

The background of the slide features a complex, spherical metal structure, likely a sculpture or architectural element, composed of numerous interconnected circular and linear metal beams. This structure is set against a clear blue sky and a city skyline, with several skyscrapers visible in the distance. The overall scene is brightly lit, suggesting a sunny day.

DIREC 2010

Track 1 Technology and Infrastructure

KEY FINDINGS

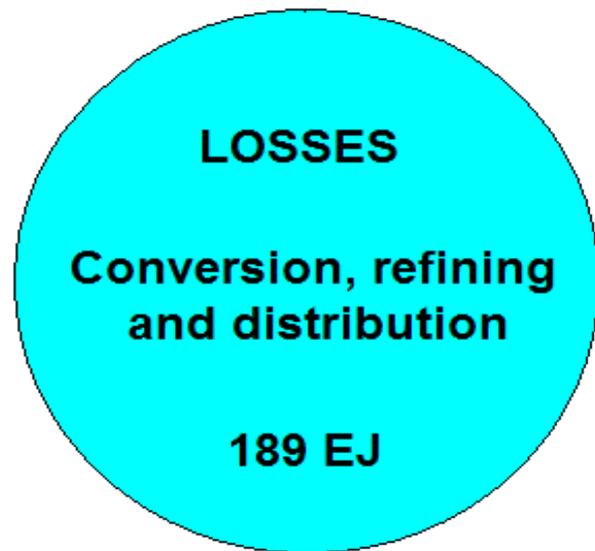
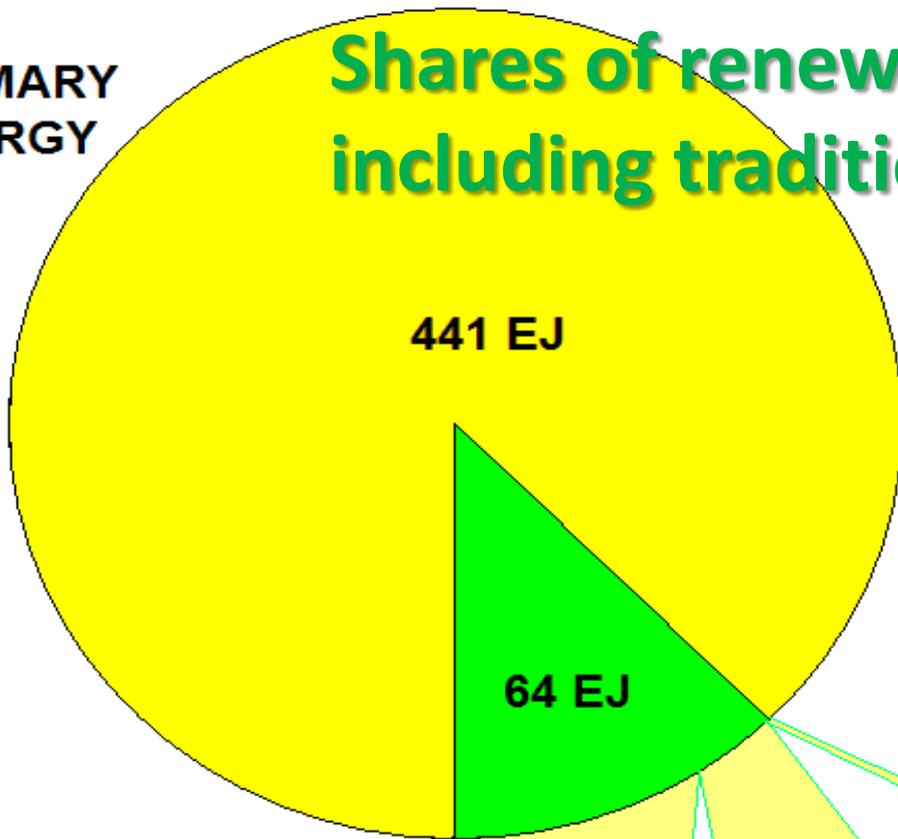
Prof Ralph E H Sims, Massey University, New Zealand
R.E.Sims@massey.ac.nz

Overview

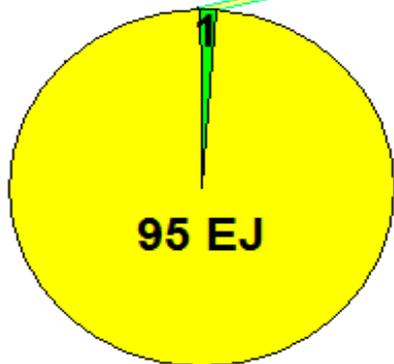
- **RE technology is rapidly advancing.**
DIREC Exhibition bears testimony to that.
- **Go back 20 years to 1990:**
 - **Few bioenergy CHP plants and gasifiers;**
 - **Wind turbines up to 100 kW;**
 - **No ground source heat pumps;**
 - **No flexi-fuel ethanol or hybrid vehicles;**
 - **Solar PV thin film, ocean energy emerging;**
 - **Little privatisation of the power sector;**
 - **Low oil and gas prices;**
 - **No DIREC congresses!**
- **Now go forward 20 years to 2030.....**

