Appendix A:
Research Reference Group

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Appendix B:
First draft of policies and measures per sector

POLICIES AND MEASURES	EVALUATION CRITERIA															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & adminis-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
ENERGY SECTOR																
Regulatory measures																
i) Legislative framework	+	+	0	0	+	+	0	+	0	0	+	+	+	+	+	**19**
ii) Renewable electricity portfolio standard / Grid Feeder laws – Targets	+	+	0	0	+	-	0	+	+	+	+	+	+	+	+	**22**
iii) Air quality standards	+	+	0	0	+	0	0	+	+	0	+	+	+	+	+	**20**
iv) Non-discriminatory access to the grid	+	+	+	+	-	+	0	+	+	+	+	+	+	+	+	**24**
v) Requiring distributors to invest in energy efficiency	+	+	0	0	-	-	-	+	+	+	+	+	+	+	+	**16**
vi) Cross-sectoral energy efficiency programme and institution/agency	+	+	0	0	-	+	0	+	0	0	-	+	+	+	+	**12**
Market based programmes																
i) Phasing out permanent subsidies to established technologies and increasing funding for RD&D for energy efficiency & renewable energy	+	+	+	+	+	-	-	-	-	-	+	-	-	0	0	-2
ii) Full-cost pricing of energy services	+	+	-	-	+	-	-	-	-	-	+	-	-	0	0	-6
iii) Financing assistance	+	+	+	+	-	+	+	+	+	+	+	+	+	+	0	**22**
iv) Incentive for renewable electricity generation	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	**23**
v) Power purchase agreements for renewable IPPs	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	**21**

POLICIES AND MEASURES	EVALUATION CRITERIA															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & admini-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
vii) Access to finance	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	**22**
Voluntary Agreements																
RESIDENTIAL & COMMERCIAL BUILDINGS																
Regulatory Measures																
i) Building Codes																
-Commercial Building Codes	+	+	0	0	+	0	0	0	0	0	+	+	+	+	+	**14**
-Residential Building Codes	+	+	+	+	+	0	0	0	0	0	+	+	+	+	+	**16**
ii) Equipment Standards																
-Household appliance standards	+	+	0	0	+	+.	+	+	0	0	+	+	+	+	+	**19**
-Commercial categories	+	+	0	0	+	0	+	0	0	0	+	+	+	+	+	**15**
-Water conservation	+	+	+	0	-	0	0	0	0	0	-	+	+	+	-	4
iii) Utility Regulation																
-Decoupling sales from revenue and profit	+	0	0	0	+	0	0	+	+	0	+	+	0	+	0	**14**
-Performance based tariffs	+	+	0	0	+	0	0	0	0	0	+	+	+	+	0	**12**
-Licensing requirements	+	0	0	0	+	0	0	0	0	0	+	+	+	+	+	**14**
iv) Public benefits fund from wire/line charges																
-Non-by passable systems benefit charge	+	0	0	0	+	+	0	+	+	0	+	+	+	+	0	**16**

POLICIES AND MEASURES	**EVALUATION CRITERIA**															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & admini-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
Market based Programmes																
i) Tax credits and subsidies	+	+	+	0	-	0	0	+	0	0	-	+	+	+	+	**12**
ii) Financing for projects from public benefits funds	+	+	+	+	-	+	0	+	+	+	-	+	+	+	-	**16**
iii) Government procurement standards	+	+	0	0	-	0	0	0	0	0	+	+	+	+	+	**11**
Voluntary Programmes																
i) Household appliance labelling																
ii) Commercial equipment labelling																
iii) Building energy labelling																
INDUSTRIAL SECTOR																
Regulatory Measures																
i) Procurement controls for Industrial equipment on energy efficiency	+	0	0	0	+	0	0	+	0	0	+	+	+	+	+	**10**
ii) Procurement controls on GHG emission for industrial equipment	+	+	0	0	0	+	0	+	0	0	+	+	+	+	+	**16**
iii) Energy Use monitoring	+	0	0	0	0	+	0	0	0	0	0	+	+	+	+	9
iii) Emission regulations for industrial products	+	+	0	0	+	0	-	+	0	0	+	+	+	+	+	**16**
iv) Awards and Penalties	+	+	0	0	+	0	-	+	0	0	-	+	+	+	+	**14**
v) Labelling for energy consuming industrial products	+	+	+	0	+	0	+	+	+	0	+	+	+	+	0	**20**
vi) Leakage regulations	+	+	+	+	+	0	0	+	0	0	+	+	+	+	0	17

POLICIES AND MEASURES	**EVALUATION CRITERIA**															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & admini-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
Market Based Programs																
i) Financial and tax incentives (subsidies, low interest loans, etc)	+	+	0	0	-	+	+	+	+	+	+	+	+	+	0	**19**
ii) Elimination of GHG reduction related trade barriers	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0	**25**
iii) Industrial electricity tariff reforms to promote energy efficiency	+	+	0	0	-	-	-	0	0	0	+	-	0	+	0	3
iv) Relief on energy audit costs	+	+	0	0	+	+	+	+	+	+	+	+	+	+	0	**23**
v) GHG Emission tax on industrial processes or end products	+	+	+	+	-	-	-	0	0	0	+	-	+	+	+	8
vi)Phasing out bad subsidies	+	+	+	+	+	-	0	-	-	-	+	-	+	+	0	2
Voluntary Programmes																
i)Material Recycling																
ii) Efficient lighting and office equipping iii) Fuel switching/electric heating																
iv) Emission reduction targets																
TRANSPORT SECTOR																
Regulatory Measures																
i) Restrictions on road transport	+	+	0	0	+	0	0	0	0	-	+	-	+	+	+	10
ii) Review of maximum and minimum driving speed limits and strengthening on their enforcement	+	+	0	0	+	0	0	+	0	0	+	+	+	+	+	17
iii) Vehicle Procurement regulations	+	+	0	0	+	0	0	+	0	0	+	+	+	+	+	16

POLICIES AND MEASURES	EVALUATION CRITERIA															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & admini-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
iv)Public Transport Regulation – eg microbus transportation	+	+	0	0	+	+	0	+	0	0	+	+	+	+	+	**18**
v) Aviation Seat Capacity Regulation	+	+	0	0	-	0	0	0	0	0	+	+	+	+	+	13
Market Based Programmes																
i)Vehicle efficiency taxation schemes	+	+	0	0	+	0	-	0	0	0	+	+	+	+	+	15
ii) Modernisation of rail infrastructure	+	+	+	+	-	+	+	+	0	0	+	+	+	+	+	**19**
iii) Subsidising public transport –eg microbus transportation	+	+	0	0	-	+	0	+	+	+	+	+	+	+	+	**10**
iv) Road use tax	+	+	0	0	+	+	0	-	-	0	+	-	+	+	+	7
Voluntary Options																
i) Research and Development																
ii) Information dissemination iii) Education and training																
iv) Alternative fuel subsidies and tax incentives																
v) More efficient aircraft																
vi) Fuel efficiency standards																
vii) Improved fleet management and routing																
ix) Monitoring and evaluation																

POLICIES AND MEASURES	EVALUATION CRITERIA															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & admini-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
AGRICULTURAL SECTOR																
Regulatory Options																
i) Enteric Fermentation																
- Regulation - land carrying capacity / No of livestock per unit area	+	0	+	+	+	0	0	0	0	0	+	0	+	+	0	10
ii) Waste Management																
- Regulation - land carrying capacity / No of livestock per unit area	+	0	+	+	+	0	0	0	0	0	+	0	+	+	0	10
- Regulation on use of manure as a fuel	+	+	+	+	+	0	0	0	+	0	-	-	+	+	+	
- Regulation - animal waste managmt /methane emission reduction	+	0	0	0	+	0	0	0	0	0	0	0	+	+	+	9
iii) Use of Nitrogen Fertilisers																
- Regulations on amount of fertilizer per unit area	+	+	+	+	+	0	0	0	0	0	-	+	+	+	+	14
- Regulations on setting aside agricultural land	+	0	+	+	+	0	0	0	0	-	-	-	+	+	+	6
iv) CO_2 sequestration and retention in soils																
- Regulations on soil management practices	+	0	+	+	+	0	0	0	0	0	+	+	+	+	+	13
- Regulations on fallowing frequency and length	+	0	+	+	+	0	0	0	0	-	-	-	+	+	+	6
- Regulations on tilling practices	+	0	+	+	+	0	0	0	0	0	-	+	+	+	+	11
Market Based Programmes																
i) Livestock keeping																
- Financial incentives in reduction of livestock numbers	+	0	+	+	-	0	+	0	0	-	+	+	+	+	+	6

POLICIES AND MEASURES	EVALUATION CRITERIA															
Key:	*GHG reduction potential*	*Air Quality: Non-GHG emissions*	*Water Conservation & biodiversity*	*Soil Conservation & Biodiversity*	*Cost Effectiveness in mitigating GHG*	*Macroeconomic Impacts*	*International competitiveness*	*Social equity*	*Poverty Alleviation*	*Job Creation*	*Institutional & adminis-strative Capacity*	*Potential political & bureaucratic support*	*Consistency with other Public Policies*	*Replicability*	*Technology feasibility*	*TOTAL SCORE*
PROPOSED WEIGHTING	3	3	1	1	2	1	1	3	3	3	1	1	1	1	2	
- Introduction/Removal of subsidies to limit livestock numbers	+	0	+	+	-	0	+	0	0	-	+	+	+	+	+	7
- Incentives for use of manure as a fuel	+	+	+	+	-	+	0	+	+	0	+	+	+	+	+	22
- Financial incentives to reduce emissions by appropriate animal waste management	+	0	0	0	-	0	0	0	0	+	+	+	+	+	+	10
ii) Nitrogen Fertilizers																
- Subsidy or subsidy removal to set aside agricultural land	+	0	+	+	+	-	0	0	0	0	-	+	-	+	+	7
- Financial incentive/subsidy for less intensive agriculture	+	+	+	+	-	0	0	0	0	-	+	-	+	+	+	9
- Removal of subsidies for fertilizer use	+	+	0	+	-	0	-	0	0	-	+	-	0	+	0	2
iii) CO_2 sequestration and retention in soils																
- Financial incentives for less intensive agriculture (subsidies; removal or introduction)	+	+	+	+	-	0	0	0	0	-	+	-	+	+	+	7
- Financial incentives to reduce fallowing	+	0	-	-	-	+	+	+	+	+	+	+	+	+	0	12
- Financial incentive for appropriate soil management	+	0	+	+	-	+	0	0	0	+	+	+	+	+	+	13
Voluntary Options																
i) Material Recycling																
ii) Efficient lighting and farm equipping of farms																
iii) Improvement of animal waste management practices																
iv) Improved fertilizer use																
v) Improved farming methods/soil management																
vi) Research in improved farming practices for GHG reduction																

Appendix C: Summary of proposed evaluation criteria for policies and measures

These criteria have been adapted from the IPCC Technical Paper on Policies and Measures (IPCC 1996), the South African Climate Change Country Study Mitigation Assessment evaluation criteria for mitigation options (James & Spalding-Fecher 1999), the SouthSouthNorth indicators used for screening CDM projects against sustainable development and other criteria (Thorne 2001: Annex 5), and input from the Research Reference Group. Most of the evaluation criteria would be qualitative, and all would be qualitative in the first screening. For the indicators on GHG emissions reduction, other air emissions, and cost effectiveness amongst others, the later modelling phase would quantify the impacts of the policies and measures as a basket. It should be noted that the criteria of 'local economic development' is encompassed in the following three indicators: Social equity, Poverty Alleviation and Employment.

