



Climate Change/Urban Change

The changing context for the activities and projects of METREX

For consideration at the METREX Nürnberg Meeting
Thursday 16 to Saturday 18 June 2005

Briefing and Discussion Note

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1 Purpose of this Briefing and Discussion Note

The UK will take over the Presidency of the EU in July 2005 and will make Climate Change and Africa the two key issues for discussion and consideration within the Union. METREX hopes to involve the Presidency in its activities during this period and to make Climate Change/Urban Change the theme of the METREX Granada Meeting in November 2005.

In addition, METREX and other partners and contributors are now deeply involved in the PolyMETREXplus project, which seeks to contribute a metropolitan response to the objective of the European Spatial Development Perspective for better urban balance across the territory of the EU. A key aspect of better urban balance is connectivity between metropolitan areas.

Climate change now requires a major shift from the carbon-based sources of energy of the present. Such a shift will have major implications for urban life.

- **The purpose of this Briefing and Discussion Note is to present the information currently available and to open discussion on the implications for METREX activities in general and the PolyMETREXplus project in particular**
- **A clear conclusion is the need for all European metropolitan regions and areas to prepare *Carbon Light 2050-80%* assessments to explore the implications of carbon light economies, transportation systems and lifestyles (reductions in carbon dioxide emissions in the range 60-80% by 2050). These might then provide the basis for a future METREX project under the revised Interreg programme**

Briefing Note

2 Climate change

Life on earth is sustained by the radiant energy of the sun, which is retained by a belt of *greenhouse* gases in the atmosphere. Heat from the earth is reflected back by these gases. Carbon dioxide is a key greenhouse gas and the use of carbon-based fuels on earth over the last 250 years, during the period of global industrialisation and urbanization, has resulted in the build up of carbon dioxide and other gases in the atmosphere. As a result the earth is beginning to heat up and the global climate is changing.

The speed of change and its consequences is open to debate because knowledge and understanding of the relationship between climate change and global ecological systems is incomplete. However, what is known is that temperature changes of the scale now in prospect have caused major changes in the earth's climate in the past and that unless the global emission of greenhouse gases, and carbon dioxide in particular, is curtailed, then climate change may not be able to be stabilised and may become irreversible.

The known consequences are that the ability of the earth to support life will be reduced, that the habitats of many species will be marginalised leading to their extinction and that life for mankind will be severely curtailed and put at risk. The evidence is that there is now a relatively short period, perhaps 30 years, over which a major shift away from the use of fossil fuels will be required and that this change must start now.

This is the basis for the Kyoto Protocol, which became operational in February 2005 and is a start in the right direction but of itself will not achieve the scale of change required. It is now concluded, and widely accepted, that the 12.5% reduction in greenhouse gas emissions by 2012 required of signatories under Kyoto needs to rise to more like 80% by 2050. The UK government has set itself a target of 20% by 2012 and 35-45% by 2030 is implied.

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3 Greenhouse gas levels and limits

The level of green house gases in the atmosphere in 1750, prior to global industrialisation and urbanization, was some 280 parts per million (ppm). Global population was around 1 billion. This has now risen to 379 ppm and has been rising most quickly over the last 20 years. Global population is now 6 billion. The rate of change is currently 3 ppm per year. The result has been a 0.6C rise in average global temperatures since 1990 with a 0.9C rise in Europe.

It is now estimated that beyond concentrations of 400-550 ppm climate change may not be able to be stabilised and that irreversible change will then be inevitable. On a *business as usual* basis concentrations of carbon dioxide might rise to 1250 ppm by the end of the century. Average global temperatures could then rise by 5.8C. It needs to be remembered that 5-6C is the scale of change that is comparable to that between the last ice age and the present.

The accelerated melting of the polar ice and sea warming will lead to sea rises. Research suggests that a 1.5C average global rise in temperature could cause the irreversible melting of the Greenland ice cap and sea rises of 7 metres. The collapse of the West Antarctic ice cap could double this.

Although the relationships between global warming, climate change and ecological consequences may be open to debate, because of an incomplete understanding of the global science involved, there is agreement on the level of concentration of greenhouse gases in the atmosphere beyond which the global climate would be severely at risk. The International Panel on Climate Change (IPCC) argues that global warming should be limited to 2C and that this requires carbon dioxide levels to be stabilised at 550 ppm.

- **This leads to an absolute limit on the balance of emissions that can continue to be made until this threshold is reached. This is why there is only a short period of time within which to make the behavioral changes needed.**

4 Contraction and Convergence (C and C)

The Global Commons Institute (www.gci.org.uk) has put forward the concept of Contraction and Convergence as the only equitable and effective way forward in these severe circumstances. About one billion of the six billion population of the earth are responsible for the great majority of the greenhouse gas emissions. C and C proposes that the balance of greenhouse gas capacity in the atmosphere should be shared, from an agreed date, by the global population and that trading should be allowed.

Current USA levels of carbon dioxide emissions are 23.4 tonnes per person per annum (tpa) and UK levels are 11 tpa. Global levels are 1.4 tpa. The illustrative C and C diagram on page 6 shows the global per capita allocations in 2000 on which a process of contraction and convergence could be based and the scale of contraction required by 2030 from which a process of convergence could continue to 2100 and beyond.

The implications of this approach, which is now attracting widespread support as the only practical way forward to achieving the certain reductions needed, is that national limits will be set. Contraction of emissions will then proceed over a period of years and Convergence will be achieved at a level of greenhouse gas emissions that is sustainable.

As part of its current contribution to the Kyoto Protocol the EU has regulated industrial emissions from January 2005 and created a carbon trading market (European Union Emissions Trading Scheme – EU ETS). This approach is felt to offer one way forward for the future.

- **Contraction and Convergence (C and C) is the only approach to the crisis of climate change that appears to offer an equitable (and therefore politically feasible) and effective way forward.**

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5 The implications of C and C for changing patterns of energy production and use

Across the EU there are varying patterns of energy supply, with France and Lithuania having a high dependence on nuclear power and the UK having made major switch to gas from oil and coal. This has been one way in which the UK has been able to move towards its Kyoto target.

