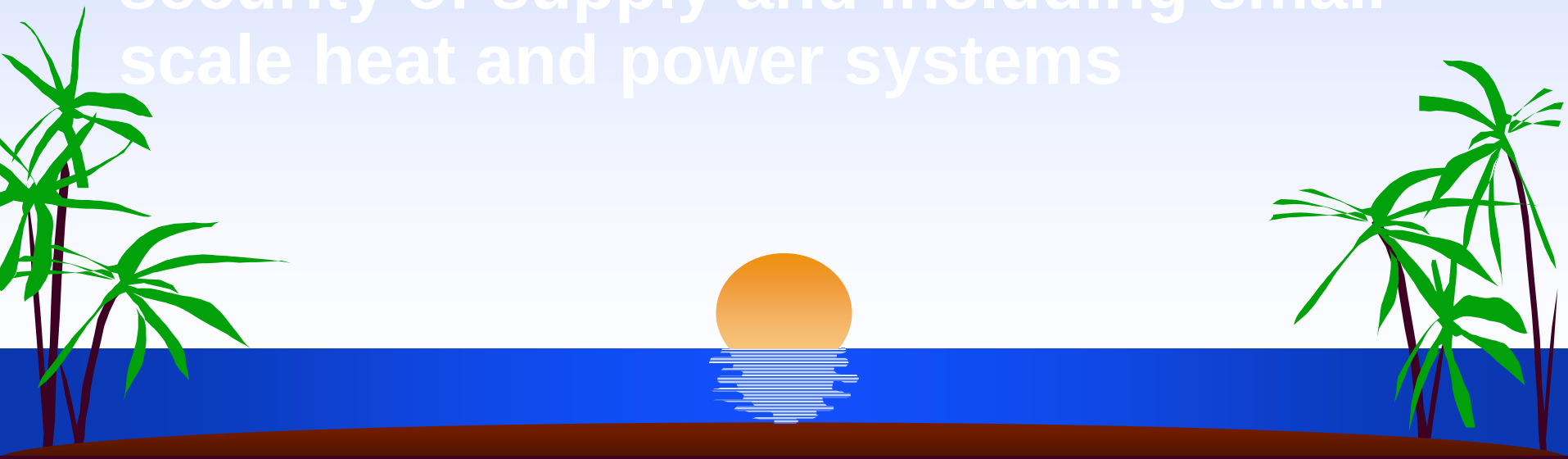
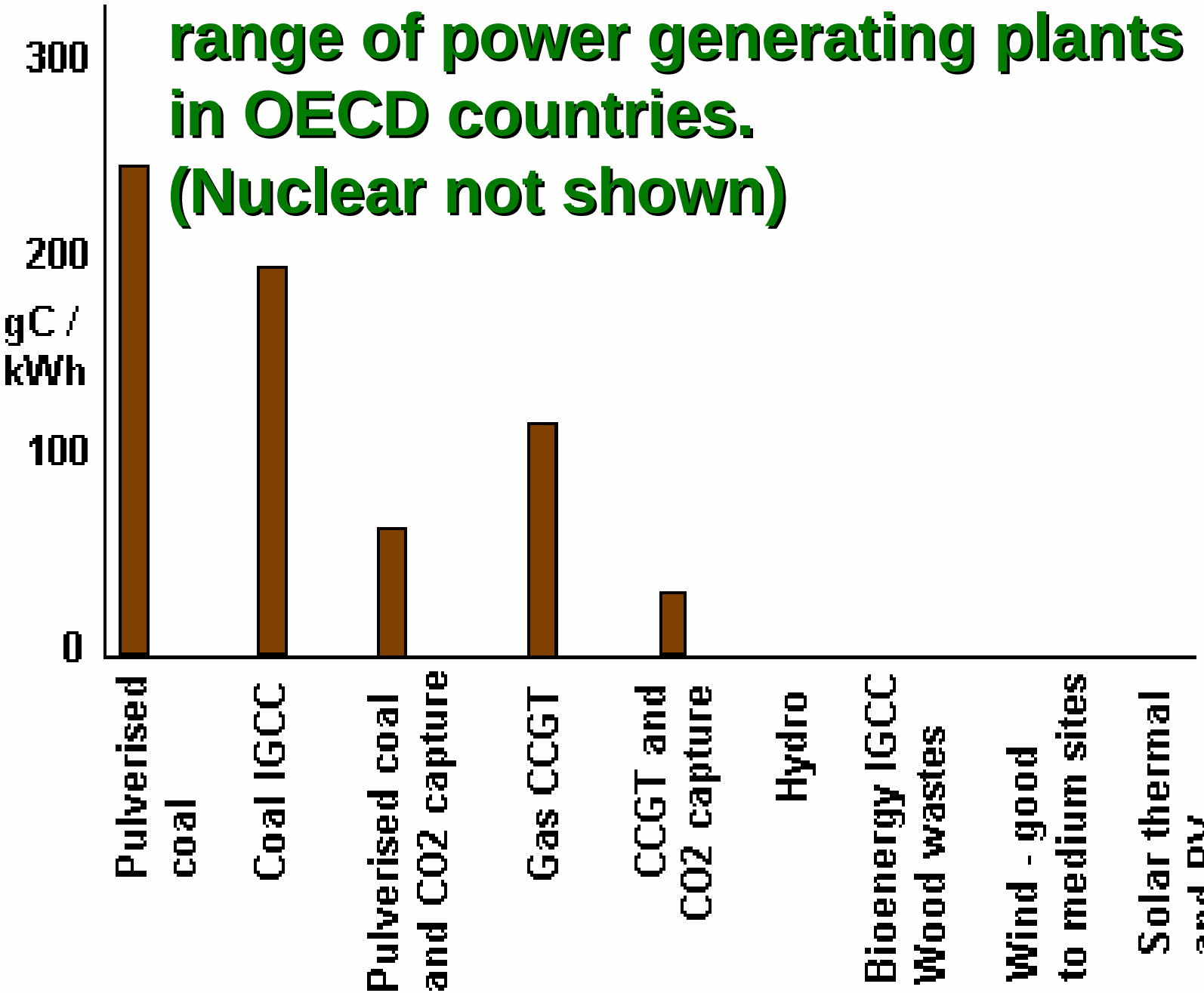