Summary of evaluation criteria for this policies and measures study

Broad Category	*Indicator*	*Definition*	*Proposed weighting*
GHG impacts	GHG reduction potential	Tonnes of carbon dioxide equivalent reduced relative to the 'baseline' scenario	3
Other environmental considerations	Air quality: non-greenhouse gas emissions	Reduction in emissions of particulate matter, SO_x, O_3, and NO_x	3
	Water resources and aquatic biodiversity	Impact on water quality, water quantity available, and aquatic biodiversity	1
	Soil conservation and terrestrial biodiversity	Impact on soil erosion, soil quality and terrestrial biodiversity	1
Economic impacts	Cost-effectiveness in mitigating GHG emissions	Cost of abatement relative to emissions reduction achieved (i.e. cost per tonne of carbon dioxide equivalent abated)	2
	Macroeconomic impacts	Impacts on GDP, trade balance, inflation, interest rates, other long term economic impacts	1
	International competitiveness	Impact on cost of production of the relevant sectors, particularly export sectors	1
Social impacts	Social equity	Distribution of benefits among different socio-economic groups	3
	Poverty alleviation	Improvement of quality of life and development of sustainable livelihoods for the poor	3
	Employment / Job creation	Types of employment, duration and distribution of these opportunities among socio-economic groups	3
Administrative, institutional and political considerations	Institutional and administrative capacity	Administrative burden of PAMs, institutional barriers, need for additional capacity building to implement PAMs	1
	Potential political and bureaucratic support	Capacity of policies and measures to pass through political and bureaucratic processes and sustain political support	1
	Consistency with other public policies	Synergies and conflicts with other major energy and sectoral policies	1
	Replicability	Adaptability to different geographical and socio-economic-cultural settings in South Africa, as well as possibility of technological learning	1
Technological considerations	Technological feasibility	Commercial availability and experience with technology inputs in South Africa, including technologies needed to implement PAM, taking into account technology development over time	2

For each criterion, PAMs would be scored from a contribution of +1 to –1, with 0 meaning no impact. The scores on different criteria would then be weighted to arrive at a composite score. The proposed weightings, for discussion with the Research Reference Group, are indicated in the last column. The weightings are adapted from earlier drafts of the Climate Change Country Study Evaluation Criteria (James & Spalding-Fecher 1999).

Measurement and reporting of indicators

This section explains each indicator in more detail, including the impact scale that should be used for rating particular policies and measures.

1. Reduction in GHG emissions

Measurement

Quantitative value: tonnes of CO_2 equivalent.

What should impact scale be?*

2. Other environmental considerations

Many policies and measures policies and measures will have environmental impacts other than those related to climate change. These impacts include those on soil conservation, water resources, biodiversity and non-greenhouse gas emission. In order to arrive at an assessment of the local environmental impacts, the following criteria must be considered where relevant:

2.1 Air quality: non-greenhouse gas emissions

The impact of policies and measures on non-greenhouse gas emissions, particularly sulphur dioxide (SO_2), ozone (O_3), particulate matter, NO_x and SO_x, should be reported.

Impact scale for qualitative criteria

Qualitative measurement: based on any quantitative information available about pollutants such as particulate matter, SO_x, O_3, and NO_x (reduction or increase in emissions). Where several pollutants are affected, criteria should related to the most important local pollutants.

+: Enhancement of air quality.

0: No impact on air quality.

--: Deterioration of air quality

2.2 Water resources and aquatic biodiversity

The following information is required:

- Water quality; including the potential impacts on the physical, chemical and biological characteristics of the water.
- Water quantity; including changes to the flow, reliability and consumption of water should be presented
- Biodiversity; including the potential impacts on ecosystem, habitat and biota which includes characteristics, condition and distribution of aquatic biota.

Impact scale for qualitative criteria

+: Enhancement of the condition and characteristics of water resources and biodiversity.

0: No impact on the condition and characteristics of water resources and biodiversity.

--: Deterioration of water quality, reduction in water and degradation of ecosystem, habitat and biota.

2.3 Soil conservation and terrestial biodiversity

The following information on the potential impact of proposed mitigation options on soil conservation and biodiversity is required:

- Soil erosion; including information on potential soil loss or gain.
- Soil quality; including information on the deterioration or enhancement of soils caused by changes in acidification, compaction, salinisation and aluminium toxicity.
- Biodiversity; including information on the impacts on the ecosystem, habitat and biota.

Impact scale

+: Substantial enhancement of soil conservation and biodiversity.

0: No impact on soil conservation and biodiversity.

--: Degradation of soils, ecosystem, habitat and biota.

3. Economic impacts

3.1 Cost-effectiveness in mitigating GHG

Although the policies and measures may not be analysed individually, from the technology inputs it should be possible to give a rough assessment of the cost effectiveness of the policies and measures in terms of mitigating greenhouse gas emissions.

Measurement and impact scale

Where possible, Quantitative value: Rands/tonne of CO_2 equivalent.

Otherwise, qualitative values:

+: zero to negative cost options

0: low to moderate cost options (e.g. what range of $ per ton of CO2???*)

--: high cost options (what range of $ per tonne of CO2???*).

3.3 Macro-economic impacts

There are a number of important macro-economic impacts, but evaluating these impacts quantitatively is only possible with a macroeconomic model. We can still assess the qualitative impacts on key variables such as GDP growth, trade balance, inflation, etc.

Impact on trade balance

In order to minimise the negative impact of climate change mitigation strategies on the balance of payments, it is important to avoid prolonged and increased dependence on imported goods and services. South Africa's ability to develop and use locally developed technology should not be compromised and the assessment should investigate possibilities for local substitution of imported goods and services.

+: Improved trade balance

0: No impact on trade balance

--: Deterioration of trade balance

Impact on GDP

+: Improved economic growth

0: No impact on GDP

--: Decline in GDP

Impact on inflation

+: Lower inflation

0: No impact on prices

--: Higher inflation

3.4 Impact on international competitiveness

Investments in technologies that are more efficient and environmentally friendly may have longer term implications for international competitiveness. On one hand, large environmental investments could raise the cost of production. On the other hand, investments that lead to more energy and resource efficient production could improve competitiveness, particularly if energy prices increase in the future.

Impact scale for qualitative criteria

+: Reduced cost of production

0: No impact on cost of production

--: Increased cost of production

4. Social impacts

4.1 Social equity, well-being and poverty alleviation

There are many types of policies and measures that could contribute towards the achievement of social equity, improved well-being and poverty alleviation. The potential impacts of these projects include improvements in the health and safety of the members of low-income households, reduction in expenditure on energy, improved comfort, improved access to sustainable forest resources, and access to housing. Further, certain projects in sectors such as energy supply, industry and manufacturing could also lead to creation of jobs.

Impact scale

+: Substantial contribution to the well-being and social upliftment of poor communities, with benefits accruing to both men and women.

0: Minimal or no impact on the well-being and social upliftment of poor communities

--: Negative effect on the well-being of poor communities.

4.2 Employment

The creation of jobs is an urgent development priority for South Africa. Considerations for assessing employment impacts include:

- the duration of time employed;
- type of work and conditions of employment; and
- the distribution of employment opportunities created according to race, gender, age, rural/urban situation, and income groups.

Impact scale

+: Substantial long-term job creation with fair working conditions and an equitable distribution of opportunity.

0: Little or no impact on job creation

--: Negative effect on employment through the loss of jobs.

5. Administrative, institutional and political considerations

5.1 Institutional and administrative capacity

It is important that local institutional and administrative capacity exists or is built to ensure that South Africa is able to independently implement the policies and measures. This assessment should include:

- identification of areas where training and capacity building is necessary;
- an assessment of the administrative burden which may arise; and
- identification of the institutional and administrative barriers to implementation.

This does not mean that no PAMs should be advocated where additional capacity building is required, but that PAMs will be more *difficult* to implement if there is limited institutional and sectoral capacity and experience.

Impact scale

+: Sufficient capacity to implement policies and measures.

0: Limited or no capacity to implement policies and measures.

--: Lack of capacity would prevent implementation of policies and measures.

5.2 Potential political and bureaucratic support

This indicator should assess the capacity of policies and measures to pass through political and bureaucratic processes and sustain political support.

Impact scale

+: Significant potential support and no major bureaucratic obstacles

0: Limited potential political support and some obstacles.

--: Major potential bureaucratic obstacles and potential conflict with political priorities.

5.3 Consistency with other public policies

Impact scale

+: PAMs support current policies and ongoing strategy development

0: Limited links to current policies and strategies.

--: Potential conflicts with current public policies and strategies

5.5 Replicability

By replicability, we mean both adaptability to different geographical and socio-economic-cultural settings within and beyond South Africa, as well as the possibility for technological learning that will make future policies and projects easier to implement.

Impact scale

+: Widely and easily replicable within South African (and SADC?*)

0: Limited scope for replicability

--: Almost no scope for replicability

6. Technological considerations: technological feasibility

As many policies and measures will have technological components it is important to provide an assessment of the feasibility of proposed technological inputs. This should take into consideration possible technology development over time, since technologies that are in the demonstration stages today may be fully commercial in 5 to 10 years. Technological feasibility includes:

- the availability of technical support for long-term operation and maintenance;
- the compatibility with existing technology; and
- the accessibility and availability of proposed technology and associated inputs (such as fuel).
- The technologies needed to implement the policy or measure itself – e.g. testing facilities for equipment standards, metering equipment for measuring energy savings

Impact scale

+: Commercially available technology with significant South African experience.

0: Borderline commercial technology with some South African expertise, or technology near commercialisation in other countries.

--: Unproven technology with very limited South African or other country expertise.

Appendix D:
Analysis of existing legal framework

The framework of energy policy has already been outlined in the text. The use of renewable energy (RE) and energy efficiency (EE) need to be viewed within the wider legal and policy framework of South Africa. This section of the document contains an overview and brief analysis of the most important legislation that presently impacts on the use of RE and EE in South Africa.

An overview of this nature also involves a review of those government policies, as reflected in various White Papers, that impact on the way in which RE and EE is dealt with by government. These White Papers may not have the status of law, but they do set out government's intention regarding, *inter alia*, its approach to the use of RE and EE. Although government policy is discussed in a number of other sections of this document it is important that the relevant White Papers and their significance for RE and EE be covered in this section, as they provide guidance on the interpretation of existing legislation and indicate the intentions and objectives for future legislative instruments and frameworks.

The first part of this section of the document identifies and provides a brief discussion of the legislation and policies impacting on RE and EE, beginning with a review of more general overarching legislation and policy including the relevant international agreements and policies. Thereafter, legislation and policy specifically relating to the energy sector will be discussed followed by a review of those instruments governing environmental management. The second part of the section examines specific policies, measures and programmes for RE and EE that currently exist within the South African framework (hyperlinks have been created between the White Paper on the Energy Policy and the measures and programmes in place, where applicable).

Overarching drivers and legislation

Before focusing on specific South African legislation, it is essential to understand the importance of RE and EE in the broader context. The promotion of RE and EE can be understood in terms of a wide range of social, economic, environmental and legal arguments. This part of the document discusses the most significant driving forces, including international agreements and policy, that have led to the attention on RE and EE and the potential benefits that could be derived from implementing strategies to promote them.