There are two ways in which all EU states can mitigate their greenhouse gas emissions. Firstly, by maximizing their use of energy from renewable sources and, secondly, through efficiency savings. It is clear that European society is profligate in its use of energy. However, it is important to recognise that the scale of reductions in carbon dioxide emissions required to stabilise climate change cannot be achieved through these means alone. An absolute reduction in energy use from fossil fuels is required on a major scale.

It is also clear that a major reduction in the use of fossil fuels is required long before the known resources of oil will run out, possibly by the end of the century. It means that such resources, and business assets, will have to remain unused other than at greatly reduced rates.

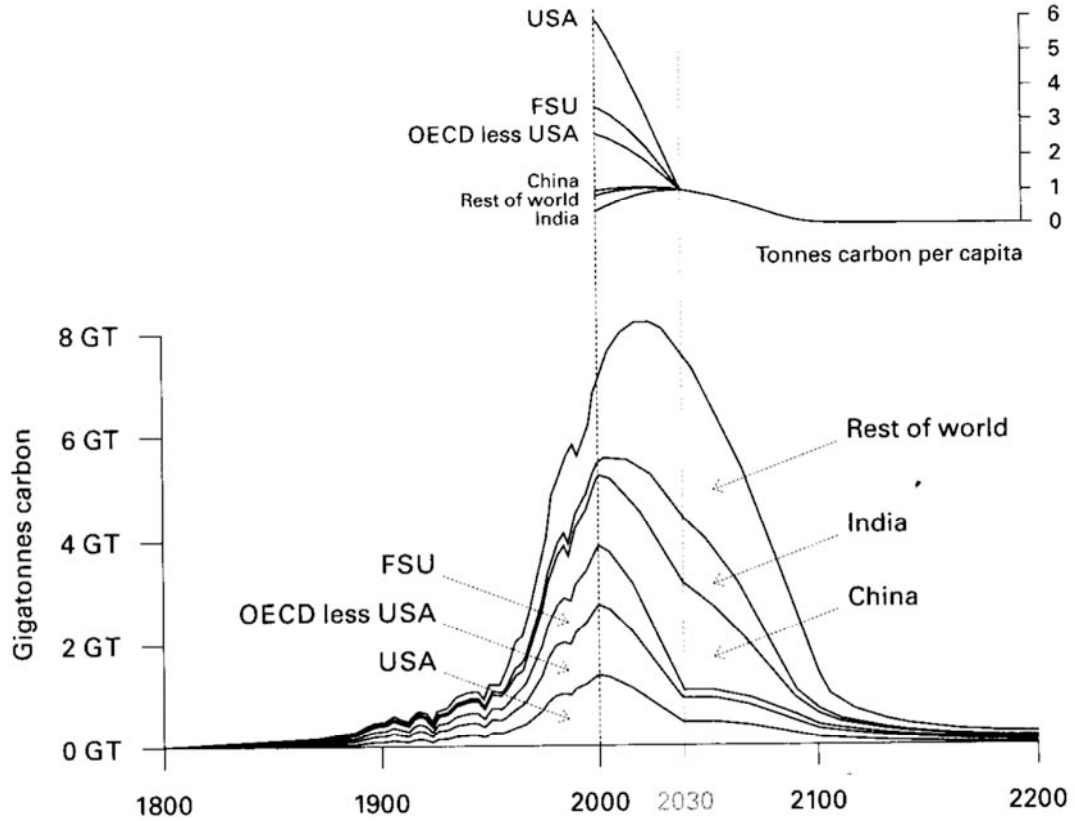
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Diagram illustrating the concept of Contraction and Convergence (C and C) devised by the Global Commons Institute (GCI), London

Diagram and text below taken from *How we can save the Planet* by Mayer Hillman with Tina Fawcett, Penguin books. Reproduced with the permission of the author.

Carbon dioxide emissions under C and C (shown gross and per capita) for a maximum of 450 ppm atmospheric concentration achieved by 2100, with permits for per capita emissions converging to equality achieved by 2030 (source GCI web site www.gci.org.uk)



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Summary

6 Possible implications of *Carbon light 2050-80%*, a reduction of 80% in carbon dioxide emissions by 2050

General implications

- Assessments and budgets of all kinds on a carbon cost as well as a financial cost basis
- Carbon viability becoming a key consideration
- Non essential travel will become too carbon costly
- A far greater emphasis on local/regional networks, facilities and economies, which are carbon light
- A move away from centralized operations of all kinds, which involve long lines of communication and are carbon heavy
- Long distance production and distribution, commuting and tourism becoming carbon uneconomic
- Increasing emphasis on maximizing renewable sources of energy and efficiency savings but a recognition that these will not provide more than 20% of the reduction target of 80%
- Recognition of the need for absolute reductions in fossil fuel usage
- Recognition that this means much of the remaining fossil fuel resources remaining unused
- Recognition that the only effective and certain way to achieve the necessary reductions will be through global/national quotas, economic sectoral caps, per capita rationing and carbon trading
- The Contract and Convergence (C and C) approach being promoted by the Global Commons Institute (www.gci.org.uk) demonstrates one way of achieving this
- There will be a debate about the wisdom of further nuclear energy plants to mitigate the need for carbon reductions
- The Lisbon Strategy will have to become carbon light
- The European Spatial development Strategy (ESDP) will have to become carbon light.
- Better European urban balance, and European connectivity, will have to be on a carbon light basis
- The nature of a globalised carbon light economy will change significantly
- The carbon cost of raw materials, labour, energy and freight will become key factors
- Whilst there will be adverse consequences for some industrial and service sectors, there will also be opportunities, for example, in renewable energy and energy efficiency
- High technology communications will be the means for most transactions

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Spatial planning and development implications