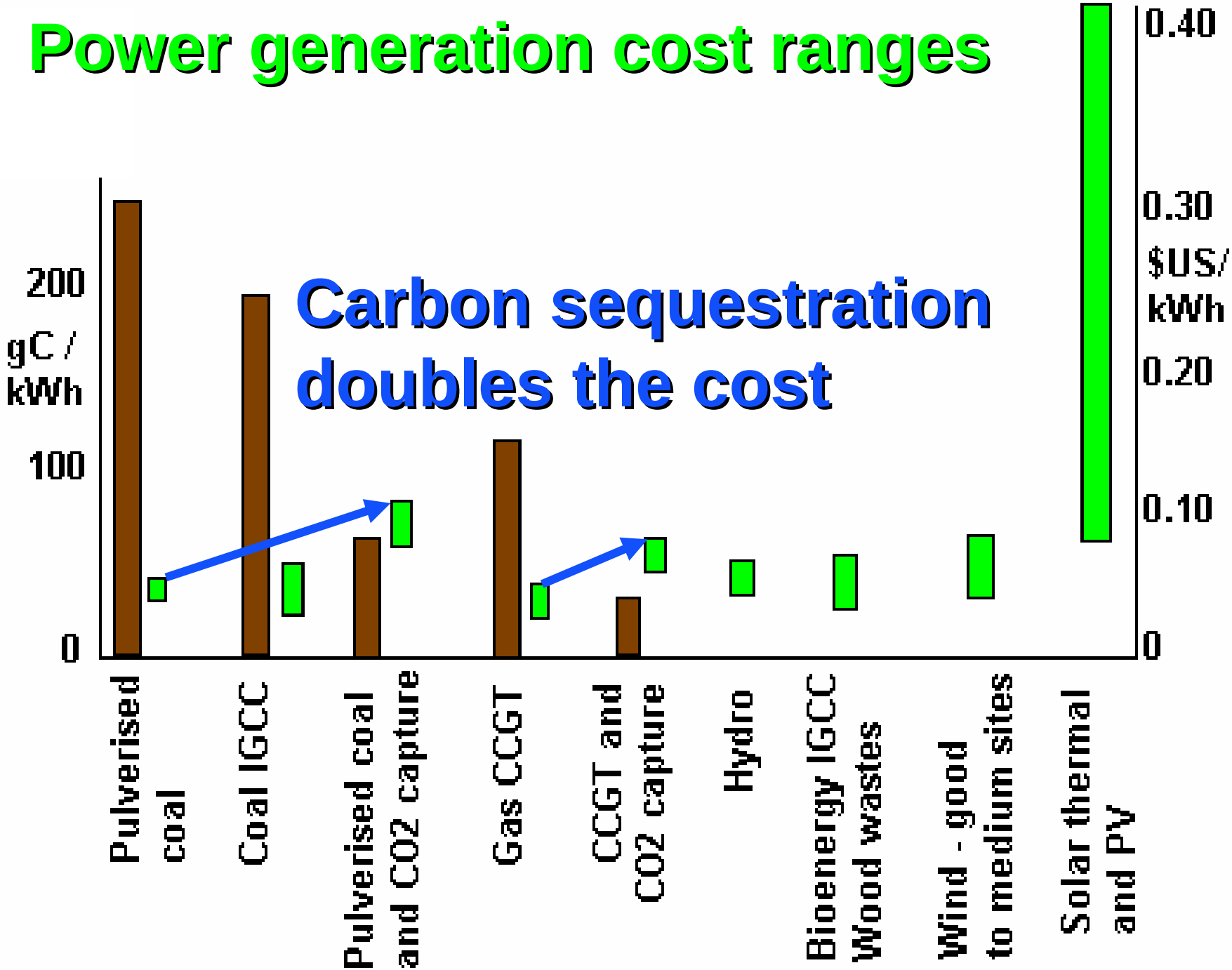
IPCC 2001 compared GHG emissions from a range of electricity generation plants