National drivers

Social and economic policies

Strategies in the form of the RDP and the Growth, Employment and Redistribution Macroeconomic Strategy (GEAR) (1996) have been driving socio-economic policy and progress in South Africa since 1994. The main energy emphasis in the White Paper on Reconstruction and Development is on meeting basic needs through the electrification of households. Other strategies relating to the rural community, such as the Integrated Sustainable Rural Development Strategy (ISRDS) (2000), also focus on the provision of energy services. Within this context, the potential implications of the use of RE and EE for the provision of energy services to those sectors of society that were previously disadvantaged are being investigated and considered.

Introducing both RE and EE in the energy economy of South Africa will lead to restructuring of the energy sector including their promotion and regulation. The White Paper on Energy Policy, which is dealt with later, provides further guidance on these issues.

The Constitution Act No. 108 of 1996

As the supreme source of law in South Africa, the Constitution establishes parameters for the development and implementation of all other legislation. Legislation conflicting with the provisions of the Constitution will be considered invalid and government action falling outside the established parameters is illegal. Two sections of the Constitution are important for this review: the Bill of Rights and the provisions allocating powers to the different spheres of government.

A number of rights contained in the Constitution are relevant to the provision and use of energy as well as the protection of the environment. Although the right of access to energy services is not

explicitly stated in the Bill of Rights, a number of other rights, by implication, require a system that provides equitable access to adequate energy sources, including:

- right to have access to adequate housing (Section 26);
- right to have access to health care, sufficient food and water and social security (Section 27);
- right to life (Section 2); and
- right to equality (Section 9).

The provision of energy sources must also not conflict with the environmental right (Section 24) which grants everyone the right to a clean and healthy environment and obliges government to take measures to protect this right, such as passing legislation to, inter alia, prevent damage to the environment, promote conservation and ensure sustainable development. In addition, certain other rights provide for procedural matters which assist in giving effect to the substantive rights mentioned above. These rights include just administrative action (Section 33), access to information (Section 32) and the limitation and enforcement of rights (Section 36 & 38).

As the Bill of Rights applies to all law and actions of government, the government is obliged to respect, protect, promote and fulfil the rights contained in the Bill of Rights. Accordingly, the provisions of the Constitution require the state to establish a national energy policy to ensure that the national energy resources are adequately tapped and developed to cater for the needs of the nation. Government must ensure that energy is made available to all citizens at an affordable cost and that energy production and distribution is not only sustainable, but will lead to improvement of the standard of living for all of the country's citizens. For this to happen optimal efficiency is required for the production and utilisation of energy. Accordingly, it was necessary for the energy policy to balance the use of and access to energy resources with environmental considerations. In addition, it will be essential for government to respect these rights in all its actions and decisions relating to the energy sector, including the granting of licenses for energy generation and the implementation of relevant legislation, codes and standards.

The Constitution also provides the legal basis for the allocation of powers to the different levels of government. The functions assigned to the different tiers of government are set out in Schedules 4 and 5 to the Constitution. Although government comprises three tiers, ie. national, provincial and local, the Constitution requires interdependence and co-ordination between them.

In terms of Schedule 4 'environment', general 'pollution control' 'housing', 'industrial promotion' and 'road traffic regulation' have been delegated as areas of concurrent national and provincial legislative competence (Part A) whilst 'air pollution,' 'building regulations' and 'electricity and gas reticulation', have been specifically delegated as a local government matter (Part B). Accordingly, local authorities have the executive authority and the right to administer issues relating to air pollution, building regulations and electricity and gas reticulation; however, provincial government has the legislative and executive authority to monitor the local authorities and ensure effective performance.

This allocation of responsibilities will affect the way in which specific PAMs are legislated and implemented and may result in duplications and ineffective regulatory control. This issue is discussed in further detail in section (cross cutting issues).

International drivers

Developing an energy framework for the promotion of RE and EE cannot be understood in the context of South Africa alone but must be seen within the global context as it involves several international transactions and agreements that involves obligations and responsibilities. In order to meet its international obligations regarding RE and EE the government must develop a framework within which the RE and EE industries can operate, grow and contribute positively to the South African economy and the global environment. As a party to certain international agreements South Africa may be able to access essential financial and other resources to develop an effective RE and EE sub-sectors

United Nations Framework Convention on Climate Change 1992

Of particular significance to energy related issues is the United Nations Framework Convention on Climate Change (UNFCCC) ratified by South Africa in 1997. The fundamental objective of this

convention is to achieve the stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, while allowing sustainable development to proceed (Article 2). As the UNFCCC is a framework convention, it reflects broad consensus in establishing institutions and procedures for further defining and approaching climate change.

By ratification of the UNFCCC, South Africa is required, in terms of Article 4, taking into account its common but differentiated responsibilities and specific national and regional development priorities, objectives and circumstances, to, inter alia:

- 'formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all GHG's not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change';
- 'promote and co-operate in the development, application and diffusion, including transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors';
- 'take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adopt to climate change'.

South Africa has conducted a Country Study, including a greenhouse gas inventory, studies on adaptation and mitigation potential and is in the process of formulating a response strategy. Having not yet submitted a National Communication containing these documents, however, much of this information is not yet in the public domain.

Kyoto Protocol to UNFCCC

The UNFCCC can only be implemented by a series of agreements by its Parties through protocols such as the Kyoto Protocol, that was adopted at the third Conference of Parties in 1997. This protocol resulted from the parties' agreement to establish a process for strengthening the industrialised countries' commitments contained in the UNFCCC. The Protocol requires industrialised countries (Annex I countries) to reduce their combined GHG emissions by 5.2% compared to 1990 levels by the period 2008 to 2012. The protocol will only come into force once it has been ratified by at least 55 parties to the UNFCCC, including Annex I parties accounting for at least 55% of the total 1990 carbon dioxide emissions in this industrialised group. The Protocol does not commit developing (non-Annex I) countries, such as South Africa, to any quantified emission targets in this first commitment period.

South Africa acceded to the Protocol in March 2002 and, as a party to the Protocol, South Africa is expected to formulate, implement, publish and update national and regional programmes which must be focused on the energy, transport, industry, agriculture, forestry and waste management sectors.

Provision is made in Article 12 of the Protocol for setting up a Clean Development Mechanism which provides for promotion of sustainable development in developing countries by allowing developed countries to invest in sustainable development projects that lead to GHG reduction and claim credit for such reductions towards their commitment to the Protocol. This mechanism could result in increased investments in South Africa programmes and projects that promote RE and EE.

Annex 1 parties, in achieving the emission limitation and reduction commitments in order to promote sustainable development are obliged in terms of Article 2 to implement and/or further elaborate policies and measures such as:

- enhancement of energy efficiency in relevant sectors of the national economy;
- research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies; and
- limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy.

To date the Protocol has yet to come into force. During the WSSD the Russian Federation announced its intention to ratify the protocol and more recently is Canada indicating that, despite the USA's attempts to scupper the Protocol, multilateral support for the climate change regime remains intact with the possibility that the Protocol may enter into force by early 2003.

World Summit on Sustainable Development: Plan of Implementation

Two main documents were negotiated during the proceedings of the WSSD in August/September 2002. The Plan of Implementation and the Johannesburg Declaration on Sustainable Development. The Johannesburg Declaration outlines the path taken from the 1992 United Nations Conference on Environment and Development (UNCED) to the WSSD, highlights challenges, expresses commitment to sustainable development and emphasises the need for implementation.

The Plan of Implementation is designed as a framework for action to implement the commitments originally agreed at UNCED. It includes eleven chapters, including a chapter on changing unsustainable patterns of consumption and production. This chapter proposes action to be taken by governments, relevant international organisations and the private section to fundamentally change the way societies produce and consume resources in order to achieve global sustainable development. The use of energy is dealt with in this context.

A target to increase the global share of RE was proposed by some countries but not included, while it is recognized in the plan that there needs to be more focus on the use of RE sources. The chapter also reflects the agreement reached on diversifying energy supply by developing advanced, cleaner, more efficient affordable and cost effective energy technologies, including fossil fuels, and RE. The final text in relation to energy for sustainable development contains twenty-three key commitments including the following:

- develop and disseminate alternative energy technologies with the aim of giving a greater share of the energy mix to renewable energies, improving energy efficiency and greater reliance on advanced energy technologies, including cleaner fossil fuel technologies (Section 19(c));
- combine, as appropriate, the increased use of RE, resources, more efficient use of energy, greater reliance on advanced energy technologies, including advanced and cleaner fossil fuel technologies and the sustainable use of traditional energy resources, which could meet the longer term commitment to achieve sustainable development (Section 19(d));
- diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost effective energy technologies, including fossil fuel technologies and RE technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of RE sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiative, where they exist, and ensuing that energy policies are supportive of developing countries efforts to eradicate poverty, and regularly evaluate available data to review progress to this end (Section 19(c));
- establish domestic programmes for EE; including as appropriate by accelerating the development of EE technologies with the necessary support of the international community (Section 19(h));
- accelerate the development, dissemination and deployment of affordable and cleaner EE and energy conservation technologies (Section 19(i));
- recommend that international financial institutions and other agencies' policies support countries to establish policy and regulatory frameworks that create a level playing field (Section 19(j));
- strengthen and facilitate, as appropriate, regional co-operation arrangements for promoting cross-border energy trade including the interconnection of electricity grids and oil and natural gas pipelines (Section 19(v)).

National energy legislation and policy

There is very little South African legislation promoting and regulating the use of RE and EE. South African potential to further develop and implement renewable energy as the resource base in this

country is extensive and many appropriate applications have been identified. South Africa has no mandatory energy efficiency standards, norms or regulations in place. The White Paper on the Energy Policy of the Republic of South Africa recognises this shortcoming and sets out government's objectives relating to these two issues. The government has reiterated these objectives and provided for specific goals and actions in the Draft White Paper on the Promotion of Renewable Energy and Clean Energy Development: Part One (DME 2002b). These two policies are discussed in some detail before focusing on legislation that regulates the electricity and liquid fuels and gas sectors.

The electricity sector is in the process of being restructured both within the electricity supply industry as well as on the distribution side based on the rationale that the restructuring of the industry will promote economic and technological efficiency as well as achieving social benefits. However, opinions vary as to whether the changes envisaged will achieve these goals. Concern has been raised on its impact on public benefits , environmental protection, public interest research and development activities and improved access to energy. In order to understand the implications of the restructuring process for RE and EE this section provides a review of the relevant legal instruments which will give effect to this process. As much of the legislation has yet to be finalised, this review aims to provide an outline of the main intention of these instruments rather than to provide an in depth analysis.

White Paper on the Energy Policy of the Republic of South Africa 1998

The White Paper is critical in setting the policy context for policies and measures for energy efficiency and renewable energy, and thus has already been outlined.

Draft White Paper on the Promotion of Renewable Energy and Clean Energy Development: Part One (August 2002)

The policy context giving rise to this draft white paper has been described above; the legal context is outlined in this section.

As a result of the position taken in the White Paper on Energy Policy in which government undertakes to provide 'support for the development, demonstration and implementation of renewable energy sources for both small and large scale applications', Part One of the White Paper on the Promotion of Renewable Energy and Clean Energy Development provides a more in depth discussion of the government's vision, policy principles, strategic goals and objectives for promoting the use of RE. In addition, it provides information to the public, the international community as well as to organs of the state as to the government's goals and the way in which it intends to achieve them.