- A demand for local and regional political structures that can take the decisions required to create carbon light towns, cities and metropolitan areas and regions
- A need to reappraise all plans in a *Carbon Light 2050-80%* context, to anticipate the implications and consequences and begin planning, or re-planning, for them
- Recognition that carbon light transportation networks will be based on local walking/cycling/carbon light bus/tram movements, regional high capacity/high load factor rail movements and inter-regional high capacity/high load factor rail movements
- Car ownership and usage will become dependent on carbon light (e.g. bi-fuel) vehicles and more consciously limited to essential journeys
- Road congestion will cease to be an issue
- Carbon light public transport capacity will become an issue
- Recognition that aviation is inherently carbon heavy and may only be carbon economic for reduced long high capacity/high load factor movements (i.e. long haul).
- Low cost airlines will become high carbon cost airlines
- Local energy production sources, avoiding energy loss from centralized plants, will become more common
- Agricultural production, processing, distribution and sale will become more localized and regional to avoid carbon costs
- Retailing will similarly become more localized and regional to avoid carbon costs
- Household formation and the growth of single person households will become carbon costly. Larger households will be carbon light
- In general, carbon light locations will be at an inherent advantage (e.g. flat landscapes as against mountainous landscapes)
- Compact, mixed use, walking, cycling, public transport orientated urban areas will also be at an inherent advantage over low density car orientated carbon heavy urban sprawl
- Maritime/water borne trade that is high capacity/high load factor and carbon light will be at an advantage
- European gateway metropolitan areas will be re-orientated to carbon light networks and activities

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7 Scenarios of future energy supply and demand

Within the context outlined above the UK pattern of energy supply and demand has been taken to illustrate the implications of a C and C approach. Diagrams follow to show the,

- Base situation in the UK and 2001 and the scale of change since 1970
- Example of the Kyoto target of 12.5% (20% target by the UK government) by 2010
- Example of the 2030 target of 35-45%, implied by a 60-80% reduction target by 2050
- Example of the 2050 target of 60%
- Example of the 2050 target of 80%
- Example of the 2050 target of 80% plus the nuclear option

Each diagram is accompanied by a short commentary to introduce and explore the social and economic implications in general and the spatial planning and development implications in particular. It needs to be emphasised that the diagrams are indicative and intended to illustrate the broad direction and magnitude of change that is needed. They are based on Figures 5 and 6 in *How we can save the Planet and Our Energy Future – Creating a low carbon economy*, February 2003, UK Department of Trade and Industry (Dti) (see sources on page 13).

- **It is hoped that some of the research organisations with expertise in this field, for example in the European Spatial Planning Observation Network (ESPON) will take the diagrams as a basis for more specific and precise productions that will help to inform spatial planning practitioner consideration of the issue of climate change and its implications for urban life**

It should be noted in all diagrams that aviation is not included. Aviation is one of the prime generators of a range of damaging greenhouse gases. The EU has made clear that the aim should be to replace short haul air travel of under 400 kilometres with high-speed rail alternatives. At the moment the aviation industry does not pay a tax on aviation fuel or VAT on new aircraft.

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Base situation in the UK and 2001 and the scale of change since 1970 Example of the Kyoto target of 12.5% (20% target by the UK government) by 2010

Commentary

The structure of the UK energy market has changed dramatically from 1970 to 2001. Gas has replaced coal and oil as the principle sources of supply, resulting in a reduction in carbon dioxide emissions. At the same time the pattern of demand has also changed with a marked reduction in energy use by industry, stable demand from services although they now comprise the major part of the economy, and marked increases in domestic and transport demand. This demand has been generated by an increase in car ownership and usage and in central heating and the use of domestic appliances.

The UK has high wind loads and significant potential for wind energy. It has not built a nuclear power station since 1996 (Sizewell B) and there are no plans to do so. Nuclear power currently provides 9% of UK energy supply but only one nuclear plant will still be operating by 2025.

The basis for future UK energy policy will be a growth in renewable source of energy and in efficiency savings but these of themselves will not provide more than perhaps 20% of the emission reductions needed. There is a danger that such savings may be used to provide a source of increased levels of energy use rather than reductions. As with every other EU country the UK will also have to make absolute reductions in overall levels of fossil fuel usage.

- **This may be achieved through a Contraction and Convergence approach within caps for European industrial sectors (within a globally agreed framework of progressive emission rationing and reduction) and domestic carbon rationing**

Implications

- The maximization of all sources of renewable energy including,
 - Wind power (onshore and offshore)
 - Solar power
 - Waste and biomass/bio-fuel sources
 - Hydro power
 - Combined heat and power (CHP)
- The maximization of all efficiency savings including.
 - Domestic, industrial and service industry energy use management and reduction
 - Bi-fuel cars and commercial vehicles
 - Gas driven vehicles
- The continuing use of emission controls, caps and quotas for industry and carbon trading.
- The exploration and testing of personal carbon quotas/rationing.
- An increasing emphasis on low energy use locations and means of communications.
- Local emphasis on walking and cycling, local bus/tram/metro connections and travel.
- Regional rail connections, and inter regional high capacity high load factor rail links.
- Maritime and rail freight emphasis.
- Long haul aviation at high cost in high capacity/high load factor aircraft.