- New global electricity plant construction options were compared including nuclear and renewables.
- Base cases used for the comparison included pulverised coal combustion plants.
- Developed countries were treated separately from developing countries.
- Only one small example of the full analysis is given today.
- Details and all assumptions made are in the IPCC "Third Assessment Report – Mitigation" www.ipcc.ch

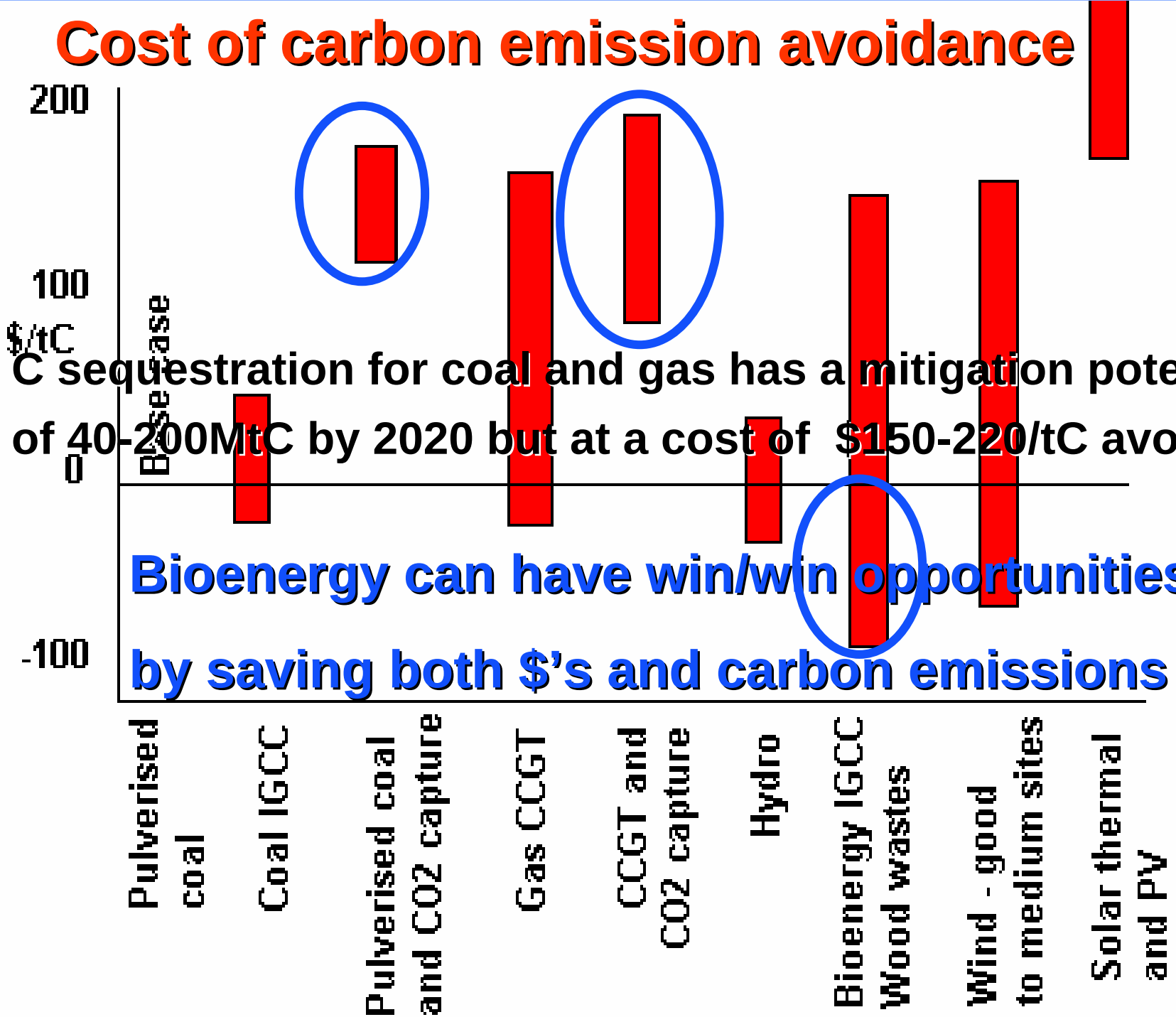
Carbon emissions from a sample range of power generating plants in OECD countries. (Nuclear not shown)