The overall vision for the role of RE in South Africa's energy economy as stated in the White Paper is: 'An energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa, thus contributing to sustainable development and environmental conservation.' The policy creates the basis from which government can strategically develop its RE resources through the implementation of a properly managed programme of action. Such a programme should provide for the sustainable exploitation of the abundant RE resources in South Africa, thereby minimising the negative effect that energy production has on the environment and contributing to the global effort to mitigate greenhouse gas emissions. In addition to the environmental benefit of using these sources as an alternative to fossil fuels, it is recognised that the current surplus of electricity generation capacity from fossil fuels is temporary and significant new capacity will be required to meet the demands in the future. RE sources therefore have an important role to play due to their abundance in this country, their ability to be exploited on a sustainable basis and the generally lower operation and maintenance costs associated with RE technologies.

Renewable energy is defined as 'solar energy, wind and biomass, to produce electricity, fuel, liquid fuels, heat or a combination of these energy types', but in estimates of potential, hydro and landfill gas are also included.

Government recognises in the White Paper that the utilisation of RE resources is presently not cost-competitive in many areas in comparison to the fossil fuel energy supply industry, which is attributed primarily to the high investment costs. Accordingly, government realises that it will need to create an enabling environment by means of fiscal and financial support mechanisms within an effective legal and regulatory framework so that RE technologies are given the opportunity to compete with traditional technologies. In addition, mechanisms will need to be developed to

overcome a number of other barriers associated with the supply of electricity, (for example, non-discriminatory third party access to the Grid or national electricity network).

A strategic plan on RE based on this policy will be developed to translate the goals and objectives into an implementation plan. The policy sets a specific medium-term goal (10 years) for RE, ie:

> An additional 10 000GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2012, to be produced mainly from biomass, wind, solar and small-scale hydro.

The sustainable development criteria of economy, environment and social priorities will be used to guide the strategy. One of the significant investigations to be undertaken during the strategy phase will involve an analysis of the legal and regulatory instruments which will need to form part of the enabling framework of mechanisms to support the promotion of RE (outlined under the legal framework).

A goal of 10 000 GWh of renewable energy is set. This goal reflects the intention of government and provides a target against which government can be measured. It is not enforceable as part of government policy; however, it reflects a clear statement of intent and a basis upon which government could be challenged if the target is not met.

The specific legal system that would be required to implement RE policy and strategy is spelled out in the White Paper. The development of an appropriate legislative and regulatory framework is necessary to meet the following objectives:

- pricing and tariff structures to support the integration of re into the energy economy and to attract investment;
- integration of independent power producers into the existing electricity system; and
- integration of local producers of liquid fuels and gas from re resources into their respective systems.

The specific deliverables identified in the White Paper include:

- appropriate regulations for grid connection and wheeling of electricity generated from RE;
- phasing of regulations requiring power generators' tariffs to be based on full cost accounting and the incorporation of environmental externalities;
- new legislation for the energy sector incorporating RE and EE that provides equitable opportunities for their development;
- regulations for the petroleum industry to accommodate locally produced bio-diesel and ethanol;
- rights for property owners to capture solar radiation on their property without interference by other structures or vegetation of neighbouring properties;
- appropriate legal and regulatory instruments to stimulate the uptake of RE power generation into the electricity system; and
- mechanisms to increase the access of renewable energy to the nat ional electricity grid.

Certain financial instruments and legal/regulatory measures to promote RE have already been identified in the policy and will require further consideration during the development of the strategy and specific action plans. The legal measures include:

- generation or refining licences;
- introduction of a grid-connection or pipeline connection code containing the minimum requirements of connecting to the grid or pipeline network;
- procedures and charges for wheeling the power from the generator to a customer through the national electricity grid;
- power purchase agreements of sufficient duration between the generator and the purchaser of electricity; and
- a system of compensation associated with the cost of electricity generated from different technologies and different geographic locations.

The policy provides for the regulation and promotion of RE within the existing institutional structure. The DME will assume overall responsibility for RE policy co-ordination, although it will work closely and facilitate the implementation of the policy in cooperation with other national departments and government bodies. The National Electricity Regulator (NER), the South African Bureau of Standards (SABS) and the Central Energy Fund (CEF) are specifically mentioned in the policy as playing an important role in the promotion of RE as outlined by the appropriate regulatory and legal framework that will be developed. The NER, which has jurisdiction over the entire industry and regulates market access through licensing of producers, transmitters, distributors and sellers of electricity, will be tasked with regulating the phased introduction of RE generators. The SABS will need to provide for the promotion and maintenance of standardisation and quality in connection with commodities and the rendering of services. It will be necessary to determine standards for a range of items such as fuel specifications, housing, water heaters, etc. A number of SABS codes deal with energy efficiency issues; however, they are all voluntary and not widely used or recognised. The CEF is aimed at, inter alia, contributing to the development of the energy sector by contributing to the universal access to energy, including the increased use of RE. Mechanisms will need to be investigated to extend operational support available from the resources in the CEF to RE programmes.

Eskom Conversion Act No. 13 of 2001

This Act converted the utility into a wholly state-owned company which is required to pay tax and dividends to the government, although tax need only be paid after the expiry of a three year tax exemption period. As ownership of the Eskom Group has not changed, this conversion amounts to the 'commercialisation' of the utility as opposed to privatisation. Within the Eskom Group a private company, Eskom Enterprises (Pty) Ltd, was formed in 1999 to carry out the non-regulated electricity related activities of Eskom in South Africa, and all its other energy and related activities outside South Africa. Eskom Enterprises' core business comprises the development, operation and maintenance of infrastructure in the energy and water supply sectors; the provision of contracted research and development, utility management, project management and consulting services; investment in the creation or acquisition of assets and business ventures in the energy generation and transmission fields, in telecommunications and in information technology; and exploring for and extracting or refining primary energy sources prior to conversion into secondary energy forms such as electricity.

Electricity Regulation Bill

The Electricity Supply Industry Regulatory Bill was released for public comment during October 2002 as the Electricity Regulation Bill. The comments received are in the process of being analysed and consolidated and the Bill will be amended if necessary prior to being re-submitted to Cabinet for final approval and subsequently to Parliament for promulgation.

This Bill, once enacted, will establish the national regulatory framework for the electricity supply industry resulting in the repeal of most of the provisions of the Electricity Act No. 41 of 1987 which is still presently applicable. The NER referred to in the 1987 Act will continue in existence under the new Act as the National Electricity Regulatory Authority (NERA) and will continue to regulate the entire industry largely regulating by market access through licensing and registration of producers, transmitters, distributors and sellers of electricity. The NERA must approve all electricity tariffs and regulate the quality of supply in addition to mediating disputes and customer complaints. Within the ambit of its powers, the NERA may promote competition in the electricity supply industry. In exercising its powers and functions, the NERA is obliged to, inter alia, encourage energy efficiency, economy and safety in the use of electricity; promote and monitor electrification; approve tariffs and charges, having regard to both the interests of customers and the needs of licensees; and have regard to the health, safety and the environment within the framework of existing policy and legislation.

The Bill provides that the members of NERA will also constitute the Gas Regulator and the Petroleum Pipelines Regulator. The balance of chapter 2 deals with the constitution of the regulatory authority and various other procedural and administrative matters relating to issues such as decision making, accounting, reporting and the formation of various committees. Chapter 3 deals with licences and registration in some detail and provides for licence conditions relating to a wide range of matters.

One of the aims of restructuring the electricity supply industry is to create an environment that facilitates the entry and operation of multiple power generators, including renewable independent power producers. The NERA in conjunction with the Department of Minerals and Energy will need

to address the main obstacles preventing entry of independent power producers into the market ie. the present low cost of Eskom's electricity and the lack of non-discriminatory third party access to the grid.

Electricity Distribution Industry Restructuring Bill

The Bill has yet to be released for public comment and the legislation development plan (dated 30 October 2002) of the DME reflects that this Bill will be presented to Parliament in the second quarter of 2003. Once enacted, this Bill will establish a national framework for the restructuring of the electricity industry. As part of the restructuring, the Bill provides for the creation of regional electricity distributors (REDs) and the transferral of employees, assets, rights, liabilities and obligations to the REDs through transfer schemes. A state-owned company which will be known as EDI Holdings (Pty) Ltd will be a shareholder in any RED established in terms of the Bill. REDs will be subject to the provisions of the Electricity Regulation Act and shall be required to apply for and hold licences under that Act.

This Bill also regulates the relationship between the REDs and municipalities by requiring the parties to enter into service delivery agreement. Guidelines or standards for these agreements may be set by the NERA, after consultation with the Minister and EDI Holdings.

Significant reservations have been expressed as to whether restructuring will result in increased public benefits. An international review of restructuring in several industrialized and developing countries concluded that the restructuring process has given relatively little serious attention towards ensuring that investment in EE is maximised (Clark 2000). As ownership passes out of government hands, EE programmes, which contribute to the social and environmental good of the country, are likely to become less important to the shareholders who are more interested in the bottom line.

Liquid fuel and gas sectors

Gas Act No 48 of 2001

This Act was promulgated in order to develop the piped gas industry and a regulatory framework within which it can operate. 'Gas' is defined in the Act as:

> all hydrocarbon gasses transported by pipeline, including natural gas, artificial gas, hydrogen rich gas, methane rich gas, synthetic gas, coal bed methane gas, liquefied natural gas, compressed natural gas, re-gasified liquified natural gas, liquified petroleum gas or any combination thereof.

Accordingly, the Act provides for the integration of RE sources such as landfill gas into the gas industry regulatory framework. Although the promotion of RE is not specifically dealt with in the Act, the Act does oblige the Gas Regulator to monitor, approve and regulate transmission and storage tariffs and charges; to promote competition in the gas industry and to promote the optimal use of available gas resources. In addition, the Minister of Minerals and Energy can make regulations regarding price regulation procedures and principles as well as mechanisms for the promotion of historically disadvantaged South Africans. These regulatory measures can be used to promote the use of RE.

Petroleum Products Act No 120 of 1977

This Act provides for, inter alia, the maintenance and control of prices associated with petroleum products, including products which can be used for a purpose for which petroleum fuel or any lubricant may be used. In terms of the proposed amendment to the Act (GG 22593 dated 24 August 2001) the Minister of Minerals and Energy will remain the liquid fuels industry regulator and may prescribe the price at which any petroleum product may be sold or bought, the method of trading, publishing of prices and quantities of crude oil or petroleum products to be maintained by any person. The Minister shall furthermore appoint a person in the public service as a Licensing Authority who shall issue licences in terms of the Act and in issuing licences shall, inter alia:

- promote an efficient and internationally competitive retail petroleum industry;
- ensure countrywide availability of petrol and diesel at competitive prices;
- ensure compliance with product, environmental, health and safety standards;

- promote employment opportunities and small business development in the petroleum sector, and
- comply with government policy as determined from time to time.

These provisions provide a basis for the integration of RE derived liquid fuels into the petroleum industry regulatory framework, particularly as the issuing of licenses will have to comply with the provisions of the White Paper on the Promotion of RE and Clean Energy Development.

Petroleum Pipelines Bill

Cabinet approved submission of this Bill to Parliament on 9 October 2002 and promulgation is therefore imminent. This Bill is an important legal instrument in the process of liberalization of the liquid fuels industry. The objects of the Bill once promulgated are to, inter alia:

- promote competition in the provision of commercial services and limit anti-competitive practices in the construction and operation of pipelines, offloading facilities and storage facilities;
- ensure the safe, efficient, economic and environmentally responsible transport and storage of cradle oil and petroleum products with regard to pipelines, offloading facilities and storage facilities; and
- promote fair and equitable access to pipelines, offloading and storage facilities, and to commercial services connected therewith.