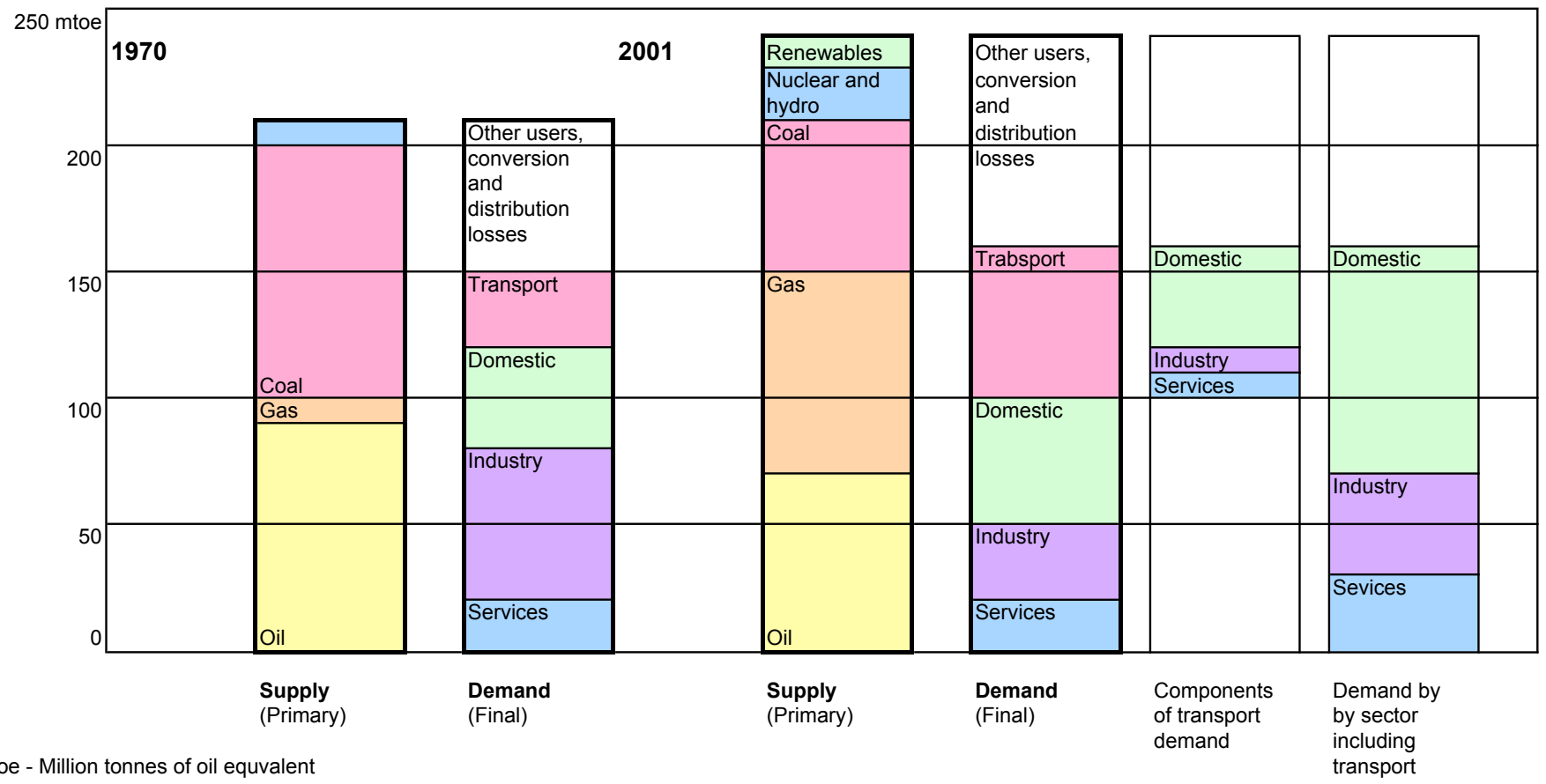
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Implications for spatial planning and development

- Spatial planning and development plans and policies that promote compact, mixed use, public transport orientated urban forms.
- Review of all urban form and the initiation of measures to maximise accessibility by walking, cycling and public transport.
- Plan for the City of Short Distances (Viennese approach).
- Plan to progressively reduce the need to travel (see SocioMETREX project check list).

Example of the base situation in the UK - Supply and demand



Example of the base situation in the UK - Energy source by sector

Commentary on reducing carbon dependency

Domestic

Efficiency savings

Local sources of renewable energy
Low carbon/high load factor transport

Non essential journeys

Industrial

Efficiency savings

Local sources of renewable energy
Low carbon/high load factor transport
Non essential journeys

Transport

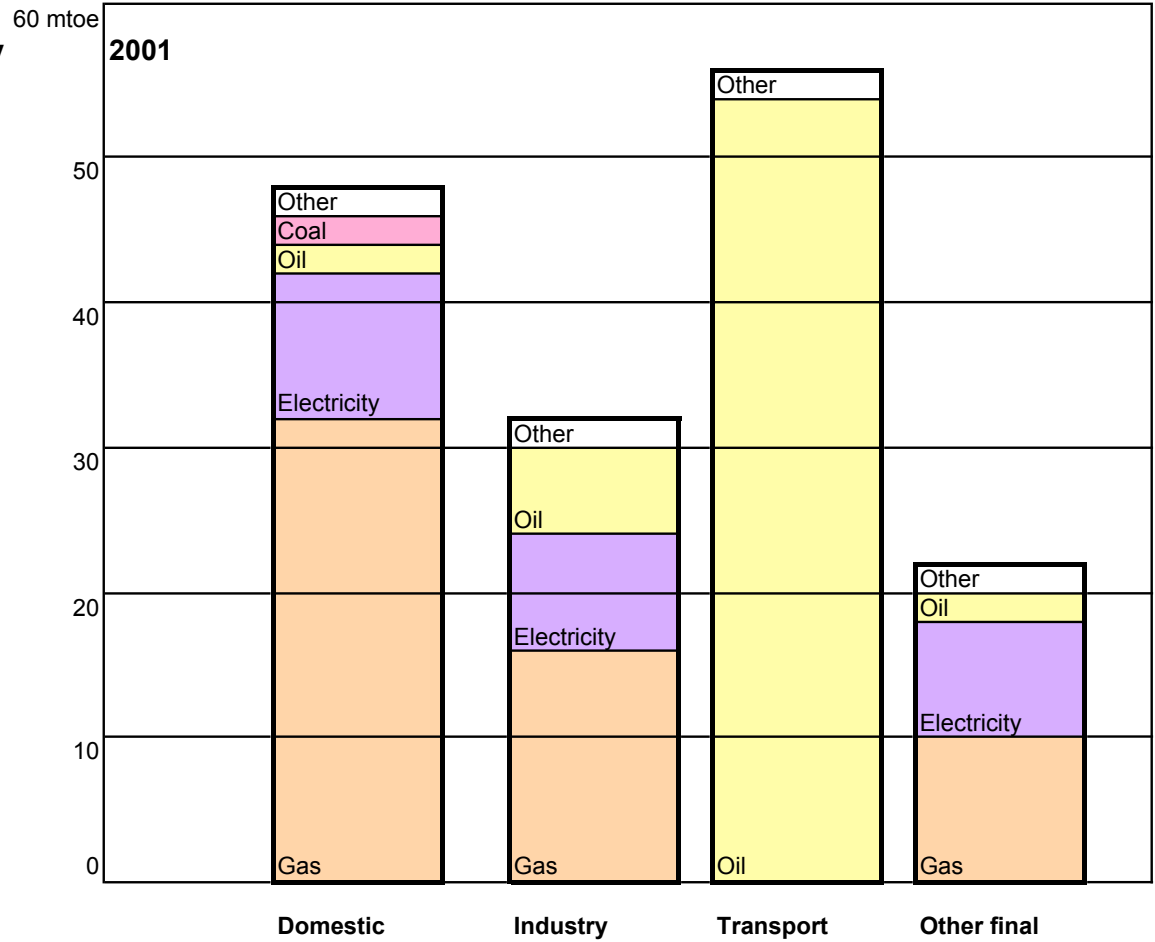
Low carbon/high load factor modes of transport
Bi-fuel cars and commercial vehicles
Hydrogen/natural gas/fuel cell powered vehicles
Integrated local/regional/inter-regional public transport