Power generation cost ranges



Cost of carbon emission avoidance

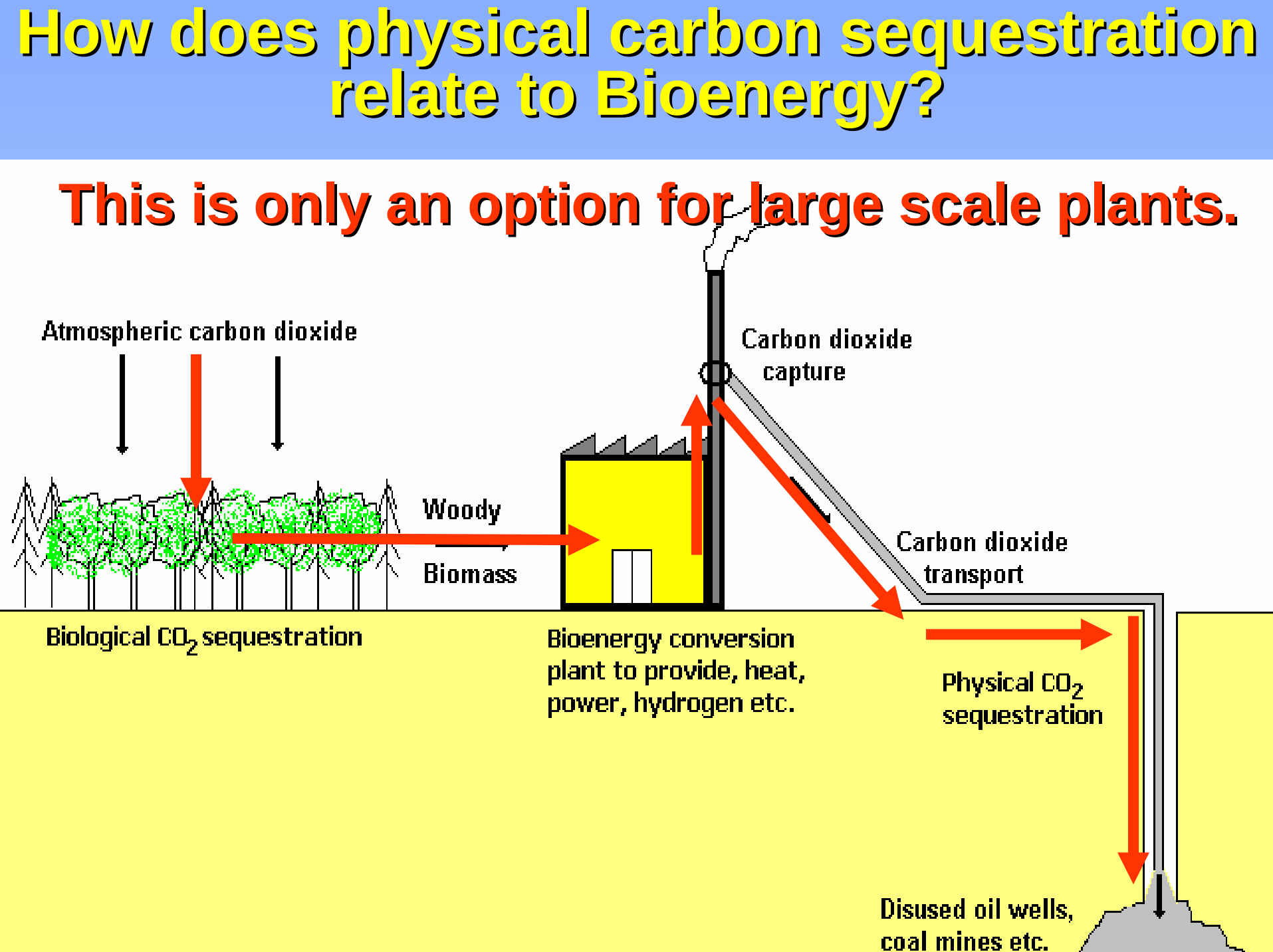


C sequestration for coal and gas has a mitigation potential of 40-200MtC by 2020 but at a cost of $150-220/tC avoided.

Bioenergy can have win/win opportunities by saving both $'s and carbon emissions

How does physical carbon sequestration relate to Bioenergy?

This is only an option for large scale plants.



Biological sequestration

Carbon dioxide

Kyoto forests - planted into pasture after 1990

60Mt CO_2 forest sink credits in 2008 - 2012

Carbon credits

New Zealand Government

Promissory notes

X tonnes of CO_2 equivalent avoided

Revenue $??/t CO_2

Revenue $??/t CO_2

Sale of carbon credits on the international market

Global changes in energy supply

1. Moving towards a hydrogen economy linked to fuel cells for stationary and vehicle applications.

2. Carbon sequestration, both physical and biological.

3. ***Distributed energy systems*** providing security of supply and including small scale heat and power systems