A Petroleum Pipelines Regulator is established in terms of the Bill in order to act as custodian and enforcer of the national regulatory framework. All necessary applications for licences and registrations must be submitted to the regulator.

This Bill is also an important component in the legal framework that will allow the integration of RE derived fuels into the petroleum industry.

National Environmental Legislation and Policy

In addition to legislation and policy that deals directly with the energy sector, the following instruments pertaining to environmental management will influence the way in which government regulates RE and EE. The use of RE and the implementation of measures to promote EE can have positive implications for human health and the environment.

National Environmental Management Act No. 107 of 1998

The National Environmental Management Act (NEMA) was promulgated to give effect to certain provisions of the White Paper on a National Environmental Management Policy for South Africa discussed below. The Act provides for co-operative environmental governance by establishing:

- principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance; and
- procedures for coordinating environmental functions exercised by organs of state.

NEMA aims to give effect to the obligations relating to co-operative government contained in section 41 of the Constitution for environmental matters. It should be viewed as a framework for the integration of sound environmental management into all government activities.

Section 2 contains a set of principles that apply to the actions of all organs of state that may significantly affect the environment (no guidance is provided in the Act as to when government's action should be regarded as doing this). The principles must be used to guide decisions as well as for the interpretation, administration and implementation of any other law concerned with the protection or management of the environment (Section 2(1)(e)). A number of these principles are open to interpretation which render any attempt to isolate clear obligations difficult. Until such time as a body of precedents has been developed, any attempt to apply these principles should be undertaken with reference to section 24 of the Constitution discussed above, and more specifically the concepts of 'reasonableness' and 'justifiability' contained in section 24 of the Constitution. (The DEAT is currently developing a guideline document to facilitate the implementation of these provisions.)

A number of the principles have implications for the promotion of RE and EE, including the following:

- Development must be socially, environmentally and economically sustainable.
- Sustainable development requires the consideration of all relevant factors including the following:
  - that pollution and degradation of the environment are avoided or where they cannot be altogether avoided, are minimised and remedied;
  - that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
  - that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
  - that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- Environmental management must place people and their needs at the forefront of its concern, and serve the physical, psychological, developmental, cultural and social interests equitably.
- Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.
- Global and international responsibilities relating to the environment must be discharged in the national interest.

The Act provides for the application of these principles in various ways including the requirement that the provinces and certain national government departments prepare either environmental implementation plans or environmental management plans. The principles provide the framework within which these plans must be formulated and the plans are designed to provide for the co-ordination of environmental functions exercised by organs of state. Accordingly, the plans prepared by government will need to address the promotion of RE and EE as a component of a wider strategy to comply with the principles and obligations contained in NEMA.

Chapter 6 of the Act deals with International Obligations and Agreements. The provisions generally set out existing practices rather than substantive issues. The Minister is empowered to pass domestic legislation to give effect to international instruments, including those that may deal with RE and EE. It also requires the Minister to prepare two kinds of reports annually: a general report concerning international environmental instruments and a specific report in order to meet the governments' commitment to Agenda 21 (Annual Performance Report on Sustainable Development). A National Strategy for Sustainable Development is also to be developed. Matters related to RE and EE are likely to feature in these reports.

In addition to the above, NEMA contains certain provisions which place obligations on government and members of civil society which have indirect implications for the use of RE and EE. These provisions relate to, inter alia:

- environmental impact assessments;
- duty of care not to pollute or degrade the environment;
- extension of liability for environmental infringements; and
- access to environmental information.

The Act also provides for the establishment of certain institutional structures, including the National Environmental Advisory Forum and the Committee for Environmental Co-ordination (CEC). The object of the National Environmental Advisory Forum is to inform the Minister of the views of stakeholders regarding the application of the principles set out in the Act and to advise the Minister on any matter concerning environmental management and governance and specifically the setting and achievement of objectives and priorities for environmental governance; and appropriate methods of monitoring compliance with the principles set out in section 2. The CEC's function is to promote the integration and co-ordination of environmental functions by relevant organs of state; and the achievement and objectives of environmental implementation plans and environmental management plans.

Atmospheric Pollution Prevention Act No 45 of 1965

This Act is the primary source of air pollution regulation and is administered by DEAT. It provides for the delegation of powers from the Chief Air Pollution Control Officer (CAPCO) to local authorities. Noxious or offensive gases, smoke, dust and motor vehicle emissions are controlled in terms of this Act. Accordingly, if industrial emissions result in noxious or offensive gases or cause smoke, the activities causing these emissions are regulated in terms of the Act. The control structure for noxious or offensive gases is process driven, in that seventy two scheduled processes listed in the Act are controlled through the granting of registration certificates. Power generation processes are included in the list and defined as processes in which:

(a) fuel is burned for the generation of electricity for distribution to the public or for the purposes of public transport;

(b) boilers capable of burning fuel at a rate of not less than 10 tons per hour are used for raise steam for the supply of energy for purposes other than those mentioned in (a) above;

(c) any fuel burning appliance is used that is not controlled in terms of Part III of this Act, excluding appliances in private dwellings.

Other scheduled processes which may be applicable to the generation of power from RE resources are gas, coke and charcoal processes (which include the use of 'wood or other carbonaceous materials or products of petroleum refining or natural gas or methane from coal mines or gas derived from fermentation of carbonaceous materials') and waste incineration processes.

The registration certificates will only be granted once the CAPCO is satisfied the best practicable means are being adopted to prevent or reduce to a minimum the escape into the atmosphere of noxious or offensive gases. These certificates will have conditions attached that must be complied with. No overall standards of air cleanliness are set and the degree of industrial air pollution tolerated will depend almost entirely on the discretion of the CAPCO. The Department of Environmental Affairs and Tourism has published South African Air Pollution Guidelines, as well as Guidelines for the Operation of Incinerators. These guidelines are not of legislative force, but are often used by the Department in determining appropriate conditions when granting registration certificates in terms of Part II of the Act.

Revised Guidelines for Sulphur Dioxide (GNR 1387, GG 22941 dated 21 December 2001) were published in terms of section 12 of the Act. These guidelines are, however, recognised as temporary as a complete revision of legislation governing air pollution is underway. The National Air Quality Management Bill is likely to be issued for comment in the first quarter of 2003. This Bill provides for the reform of law regulating air quality with the aim of reducing air pollution and improving air quality. It gives effect to the objectives related to air quality management contained in the White Paper on Integrated Pollution and Waste Management and provides for the control of air pollution through the different levels of government in accordance with the allocation of functions set out in the Constitution. The Bill focuses on ambient air quality management rather than on point source pollution control providing for impact management through compliance with ambient air quality standards. Although certain processes will be controlled through licensing procedures as is the case under existing legislation, the Bill provides mechanisms for setting both ambient air quality standards in addition to emission standards. More stringent provisions have been included to ensure compliance and facilitate enforcement, including the establishment of structures for adequate monitoring and information management. The ongoing development of standards is proceeding together with the drafting of this new legislation.

The impact of scheduled processes on the environment is also regulated through the environmental impact assessment regulations (GN 1182 and 1183 (as amended) dated 5 September 1997 issued in terms of the Environment Conservation Act No. 73 of 1989). These regulations must be followed before the commencement of any scheduled process.

In addition to controlling emissions from scheduled processes, dust generation and vehicle emissions, Part III of the Act regulates the emission of smoke by controlling the siting and performance of 'fuel burning appliances' that produce smoke (including soot, grit and gritty particles emitted in smoke). In order to control fuel burning appliances, the Act adopts a number of strategies, the first dealing with the effectiveness of these appliances. In addition to a number of other requirements, section 15(1) states that certain fuel burning appliances cannot be installed

unless they meet certain energy efficiency criteria, although it is left to the discretion of the local authority or the CAPCO as to whether the appliance is being effectively operated. Part III of the Act is administered by both national and local government.

Emissions of smoke are regulated only within areas in respect of which this Part of the Act has been declared applicable. No person may install any fuel burning appliance on any premises unless, so far as is reasonable practicable, it is capable of being operated continuously without emitting dark smoke or smoke of a colour darker than may be prescribed by regulation (although certain allowances are made for unavoidable emissions). In addition, no person may install any fuel burning appliance designed to burn pulverised solid fuel or solid fuel in any form at the rate of 100kg or more per hour or to subject solid fuel to any process involving the application of heat, unless such appliance is fitted with effective equipment to limit the emission of grit and dust emissions to the satisfaction of the local authority or the Chief Officer, as the case may be. Prior notice must be given to the authorities of such a proposed installation. In addition to ensuring the effective operation of fuel-burning appliances, these requirements/criteria also constitute measures to promote EE.

Although the provisions of the APPA were drafted to regulate air pollution in accordance with best environmental practice, the Act was promulgated in 1965 when measures and technologies to ensure effective environmental management were less advanced than they are today. The focus of this Act, which has not been substantially amended since its promulgation, was not on contemporary issues such as EE and the promotion of the use RE. The government has recognized the need for more stringent, modern legislation to manage air quality and the National Air Quality Management Bill is in the process of being finalised.

Environmental policy instruments

The following two important policies create the government's framework for the management of the environment in South Africa. Although RE and EE are not specifically dealt with in these documents, the promotion and use of RE and measures to ensure EE are vital for the sustainable use of energy and contribute to the protection of the natural environment.

White Paper on an Environmental Management Policy for South Africa, 1998

DEAT published the White Paper on the Environmental Management Policy for South Africa on 15 May 1998 (GG 18894) which develops a policy based on sustainable development as required by the Constitution. The incorporation of the sustainable development concept in the environmental policy represented a departure from the basis on which legislation had been drafted in the past and reflects the alignment of South Africa policy with international trends.

The National Environmental Management Act (discussed above) was promulgated to give effect to the White Paper but does not expressly give effect to all the issues addressed in the White Paper.

The government's new vision recognises 'that past developments have emphasised exploitation and optimisation of South Africa's mineral and natural resources with little concern for long term environmental impacts'. It also recognises that 'constraints, essential for environmental sustainability can lead to innovation' and quotes, as an example, the technological innovation in countries like Japan and Germany, based partly on the search for energy efficiency that was driven by high energy prices. A clearly stated goal of the policy is to 'move from a previous situation of unrestrained and environmentally insensitive development to sustainable development with the aim of achieving a stable state economy in balance with ecological processes.'

White Paper on Integrated Pollution and Waste Management, 2000

The main aim of this White Paper, which was published on 17 March 2000 (GG 20978), is to develop an integrated system of pollution and waste management and to achieve sustainable social and economic development while affording the necessary protection to air, water and land resources. The White Paper addresses the problems arising out of current pollution control practices by, inter alia, establishing an integrated management system. The White Paper identifies the following issues relevant to air pollution which will be considered in relation to policy implementation:

- smoke (particulates) arising from coal and fuel burning;
- vehicle emissions;

- emissions from industrial activities;
- dust arising from mining and industrial activities;
- various sources of greenhouse gases;
- waste disposal sites;
- incineration emissions;
- acid rain; and
- noise.

The more extensive use of RE and measures to promote EE will result in decreased air pollution and should form part of any strategy to tackle this type of pollution.

The National Waste Management Strategy process was initiated to give effect to the waste elements of the White Paper and focuses on, *inter alia*, waste minimisation and avoidance and prevention of pollution. Waste disposal is seen as the last waste management option that should be considered. National legislation to give effect to the policy and strategy is in the process of being drafted.