Shares of renewable energy today – including traditional biomass

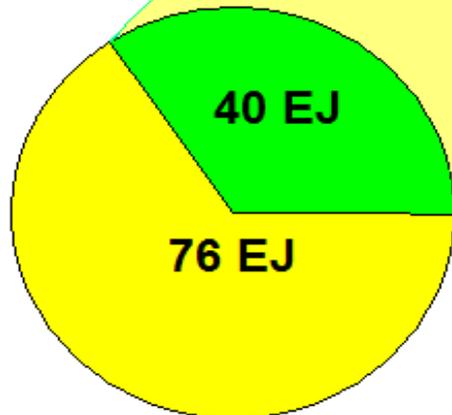
PRIMARY ENERGY



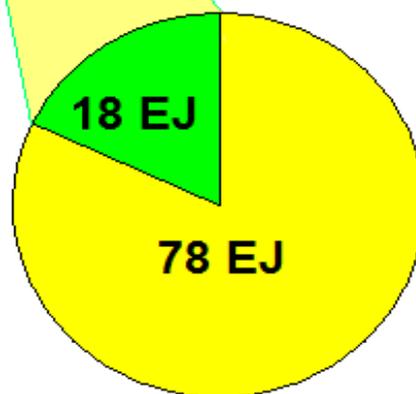
FINAL CONSUMPTION



Transport



Buildings



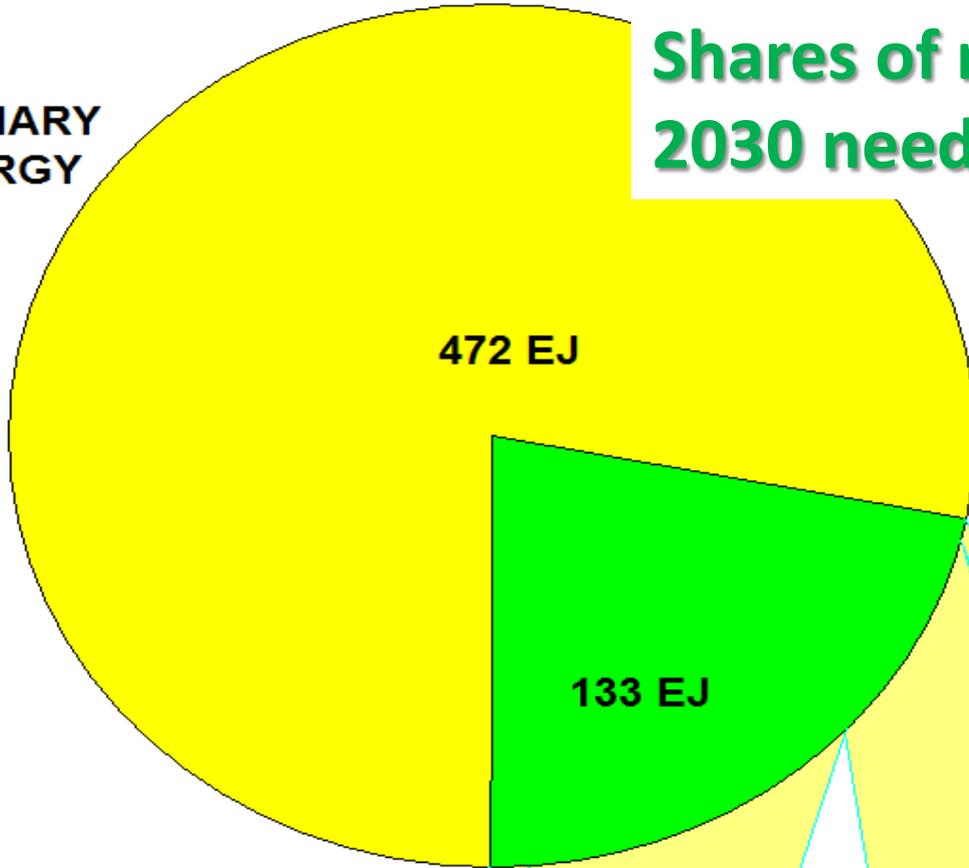
Industry



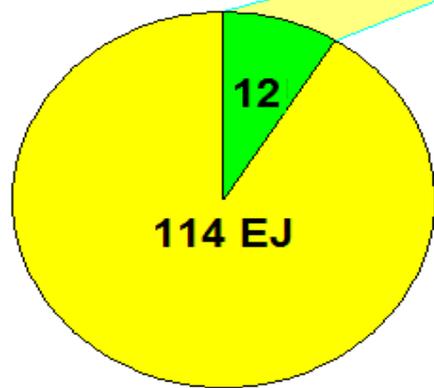
Agriculture

Shares of renewable energy in 2030 needed to reach 450 ppm

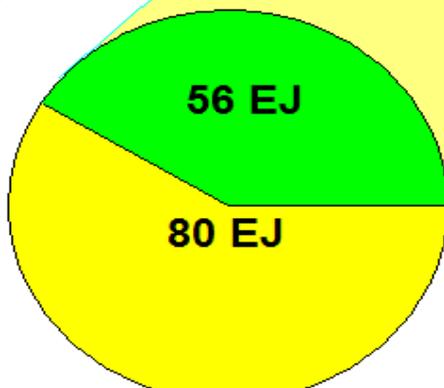
PRIMARY ENERGY



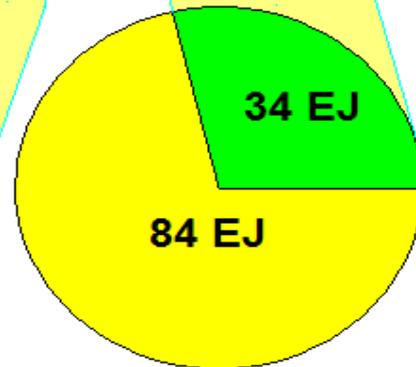
FINAL CONSUMPTION



Transport



Buildings



Industry



Agriculture

Scenarios reported

- **Several show high penetration levels by 2050.**
- **Some aiming for 100% Renewables.**
- **Decarbonisation of power sector by 2030.**
- **BUT Fossil fuels and nuclear sectors won't easily go away.**
- **IPCC Special Report on R E is grappling with this issue.**
- **All scenarios projecting large energy efficiency improvements. Cannot hope to get high penetration levels of RE without these.**

Power technology and Infrastructure



- **RE can be integrated into all types of electrical power systems, from large, interconnected to small autonomous.**
- **System cost depends upon resources available and nature of existing system.**
- **As the penetration of variable RE increases, maintaining reliability becomes more challenging and costly, but can be partly overcome by the construction of additional transmission and distribution networks and the modification of market arrangements.**
- **System costs can be minimised by deploying a portfolio of flexible resources including network interconnections, complimentary generation, responsive demand, improved regulatory and market mechanisms.**
- **Energy storage remains a challenge.**
- **Whether serving a village or a continent, to increase the penetration of RE in a specific electricity system will need determination of a unique pathway and investment costs.**
- **The future for more Re through Smart Grids is promising.**

Heating and Cooling



- **RE benefits not well understood and huge potential to expand biomass, solar thermal and geothermal systems for domestic, institutions and industrial applications.**
- **Solar thermal systems have reached the mass market but should aim for long-life, quality products.**
- **Many biomass-based industries are already net suppliers of heat and electricity to adjacent grids.**
- **District heating systems offer fuel flexibility and can therefore use low temperature thermal RE inputs.**
- **District cooling systems are less common but growing.**
- **Solar absorption technologies are emerging but costly.**
- **Training of installers and RD&D remain priorities.**
- **Many successful examples exist for local and national governments to use as models for greater deployment.**

Buildings