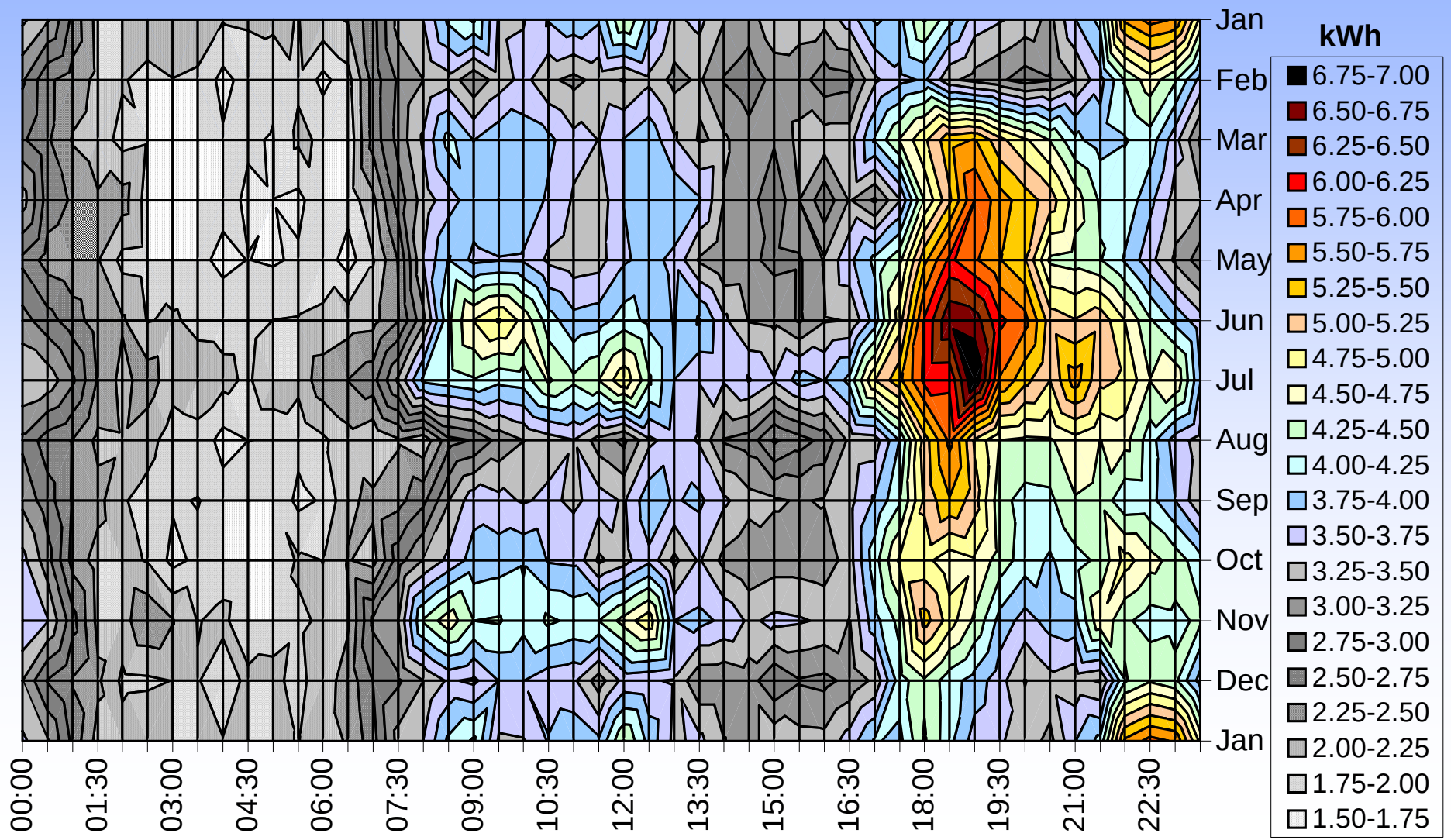

POWERGEN
WHISPER GEN
WhisperGen
Micro Combined Heat and Power
(Micro CHP)
Clean: designed for use inside the home
Service life: comparable to standard boilers
Quiet operation: similar noise levels to other household appliances
Unique: differentiated offering for developers
Standard connections: gas, water and electricity
Compliance: helps facilitate compliance with new energy efficiency regulations.

Distributed energy demonstration in a small New Zealand rural community

- Three farms with 5 houses and several farm buildings.
- Good wind resource, 2000 hours per year of sunshine, and a good stream for micro-hydro running all year round.
- Several forest plantations.
- Strong interest by the community in developing renewable resources.