Appendix E:
Estimates of renewable energy potential

The draft Renewable Energy White Paper estimates are reported in Table A1.

Table A1: Renewable energy potential
Source: DME (2002b)

Resource	***Theoretical potential***	
	TWh/year	*PJ / year*
Solar water heating [1]	0.5	1.8
Solar photovoltaic [2]	40 000	144 000
Solar thermal electric [3]	20 000	72 000
Wind [4]	5.7	20.52
Bagasse [5]	5	18
Wood waste [6]	2.62	9.432
Landfill gas [7]	0.93	3.348
Hydro [8]	10	36
Total energy consumption 1999	600	2 160

Notes

1. Based on estimate of SWH market potential.
2. Based on average of 7501 MJ/m ^{2}/year solar radiation (DME, Eskom, CSIR, 2001), 8% solar to electric efficiency, 22% capacity factor, 84% land area.
3. Based on 6480 MJ/m2/year solar radiation (DME, Eskom, CSIR, 2001), 16% solar to electric efficiency, 40% capacity factor, 16% land area. (Based on Eskom's 100 MW Solar Thermal Power Plant feasibility study, 1% (19400km ^{2}) of suitable area in the Northern Cape which is harnessed for solar thermal power generation could generate a potential of 1.3 x 10 ^{6} TJ or 30 Mtoe/year electricity which is 1.7 times the total energy consumption of 1999 (2.2 million TJ) (16% solar to electric efficiency, 40% capacity factor)).
4. Assumed annual capacity factor of 33%
5. Assumed annual capacity factor of 68.5%
6. Assumed annual capacity factor of 80%
7. Assumed annual capacity factor of 85%
8. Assumed annual capacity factor of 55% (run-off river schemes)

A DANCED-funded study on the market potential for renewable energy provided the estimates shown in Table A2.

Table A2: Renewable energy resources
Source: DME (2000a)

Resource	*Total energy contribution (PJ/year)*
Wind [1]	6.2
Bagasse [2]	47
Wood [1]	44
Hydro [3]	40

Notes

1. Based on total theoretical potential of total resource
2. Based on total energy value of current harvest
3. Harvestable potential

The difference between stock and flow resources is applied to South African energy sources in Table A3, comparing both renewable and non-renewable resources and reserves.

Table A3: South African energy resources
Source: Adapted from Howells (2000)

Resource	*Reserves*	*Reference*
Flow (in PJ / year; 10^{15} joules /yr)		
Hydro	20	Dutkiewicz (1993)
Wind	50	Estimate
Solar	8 500 000	Doppegieter (1996)
Wood	220	Forest Owner's Association (1997)
Agricultural waste	20	Estimate
Municipal solid waste	34	Dutkiewicz (1993)
Bagasse	49	Kenny (1999)
Stock (in PJ)		
Coal	850 022	Minerals Bureaux (2000)
Crude oil	1 920	Estimate
Natural gas [1]	1 418	International Energy Agency (1996)
Coal bed methane	3 500	International Energy Agency (1996)
Uranium [2]	157 853	Department of Minerals & Energy (1997)

Notes

1. The Bredasdorp basin off the Cape South coast.
2. Includes 'reasonably assured resources' and 'estimated additional resources'

Appendix F: Modelling input tables

1. Modelling input structure

Agriculture	Thermal	by fuel (electricity, coal, Diesel, LPG, Petrol, Kerosene, etc)
	Non- thermal	by demand (cooling, HVAC, Pumping, Fans, Material Handling, Process, Other Motive, Lighting, Homes and Hostels)
Transport	land freight	by modes (Diesel train, Diesel truck, Electric train, Efficient Diesel Truck)
	Air transport	by fuel (Jetfuel, Petrol)
	land passenger	by mode (std and eff petrol cars, Diesel cars, electric cars, rail, bus, petrol taxi, diesel taxi, steam train)
	Other	by fuel (fuel oil, LPG, Kerosene)
Other	All end uses	by fuel
Commerce	Thermal	by fuel (Coal, CH4 rich gas, LPG, Kerosene, Fuel oil, H2 rich gas, Natural gas, Electricity)
	Non- thermal	by demand (HVAC, Lighting, Refrigeration, other, eff HVAC)
Residential	Cooking	by demand device (Elec hot plate, elec microwave, elec stove, Kro primus, Kero wick, LPG ring, coal stove, coal Brazier, wood stove, nat gas ring, eff wood stove, eff coal stove)
	Water heating	by demand device (LPG geyser, elec geyser, Kerosene, solar, nat gas geyser, wood, coal, agricultural waste, insulated geyser)
	Other	by demand device (all elec, LPG fridges)
	Lighting	by demand device (Elec incandescent, elec four, elec cfl, LPG pres, Kero wick, Keo pres)
	Space Heating	by demand device (elec heater, wood, dung open fire, kero heater, anthro heater, LPG heater)
Industry	gold mining	by fuel (Electricity, coal, H2 rich gas, fuel oil, diesel, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Iron and Steel	by fuel (Electricity, coke oven coke, coal, H2 rich gas, fuel oil, coke oven gas, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Chemical	by fuel (Electricity, coal, H2 rich gas, fuel oil, CH4 rich gas, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Other mining	by fuel (Electricity, coal, diesel, H2 rich gas, fuel oil, LPG, kerosene, natural gas)

		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Non ferrous Metals	by fuel (Electricity, coal, H2 rich gas, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	non metalic minerals	by fuel (Electricity, coal, H2 rich gas, fuel oil, CH4 rich gas, natural gas) elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Pulp and Paper	by fuel (Electricity, coal, wood, CH4 rich gas, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Other Industry	by fuel (Electricity, coke oven coke, H2 rich gas, CH4 rich gas, fuel oil, petrol, diesel, kerosene, LPG, coal, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
	Food and Tobacco	by fuel (Electricity, H2 rich gas, fuel oil, bagasse, methane rich gas, coal, natural gas)
		elec process requirements (cooling, HVAC, pumping, fans, comp air, mat handling, process, other motive, lighting , electro chem, homes and hostels)
Non Energy	coal products	
	oil products	
	wood products	
	natural gas products	
Marine Bunkers	ships	

2. Household energy demand

				final energy		useful energy	
End Use	***% of households***	***Intensity***	***Fuel***	***%Share of fuel***			
		GJ/hh		***2000***	**2020 (baseline)**	**2000**	**2020 (baseline)**
Cooking	100	12.3	Elec	19	46.5	40.8	65.3
			Coal	49	32.5	25.9	15.2
			Kerosene	18	12	20.7	12.1
			LPG	2	1	2.7	1.6
			Wood	12	8	9.9	5.9
Water heating	100	3	Elec	98	99	98	99
			LPG	1	<1	1	<1
			Solar	1	<1	1	<1
			Agri Waste	<1	<1	<1	<1
			Coal	<1	<1	<1	<1
			Wood	<1	<1	<1	<1
Other	2001,55%:2020,80%	5.6	Elec	94	96	90	93
			LPG	6	4	10	7
Lighting	100	1.6	Elec	81	92	99	99
			Kerosene	18	7	<1	<1
			LPG	<1	<1	<1	<1
Space heating	100	9.5	Anthracite	3	3	3	3
			Dung open fire	5	3	4	2
			Electric Heater	12	19	24	38
			Kerosene	2	1.5	4	2
			LPG	1	<1	1	<1
			Wood	78	73	65	56

3. Electrification

Year	Type of Area	Population*	Houses*	Houses Electrified	Houses Not Electrified	% Electrified	% Not Electrified
1999	Rural	20 009 245	3 873 990	1 793 193	2 080 797	46.29	53.71
	Urban	23 045 062	5 745 180	4 585 185	1 159 995	79.81	20.19
	Total	**43 054 307**	**9 619 170**	**6 378 378**	**3 240 792**	**66.31**	**33.69**
2000	Rural	19 96 7 564	4 267 548	1 952 494	2 315 054	45.75	54.25
	Urban	23 357 452	6 503 427	4 828 103	1 675 324	74.24	25.76
	Total	**43 325 016**	**10 770 975**	**6 780 597**	**3 990 378**	**62.95**	**37.05**
2001	Rural	20 832 416	4 267 548	2 095 229	2 172 319	49.1	50.9
	Urban	23 723 327	6 503 427	5 023 186	1 480 241	77.2	22.8
	Total	**44 560 743**	**10 770 975**	**7 118 415**	**3 652 560**	**66.1**	**33.9**

2020 , 80% of households have access to electricity.

Take back effects in residential housing

Thermal improvements	Low income new and retrofit houses	50%
	Middle income housing	20%
Efficient refrigerators		-
Solar water heating		10%
Lighting		20%

Characteristics of power stations

Station type	*Efficiency*	*Overnight capital cost, 2002 $/KW*	*Present value/ capital cost[1] ($/KW) (potential)*	*Operation and maintenance $/kW*	*Average fuel cost ($/GJ)*	*Capital cost (2020) $/kW[7]*	*Operating life (yrs)*	*load factor used in economic calculations*
Coal (pulverised fuel)	35%	935	1120	28	$0.55/GJ	1120	34	75
Combined cycle gas turbines	54%	652	900	17	$2.5/GJ[2]	900	34	75
Biomass[3]	35%	1342	1857	42	R6/GJ[4]	929	34	75
Landfill gas	15%	1100	1448	200	Nominal	724	34	75
Small hydro	N/A	1350	1516	10	0	758	34	46
Wind	N/A	998	998	14	0	499	34	24
Hydro	N/A	1000	1637	10	0	1637	34	75
Pumped storage	80%	1500	2455	10	Marginal cost of electricity[6]	2455	34	24
Solar Thermal	N/A	1427	3957	50	0	1979	34	34

Notes:

1. Assuming an 8% discount rate and differing construction times and expenditure patterns before commissioning.
2. Based on communications with the Shell-Namibia Kudu Cape Power Plant project leader (Fortune 2002).
3. Co-generation was not explicitly considered due to South African industry specific limitations (dispersed industry with access to low cost biomass and other customers.) A small quantity is available currently for co-generation within the Paper and Pulp and Food and Tobacco Industries in particular.
4. Depends on location and twining with industry.
5. For a limited number of favourable sites.
6. Marginal cost is the cost of an extra unit of electricity. The cost varies according to the time of day, the cheaper the off-peak and more expensive the peak marginal cost of electricity is, the more likely pumped storage will be an economic option. Transmission and distribution losses for 2000 were 9.4%. The net supply sent out being 194461GWh and the transmission and distribution losses 6313GWh and 12071GWh respectively (NER 2000).
7. Values over time were based on reductions in capital costs for Renewable Energy technologies of 2012 – 70% and 2020 – 50%.