Regulation

Carbon quotas/trading business regulatory context
Carbon quotas/rationing domestic regulatory context

Key first steps in red


mtoe - Million tonnes of oil equivalent





Example of the 2012 Kyoto target of 12.5-20% in the UK energy demand/supply situation


250 mtoe


Action

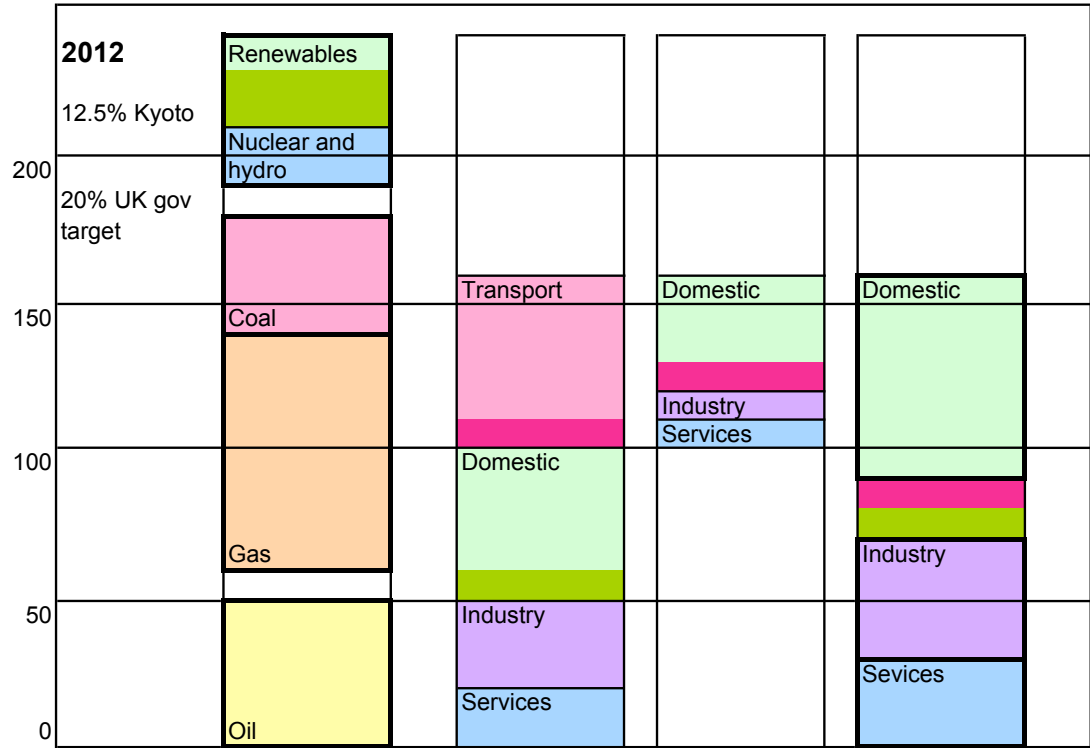
 Increase renewables to 10%
(EU target 12%)
(eg. Wind and biomass/biofuels)

 Equivalent decrease in coal and
gas based energy usage

 Make efficiency savings on transport
(eg. Bi-fuel vehicles)

 Make domestic efficiency savings
(eg. Energy management)

 **Balance of supply and demand
with 12.5-20% emissions reduction**



Supply
(Primary)

Demand
(Final)

Transport
demand

Demand
including
transport

Increase
renewables
reduce coal
and gas

Domestic
and transport
efficiency
savings

Primarily
domestic
transport
savings

Domestic
efficiency
and transport
savings

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Example of the 2030 target of 35-45%, implied by a 60-80% reduction target by 2050

Commentary

Within a Contraction and Convergence approach, energy saving through greater domestic energy efficiency and domestic and other transport efficiencies could continue. However, such technological benefits will need to be matched by the start of absolute reductions in carbon based energy usage, with an emphasis on transportation and non-essential journeys. The introduction of personal carbon rationing would initiate this process. There is a limit to what the price mechanism alone can achieve.

Implications

- The introduction of Industrial/business and domestic carbon rationing would inevitably lead to the curtailment on non essential journeys and priority being given to journeys that can be made with others.
- Commuting would become more difficult to sustain.
- Freight and goods movements would have to be carried out much more efficiently, with higher load factors and lower speeds. Just in time deliveries would cease to be economic.
- Only high value goods would justify long haul freight unless low energy/low speed means of transport were used.
- Highly centralized commercial operations, including many aspect of retailing, involving lengthy supply chains, would have to change their emphasis to local/regional sources of supply.
- Local and regional markets for food products and services would emerge.
- Long life products would have greater value. All aspects of the disposable society would be reconsidered, including packaging and marketing.
- The tourism industry would have to change its emphasis to low energy cost travel. Local and regional holiday markets would improve.