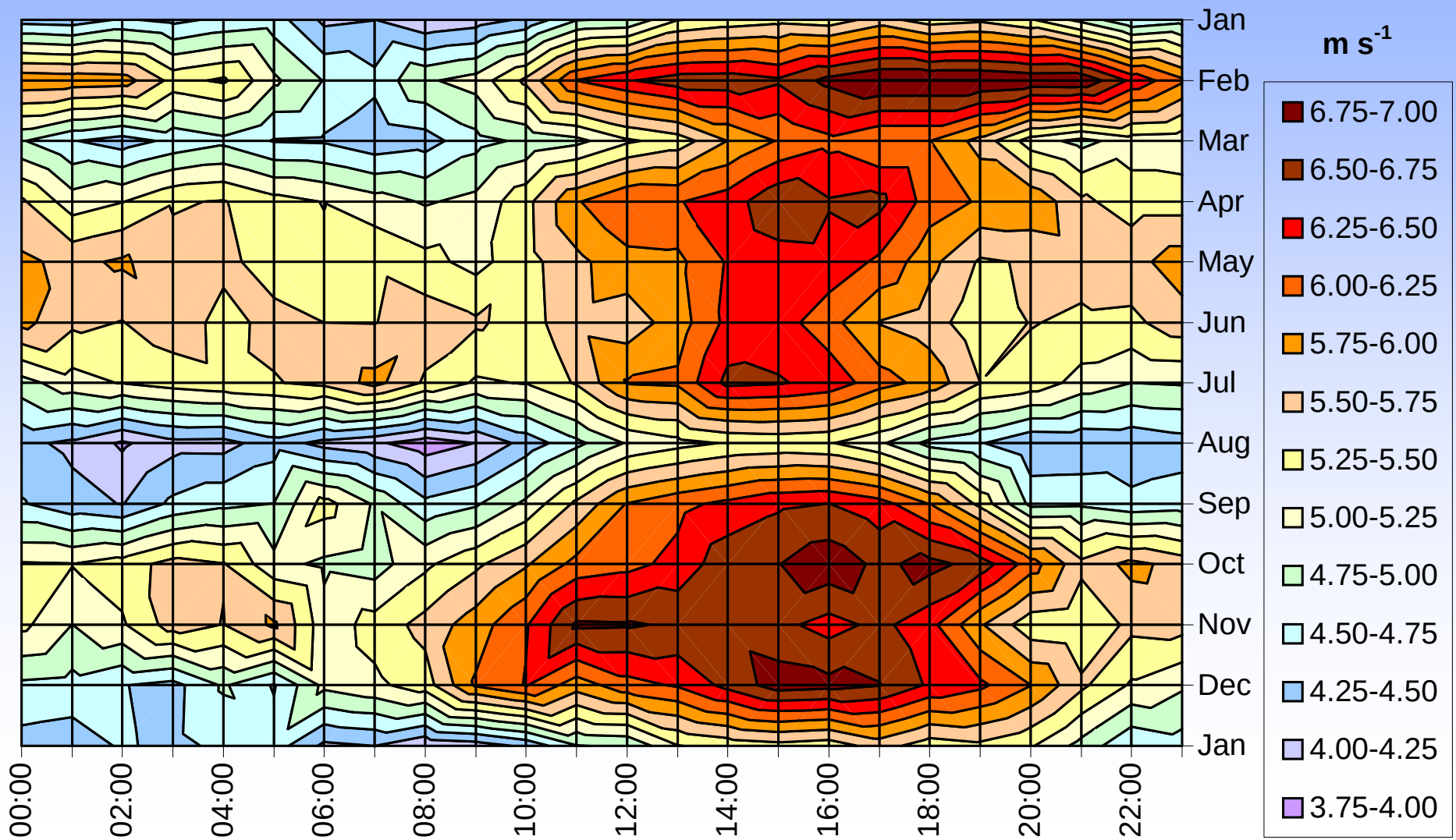
Electricity demand profiles – whole community