4. Operating life and existing capacity of coal stations

Existing capacity life exceeds the duration of the project:

Arnot	1980 MW
Duvha	3450 MW
Hendrina	1900 MW
Kendal	3840 MW
Kriel	2850 MW
Lethabo	3558 MW
Majuba dry	1836 MW
Majuba wet	2007 MW
Matimba	3690 MW
Matla	3450 MW
Municipal coal	1350 MW
Tutuka	3510 MW
Total	**33421 MW**

5. RE Subsidies used in policy scenarios

R million/PJ	subsidy																
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Intensive Policy	Biomass	0	0	-76.56	-71.775	-66.99	-62.20	-57.42	-52.63	-47.85	-47.85	-43.06	-38.28	-33.49	-28.71	-28.71	-28.71
Economic instruments	Biomass	0	0	-76.56	-71.775	-66.99	-62.20	-57.42	-52.63	-47.85	-47.85	-43.06	-38.28	-33.49	-28.71	-28.71	-28.71
Intensive Policy	Biomass landfill	0	-174.13	-163.89	-153.65	-143.40	-133.16	-122.92	-112.67	-102.43	-102.43	-92.19	-81.94	-71.70	-61.46	-61.46	-61.46
Economic instruments	Biomass landfill	0	-174.13	-163.89	-153.65	-143.40	-133.16	-122.92	-112.67	-102.43	-102.43	-92.19	-81.94	-71.70	-61.46	-61.46	-61.46
Economic instruments	Mini Hydro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intensive Policy	Solar	-353.83	-334.17	-314.52	-294.86	-275.20	-255.54	-235.89	-216.23	-196.57	-196.57	-176.91	-157.26	-137.60	-117.94	-117.94	-117.94
Economic instruments	Solar	-353.83	-334.17	-314.52	-294.86	-275.20	-255.54	-235.89	-216.23	-196.57	-196.57	-176.91	-157.26	-137.60	-117.94	-117.94	-117.94
Intensive Policy	Wind	-114.48	-108.12	-101.76	-95.4	-89.04	-82.68	-76.32	-69.96	-63.6	-63.6	-57.24	-50.88	-44.52	-38.16	-38.16	-38.16
Economic instruments	Wind	-114.48	-108.12	-101.76	-95.4	-89.04	-82.68	-76.32	-69.96	-63.6	-63.6	-57.24	-50.88	-44.52	-38.16	-38.16	-38.16

Note: To convert R millions/PJ to c/kWh multiply by 0.36

6. Externality costs

$/tonne	High level	Low level	Indoor
Local pollutants			
Nitrogen oxides	23	101.1	101.1
Total suspended particulates	88.6	389.7	3000
Sulphur dioxide	186.3	819.5	3000
Greenhouse gases			
Carbon dioxide	9	9	9
Nitrous oxide	2664	2664	2664
Methane	207	207	207

Residential SO2, NOx and particulates – indoor

Transformation SO2, NOx and particulates – high level

All others low level

7. Pollution tax

$/tonne	High level	Low level
Local pollutants		
Nitrogen oxides	23	101.1
Total suspended particulates	88.6	389.7
Sulphur dioxide	186.3	819.5
Greenhouse gases		
Carbon dioxide	6	6
Nitrous oxide	1035	1035
Methane	43	43

Pollution tax applied to the industrial and transformation sectors is constant throughout the period, no pollution tax applied to the residential sector,

Industrial pollution low level

Transformation high level

8. Equipment Life (yrs)

Equipment	Life (yrs)
VSD	10
Motors	10
Comp air	10
Industrial Lighting	6
HVAC includes some VSDs	20
Energy Star Equipment	4
Commercial building design	20
Boilers	30
CFL	3
Stoves	20
SWH (commercial, residential)	15
thermal performance in buildings	20

Appendix G: Modelling output tables

Total energy consumption (PJ)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential																				
Base	287.73	293.23	298	303.14	308.64	312.83	317.62	321.6	326.35	330.2	334.66	338.84	342.69	347.35	351.12	355.63	359.15	363.02	366.62	370.32
Intensive Policy	287.73	291.54	296.88	303.11	308.67	313.31	317.38	320.89	324.85	328.5	331.87	335.65	338.9	342.48	345.62	349.05	351.97	355.06	358.01	361.07
Economic Instruments	287.73	291.54	261.57	266.84	272.01	276.52	281.13	285.26	289.93	294.4	298.56	302.87	306.9	311.4	315.87	320.58	324.76	329.11	333.32	337.66
Policy Reform	287.73	288.34	290.62	293.79	296.28	297.95	299.05	299.61	300.65	301.4	301.88	305.46	309.38	313.73	317.65	321.96	325.75	329.77	333.69	337.71
Transport																				
Base	701.03	720.68	738.85	756.02	780.41	803.93	829.42	857.06	883.93	910.8	937.65	966.85	997.88	1028.2	1059.3	1089.6	1121.01	1154.58	1188.62	1221.5
Agriculture																				
Base	99.74	100.07	100.61	101.66	102.33	102.86	103.56	104.4	104.93	105.3	105.76	106.31	106.67	106.98	107.3	108.33	109.29	110.42	111.11	112.26
Intensive Policy	99.75	100.08	100.4	101.08	101.57	101.97	102.24	102.63	102.79	103.3	103.58	104.39	104.65	105.16	105.65	106.32	107.23	108.44	109.19	110.4
Economic Instruments	99.7	100.19	101.11	102.34	102.65	102.69	103.33	104.14	104.95	105.6	106.1	106.78	107.02	107.36	107.64	108.33	109.27	110.41	111.14	112.47
Policy Reform	99.75	100.08	100.4	101.08	101.57	101.97	102.24	102.63	102.79	103.3	103.58	104.39	104.65	105.16	105.65	106.32	107.23	108.44	109.19	110.4
Commerce																				
Base	82.78	84.95	87.13	90	92.87	95.4	97.91	100.37	102.8	105.2	107.93	110.63	113.26	115.87	118.44	122.44	126.48	130.53	134.62	138.73
Intensive Policy	82.23	84.4	80.84	80.5	80.26	80.23	80.19	80.14	80.1	79.99	80.33	81.07	81.8	82.48	83.15	84.65	86.13	87.63	89.57	91.59
Economic Instruments	82.78	84.95	81.99	82.99	84.08	85.3	86.5	87.68	88.85	89.97	91.33	92.67	93.98	95.25	96.49	98.78	101.06	103.35	106.1	108.93
Policy Reform	82.23	84.4	80.84	80.5	80.26	80.23	80.19	80.14	80.1	79.99	80.33	81.07	81.8	82.48	83.15	84.65	86.13	87.63	89.57	91.59
Other																				
Base	53.89	55.17	56.48	58.17	59.92	61.83	63.71	65.63	67.52	69.43	71.53	73.67	75.79	77.92	80.03	82.34	84.69	87.01	89.36	91.7
Intensive Policy	53.91	55.25	56.6	58.41	60.23	62.23	64.26	66.29	68.35	70.39	72.71	75.01	77.33	79.6	81.87	84.36	86.86	89.36	91.88	94.36
Economic Instruments	53.91	55.25	56.6	58. 41	60.23	62.23	64.26	66.29	68.35	70.39	72.71	75.01	77.33	79.6	81.87	84.36	86.86	89.36	91.88	94.36
Policy Reform	53.91	55.25	56.6	58.41	60.23	62.23	64.26	66.29	68.35	70.39	72.71	75.01	77.33	79.6	81.87	84.36	86.86	89.36	91.88	94.36
Industry																				
Base	1298.8	1327.94	1356.8	1398.7	1439.2	1484.1	1528.3	1572	1614.7	1656	1704.9	1751.2	1797.7	1842.9	1886.7	1962.2	2038.83	2117.4	2196.65	2278.09
Intensive Policy	1298.8	1327.95	1348.5	1383.4	1415.8	1451.7	1487.4	1522.7	1557	1590	1630	1667.4	1705	1741.4	1776.6	1840.6	1905.53	1972.2	2039.31	2106.46
Economic Instruments	1298.8	1327.95	1350.5	1387.4	1421.9	1459.7	1496.8	1533.3	1568.9	1604	1644.5	1683.2	1722.1	1759.8	1796.2	1861.9	1928.62	1997.09	2065.15	2134.08
Policy Reform	1298.8	1327.95	1348.5	1383.4	1415.8	1451.7	1487.4	1522.7	1557	1590	1630	1667.4	1705	1741.4	1776.6	1840.6	1905.53	1972.2	2039.25	2105.31

Total energy investment (R mill)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	202
ıport																				
ase Case	31715.37	32765.93	33484.43	34387.65	35296.08	37548.1	38532.67	39538.97	40575.63	41613.53	42794.3	44183.26	45734.44	47268.08	48918.04	50825.82	52891.88	54864.4	56927.74	58978.3
tensive olicy	31713.33	32746.11	33235.05	33900.09	34566.39	36634.73	37354.82	38102.74	38864.59	39694.66	40654.58	41889.54	43126.8	44499.87	45976.51	47391.29	48986.92	50725.14	52460.38	54523.9
conomic struments	31713.33	32747.15	33217.84	33853.53	34490.47	36529.45	37249.06	38215.68	39193.09	40235.41	41299.5	42397.6	43634.76	44933.52	46374.91	47902.87	49471.18	51124.01	52799.58	54439.1
olicy eform	31713.33	32746.11	33235.05	33900.09	34566.39	36634.73	37354.82	38102.74	38864.59	39694.66	40654.58	41889.54	43126.8	44499.87	45976.51	47391.29	48986.92	50725.14	52443.48	54126.
‹port (not inc coal, nuclear included in power station costs &Imported hydro considered as local)																				
ase Case	-1016.7	-1280.48	-979.44	-834.93	-623.51	-2078.47	-1842.15	-1303.41	-854.48	-424.45	-74.76	-61.92	-215.2	0	0	0	0	0	0	
tensive olicy	-1012.06	-1384.33	-1303.11	-1188.26	-955.26	-2501.66	-2213.6	-1608.06	-1054.04	-519.26	-203.14	-189.01	-144.62	-86.14	-109.88	-83.64	-95.56	-117.1	-132.74	-142.5
conomic struments	-1023.07	-1360.71	-1303.11	-1188.26	-955.26	-2501.66	-2303.76	-1799.83	-1350.71	-917.23	-578.48	-328.44	-247.03	-252.94	-165.41	-174.83	-140.66	-100.53	-69.55	-27.9
olicy eform	-1012.06	-1385.36	-1303.11	-1188.26	-961.98	-2504.36	-2213.6	-1616.21	-1058.46	-519.93	-211.36	-196.46	-164.8	-96.27	-109.88	-83.64	-95.56	-117.1	-132.74	-142.5
ctraction / Harvesting																				
ase Case	21182.55	20377.92	21163.92	22008.61	22963.19	23901.54	24257.19	24621.73	25015.72	25408.66	25899.4	26386.96	26768.23	27173.36	27589.04	28243.88	28932.35	29605.32	30269.82	30953.0
tensive olicy	21242.82	20417.87	20987.52	21603.94	22236.51	23041.39	23344.29	23646.5	23942.56	24229.01	24577.04	24869.8	25151.64	25380.22	25684.75	26145.62	26602.9	27072.01	27541.64	27886.8
conomic struments	20363.51	19529.5	20074.43	20497.29	21001.21	21754.47	21994.83	22234.8	22473.34	22704.99	22974.82	23232.82	23491.93	23746.89	23996.76	24341.88	24734.94	25078.55	25366.05	25688.9
olicy eform	21148.49	20339.3	20988.56	21660.85	22442.8	23375.13	23657.01	23931.65	24199.63	24289.66	24606.63	24918.75	25213.72	25497.04	25770.18	26254.88	26735.64	27229.3	27727.69	28256.6
ansformation																				
ectricity																				
ase Case	18,282.79	16,957.66	17,159.65	17,371.90	17,671.44	17,910.00	18,408.73	18,916.88	19,597.75	20,626.07	22,649.01	24,886.41	26,549.23	28,224.40	30,287.57	32,373.01	33,483.67	35,577.58	38,014.12	40,111.7
tensive olicy	18,335.08	16,897.51	20,205.46	22,533.98	28,227.68	31,157.50	35,116.96	35,169.35	35,217.11	35,261.85	36,456.20	38,893.62	39,566.08	40,729.69	41,498.32	42,171.16	42,821.95	43,459.49	44,139.83	45,218.9
conomic struments	17,387.15	16,138.26	16,276.08	16,438.87	16,831.21	18,316.32	18,569.24	18,641.76	21,007.29	22,497.54	24,289.34	26,728.48	27,574.43	28,369.53	29,748.40	30,528.45	32,266.44	33,718.83	34,615.28	35,481.9
olicy eform	18,235.13	16,835.89	17,519.43	18,246.73	19,087.43	19,861.22	20,576.33	21,269.27	21,937.04	22,580.09	24,355.38	26,889.15	27,933.33	28,946.99	30,562.58	31,589.45	32,584.58	33,557.79	34,508.24	35,573.1
il																				
ase Case	5100.48	5100.48	5100.48	5100.48	5216.36	5519.91	5628.06	5120.52	5120.52	5120.52	5120.52	5175.11	5260.4	5261.54	5270.2	5275.1	5279.87	5287.51	5295.14	5300.3
tensive olicy	5100.48	5100.48	5100.48	5100.48	5208.63	5519.91	5628.06	5120.52	5120.52	5120.52	5125.69	5193.5	5257.62	5270.89	5282.5	5285.84	5291.88	5299.36	5307.08	5312.1
conomic struments	5100.48	5100.48	5100.48	5100.48	5208.63	5519.91	5628.06	5120.52	5120.52	5120.52	5120.52	5148.24	5204.91	5260.4	5267.06	5271.17	5275.79	5283.03	5290.36	5295.
olicy	5100.48	5100.48	5100.48	5100.48	5208.63	5519.91	5628.06	5120.52	5120.52	5120.52	5125.69	5193.5	5257.62	5270.89	5282.5	5285.84	5291.88	5299.36	5307.08	5312.1