- **Integration of RE into the existing built environment, combined with energy efficient “green building” designs, have good potential.**
- **RE generation technologies integrated into new and existing buildings could enable them to become net suppliers of electricity and heat.**
- **RE heating systems of buildings are already widespread at the domestic, community and district scales since they can be cost-competitive.**
- **“Students of architecture have yet to learn which way the sun shines”.**

Transport (road only)



- **The transport sector currently has low shares of RE, mainly liquid biofuels and a small share of electric rail.**
- **Sustainable production of biofuels, based on well-to-wheel analysis, remains an issue.**
- **Hydrogen, electricity, biogas and liquid biofuels can be produced from RE resources at either on-site or centralised locations.**
- **Electric vehicles, including 2 wheel vehicles are developing rapidly but range between recharging remains**
- **When, and to what extent, flex-fuel, plug-in hybrid, electric or fuel cell vehicles might displace the current light duty vehicle fleet partly depends on the future source and availability of the energy carriers.**
- **The cost of developing the supporting infrastructure will be high.**
- **Technological developments of biofuels, batteries and fuel cells is continuing.**
- **Whether there will be a “winner” or a range of future drive-train sources is uncertain.**
- **The age of cheap transport could be reaching an end.**
- **“Avoiding oil dependence could result in lithium dependence”.**

Final comments

- **Integration across the transport, heat and electricity supply sectors is conceivable as a step towards an energy transition.**
- **Parallel developments in transport (e.g. electric vehicles), heat (e.g. heat pumps), demand side (e.g. smart meters) and thermal generation may provide future system flexibility and possibly lead to dramatic changes in electrical power systems.**
- **Large infrastructural investment will be necessary.**
- **Improved end-use energy efficiency can further facilitate RE integration and lead to higher shares.**
- **Regardless of the energy system presently in place, whether in energy-rich or energy-poor communities, increased RE integration is technically feasible.**
- **However the rate of RE penetration is policy dependent.**

- **There are few, if any, technical limits to developing a portfolio of RE technologies.**
- **In most developed and developing countries, suitable resources exist to meet the full range of energy services for both large and small communities.**
- **To reach projected RE growth levels will require investment in enabling infrastructure and R&D, reductions in costs, modified institutional and governance frameworks, and innovative planning.**



But it is not just technology!

What do people want?