- Typical peak in the evening
- Mid afternoon and night troughs

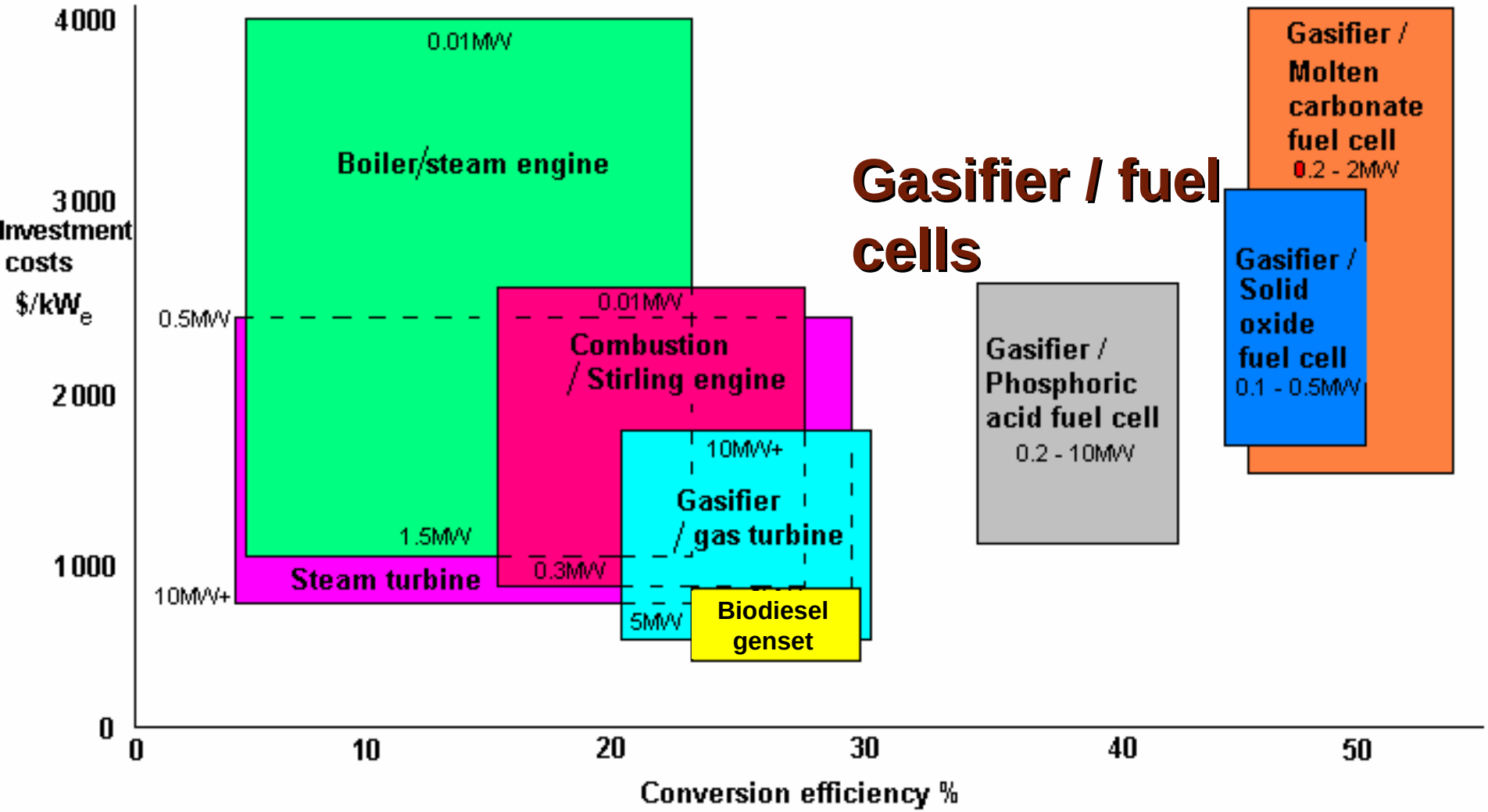


Renewable energy resources e.g. wind

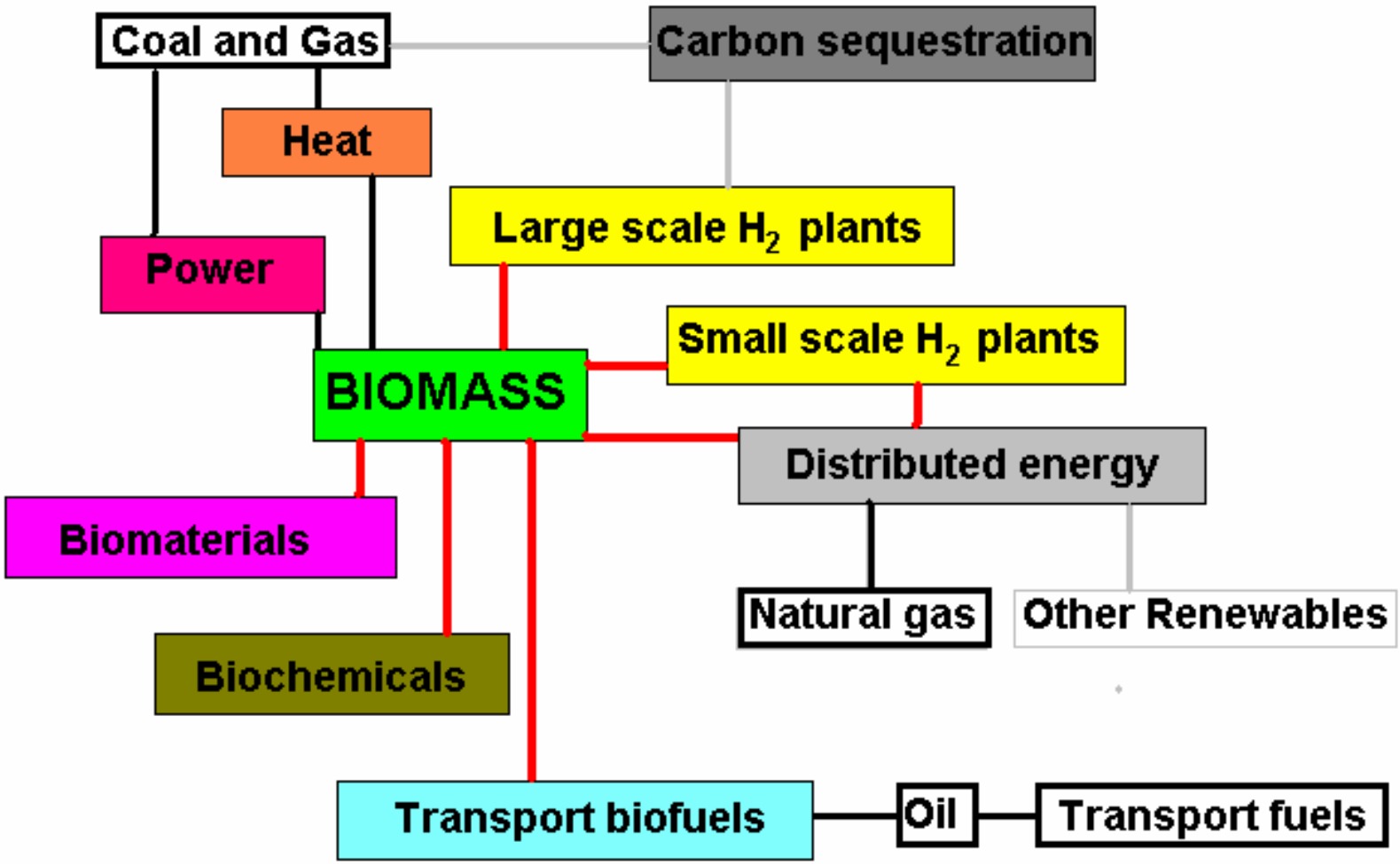
- **Windiest in late afternoons and evenings and in spring and late summer.**