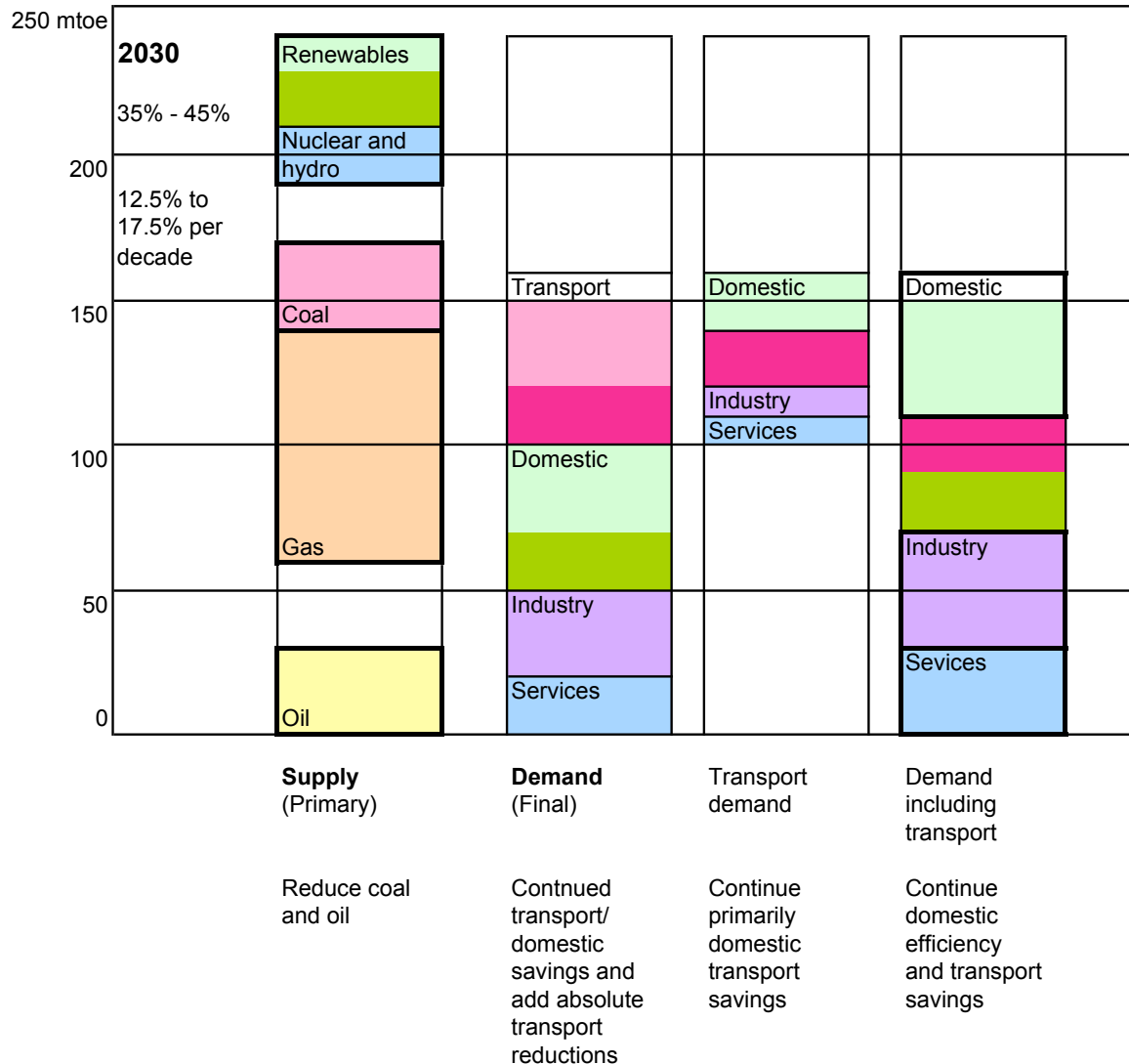
Implications for spatial planning and development

- Congestion would reduce as an issue.
- Demand for development may refocus on local and regional markets for housing, jobs and services.
- Infrastructure investment would maximise local low energy cost benefits, for example, from walking and cycling.

Example of the 2030 target of 35-45% (leading to 60-80% in 2050)

Action

- Continue to make efficiency savings on transport
- Continue to make domestic efficiency savings (eg. 40% house approach)
- Make absolute reductions in transport energy use (eg. Carbon quotas/ rationing and the price mechanism)
- Equivalent decrease in coal and oil based energy usage
- Balance of supply and demand with 35-45% emissions reduction**



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Example of the 2050 target of 60%

Commentary

Within a Contraction and Convergence approach, efficiency savings would be concluded and absolute reductions would be required in energy use for transportation, domestic and industrial activities.

Implications


- All the implications for the 35-45% scenario apply but real changes in life style, social and economic life would be taking place.
- In general society and business would have to reappraise all their activities in terms of their energy budgets not just financial costs and return.
- There would be a limit to the extent that carbon trading at the global, EU and national levels could sustain otherwise unsustainable activities and operations. Trading just buys time for readjustment.


Implications for spatial planning and development


- All the implications for the 35-45% scenario apply but with greater certainty.
- With the need for absolute reductions in domestic energy usage, and within a context of carbon rationing, single person households would be very energy inefficient. Higher levels of dwelling occupancy could be envisaged.