Small scale bioenergy systems compared

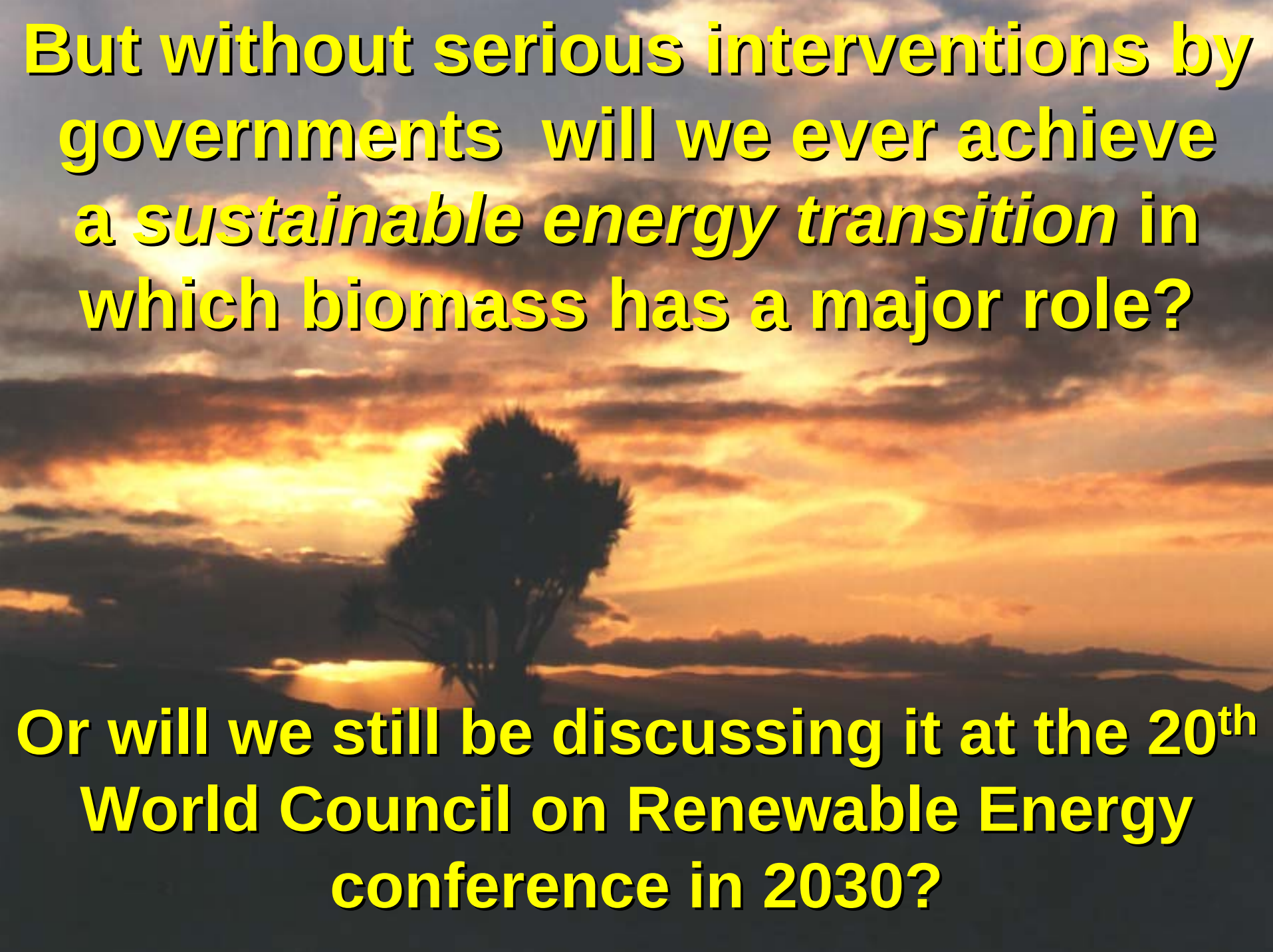


Distributed generation options



In Summary:

- Bioenergy has had an increasing share of supply over the past 30 years.
- The growing trends in the next 30 years towards biomaterials, hydrogen, carbon sequestration, and distributed energy offer good opportunities for the global biomass industry of the future.
- These trends are interlinked and all relate to sustainability, equity and development.


But without serious interventions by governments will we ever achieve a *sustainable energy transition* in which biomass has a major role?
Or will we still be discussing it at the 20th World Council on Renewable Energy conference in 2030?