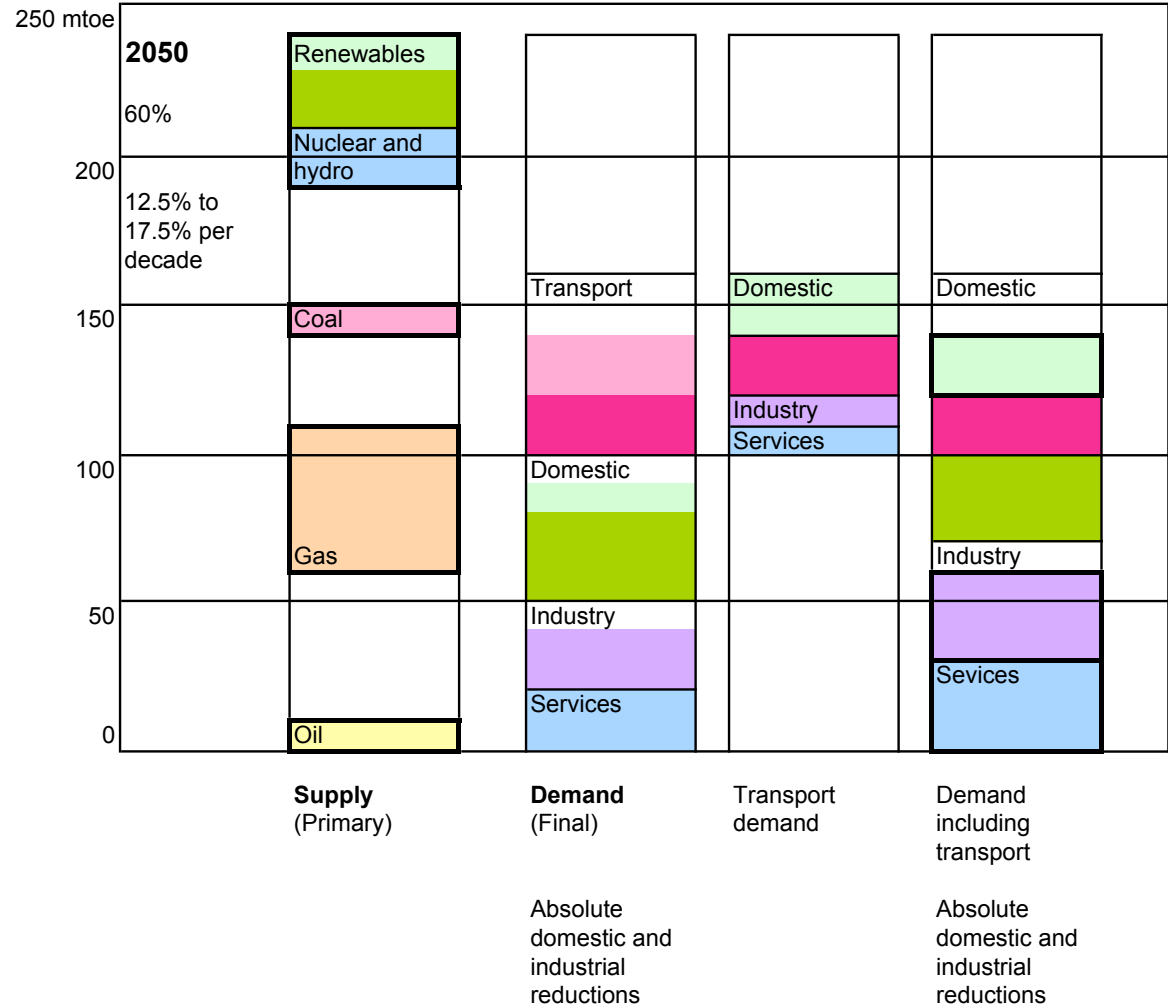
Example of the 2050 target of 60%

Action

 Make absolute savings in transport, domestic and industrial energy use through quotas/rationing and the price mechanism

 Equivalent decrease in coal, oil and gas based energy usage

 Balance of supply and demand with 60% emissions reduction



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Example of the 2050 target of 80% Example of the 2050 target of 80% plus the nuclear option

Commentary

Within a Contraction and Convergence approach, continuing and more significant absolute reductions would be required in energy use for transportation, domestic and industrial and service activities. Although the energy needs of the economy may be protected in the early stages of adjustment to a less carbon dependent world there will come a point when such reductions will become essential for businesses to remain viable. At the same time new businesses may arise in this new world of high-energy efficiency.

Implications

- All the implications for the 60% scenario apply but by this time society will have made real and substantial adjustments to lifestyles and economic activities.
- The value of certain aspects of life will change. For example, it might be concluded that local and regional governance will become more of an issue as citizens seek political decisions and investments that will allow them to live a low energy life.

Implications for spatial planning and development

- All the implications for the 60% scenario apply but with even greater certainty.
- The relative attraction of locations that allow and support a low energy lifestyle, with low energy opportunities for employment, social and leisure activities, will become more attractive. Conversely high-energy locations may become less marketable.
- Urban life will offer the added advantage of accessibility and mobility and lower energy cost or higher levels of efficiency.
- Car orientated locations of all kinds will be at a disadvantage.
- Investment will switch significantly from the inter regional and national road network to local and regional bus and rail systems and interchanges and inter regional rail systems and interchanges, where high load factors are in prospect.

The nuclear option

It has been assumed that nuclear energy will remain unattractive because of the high cost of construction, energy production and the unresolved problems of decommissioning. However, if the options are high cost/higher risk energy to mitigate the effects of a reduction in the use of fossil fuels or a reduced and more constrained way of life, it may be that advanced societies and economies will chose the nuclear option to varying degrees.

However, there is a real issue about the sustainability of the nuclear option because plants have a limited life and have to be replaced a regular intervals. The spatial planning implications of the nuclear option need to be investigated and considered having regard to the level of energy supply that may be being considered from this source and the number and location of plants.

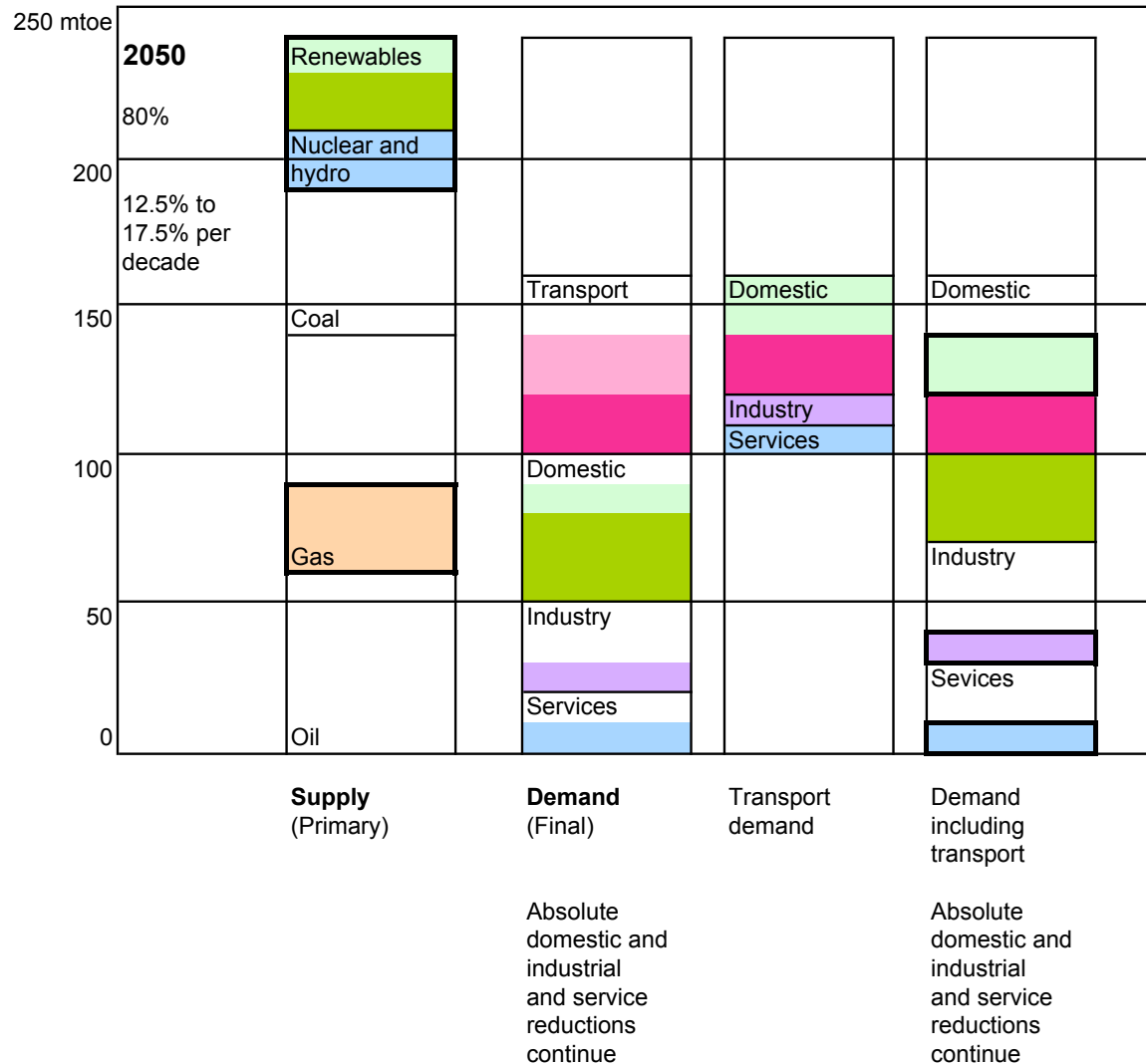
Example of the 2050 target of 80%

Action

Make absolute savings in transport, domestic industrial/service energy use through quotas/rationing and the price mechanism

Equivalent decrease in coal, oil and gas based energy usage. Residual gas energy usage?

Balance of supply and demand with 80% emissions reduction

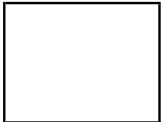


Example of the 2050 target of 80% plus the nuclear option

Action



Make absolute savings in transport, domestic industrial/service energy use through rationing and the price mechanism



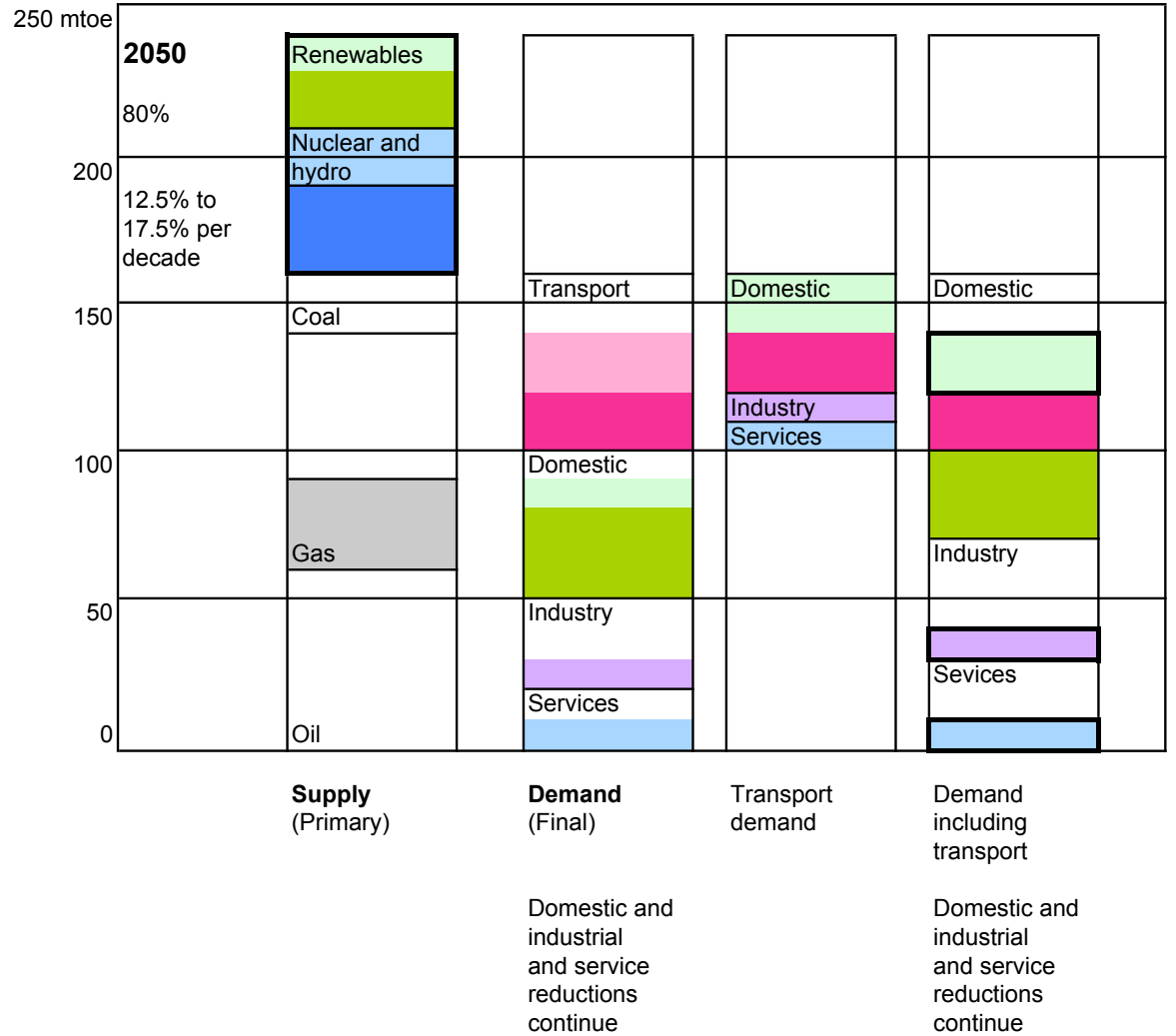
Equivalent decrease in coal, oil and gas based energy usage. Residual gas energy usage?



Possible nuclear programme to offset gas and greatly reduce fossil fuel usage or give extra capacity



Balance of supply and demand with 80% emissions reduction



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8 Sources and further reading

- *The International Challenge of Climate Change – UK Leadership in the G8 and EU*. March 2005. UK House of Commons Environmental Audit Committee.
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