eform																				
ther																				
ase Case	8426.62	9523.22	10074.35	10779.28	11448.77	10589.91	11311.41	12091.39	12894.29	13695.15	14609.29	15868.84	17364.92	18509.62	19849.74	21385.8	22966.77	24589.12	26280.86	27933.9
tensive olicy	1331.26	1362.91	1376.16	1404.24	1431.7	1458.53	1439.53	1419.84	1399.46	1378.4	1356.66	1334.14	1310.85	1286.8	1261.99	1236.4	1209.97	1182.7	1154.6	1133.3
conomic struments	1331.26	1362.91	1324.93	1292.65	1456.76	1731.63	2001.76	2211.51	2418.47	2620.09	2756.1	2796.79	2838	2876.01	2911.73	2988	3065.67	3144.36	3223.01	3311.6
olicy eform	1331.26	1362.91	1376.16	1404.24	1431.7	1322.03	1295.16	1267.59	1239.33	1378.4	1356.66	1334.14	1310.85	1286.8	1261.99	1236.4	1209.97	1182.7	1154.6	1133.3
&D																				
l																				
ase Case	3546.59	4077.46	4338.13	4665.48	4977.18	4523.21	4859.65	5225.81	5602.07	5979.3	6408.66	7013.56	7734.25	8285.45	8930.23	9649.84	10389.65	11147.74	11942	12714.3
tensive olicy	3545.45	4070.15	4238.76	4468.41	4674.73	4151.06	4386.41	4655.18	4928.86	5227.13	5582.73	6153.13	6718.01	7282.91	7886.28	8413.61	9022.08	9691.26	10354.96	10989.6
conomic struments	3545.45	4070.67	4239.4	4469.03	4675.34	4151.64	4386.98	4655.73	4929.39	5227.64	5561.91	5997.77	6537.62	7097.49	7646.38	8200.61	8772.26	9390.33	10016.96	10614.7
olicy eform	3545.45	4070.15	4238.76	4468.41	4674.73	4151.06	4386.41	4655.18	4928.86	5227.13	5582.73	6153.13	6718.01	7282.91	7886.28	8413.61	9022.08	9691.26	10354.96	10989.6
ectricity																				
ase Case	6889	7080	7268	7506	7749	7954	8158	8357	8555	8743	8958	9164	9359	9559	9745	10077	10399	10737	11062	1140
tensive olicy	6883	7065	7210	7240	7333	7404	7473	7544	7609	7670	7748	7831	7911	7988	8062	8229	8388	8555	8724	890
conomic struments	6891	7067	7214	7273	7390	7481	7572	7663	7751	7835	7935	8032	8126	8218	8310	8504	8690	8883	9080	929
olicy eform	6883	7070	7222	7257	7357	7434	7509	7585	7657	7723	7808	7892	7974	8052	8127	8296	8456	8624	8800	913
emand Investments																				
ase Case	20.35	15620.33	16064.13	16578.57	17032.46	17498.58	17981.59	18451.51	18942.27	19437.54	19934.87	20447.29	20950.21	21480.1	21935.24	22484.86	22960.47	23446.2	23996.1	24487.4
tensive olicy	25.15	15313.95	15551.59	15869.51	16180.49	16525.78	16927.28	17267.1	17677.36	18043.03	18470.17	18876.38	19272.44	19748.29	20118.55	20669.37	21100.15	21590.13	22095.16	22547.2
conomic struments	20.35	15309.12	15475.14	15701.41	16028.24	16327.67	16681.14	16938.09	17266.89	17552.25	17908.6	18261.23	18604.5	19054.02	19349.82	19823.86	20176.73	20585.03	21010.91	21382.8
olicy eform	21.55	15310.6	15549.84	15866.92	16184.48	16524.46	16922.1	17270.17	17675.45	18036.07	18470.82	18875.36	19284.78	19748.64	20106.8	20656.88	21086.92	21577.74	22083.8	22535.0

otal discounted systems costs

rectly from MARKAL

Base Case	1,213,878
Intensive Policy	1,226,493
Economic Instruments	1,186,752
Policy Reform	1,174,539

Energy costs by chain (R mill undiscounted)

Total energy costs by chain include primary energy costs (import, export, mining, harvesting), operation and maintenance (fixed and variable o&m), transmission and distribution costs and demand costs (investment costs)

Primary Energy (coal exports are not included)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																				
Import	31396.53	32439.54	33150.03	34042.63	34940.16	37179.75	38152.41	39146.55	40172.4	41198.14	42366.11	43744.12	45282.84	46849.36	48508.82	50380.37	52557.59	54499.74	56513.32	58530.72
Export	1016.903	1280.74	979.7266	835.0409	623.5092	2078.378	1842.344	1303.068	854.5738	424.3084	74.825	62.1135	215.2305	0	0	0	0	0	0	0
Mining	20262.74	21069.2	21887.34	22756.39	23763.85	24742.42	25132.42	25534.33	25972.98	26411.01	26965.53	27522.88	27934.81	28379.99	28842.73	29589.13	30391.77	31157.43	31910.87	32688.09
Harvesting	919.825	927.275	934.925	942.7	950.4	958.4	966.375	974.05	981.925	989.5	997.3	1004.95	1012.65	1020.075	1027.65	1035.075	1042.45	1049.8	1057.175	1064.5
Intensive Policy																				
Import	31394.58	32419.95	32898.54	33542.42	34187.55	36234.73	36954.82	37702.74	38464.59	39294.66	40254.58	41489.54	42726.8	44099.87	45576.51	46991.29	48586.92	50325.14	52060.38	54123.94
Export	1012.06	1384.33	1303.11	1188.26	955.26	2501.66	2213.6	1608.06	1054.04	519.26	203.14	189.01	144.62	86.14	109.88	83.64	95.56	117.1	132.74	142.52
Mining	20322.97	19489.88	19975.24	20540.15	21126.69	21779.92	21749.52	22047.9	22339.5	22621.86	22965.32	23254.6	23533.06	23757.91	24058.26	24513.49	24967.63	25433.95	25892.69	26226.94
Harvesting	919.85	927.99	1012.28	1063.79	1109.82	1261.47	1594.77	1598.6	1603.06	1607.15	1611.72	1615.2	1618.58	1622.31	1626.49	1632.13	1635.27	1638.06	1648.95	1659.9
Economic Instruments																				
Import	31394.87	32420.8	32899.56	33543.79	34188.43	36235.72	37140.76	38649.91	39611.62	41060.14	42323.8	43391.4	44597.55	45865.42	47277.32	48754.48	50271.89	51871.9	53494.7	55080.66
Export	1022.612	1360.853	1303.091	1188.076	955.3539	2501.758	2303.626	1799.432	1350.701	917.4687	578.3919	328.5851	246.9462	252.7875	165.636	174.7845	140.598	100.6335	69.336	27.927
Mining	20391.38	21174.94	21737.12	23047.77	24086.1	25405.29	25782.96	25970.44	26147.99	26331.8	26679.03	27044.33	27473.02	28030.17	28568.45	29451.05	30337.63	31249.02	32161.26	33107.36
Harvesting	919.825	927.975	867.9	879.6	889.9	895.675	901.4	906.275	955.05	966.7	977.95	989.55	1032.1	1054.525	1075.2	1096.6	1117.4	1138.225	1159.025	1179.85
Policy Reform																				
Import	31394.58	32419.95	32898.54	33542.42	34187.55	36234.73	36954.82	37702.74	38464.59	39294.66	40254.58	41489.54	42726.8	44099.87	45576.51	46991.29	48586.92	50325.14	52043.48	53726.8
Export	1012.06	1385.36	1303.11	1188.26	961.98	2504.36	2213.6	1616.21	1058.46	519.93	211.36	196.46	164.8	96.27	109.88	83.64	95.56	117.1	132.74	142.52
Mining	20228.64	19411.38	20014.2	20643.51	21387.61	22296.78	22559.81	22815.37	23064.15	23135.37	23432.5	23726.26	23986.76	24236.3	24475.26	24923.81	25370.91	25831.04	26295.45	26790.42
Harvesting	919.85	927.92	974.36	1017.34	1055.19	1078.35	1097.2	1116.28	1135.48	1154.29	1174.13	1192.49	1226.96	1260.74	1294.92	1331.07	1364.73	1398.26	1432.24	1466.24

Transformation

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																				
Oil Refineries	5667.58	6207.03	6476.28	6816.47	7147.72	6807.77	7155.97	7532.87	7920.89	8308.86	8751.06	9367.78	10101.31	10665.41	11330.67	12074.44	12839.42	13625.49	14447.72	15246.71
Gas production	740.14	759.76	773.55	801.62	825.86	852.11	878.17	904.42	932.69	958.14	989.15	1016.6	1047.48	1067.31	1096.51	1151.5	1209.72	1271.75	1330.78	1392.8
Coke Ovens	286.88	293.54	300.96	310.28	320.31	331.38	342.18	352.85	363.2	373.41	384.98	395.46	406.44	417.15	426.69	449.28	472.01	495.81	519.66	544.68
Bagasse	0	0	0	0	51.19	102.38	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57
Electricity	1.19E+04	1.21E+04	1.18E+04	1.19E+04	1.20E+04	1.20E+04	1.44E+04	1.46E+04	1.59E+04	1.90E+04	3.22E+04	3.41E+04	2.63E+04	2.73E+04	3.22E+04	2.98E+04	2.15E+04	3.03E+04	3.42E+04	3.12E+04
Intensive Policy																				
Oil Refineries	5100.48	5100.48	5100.48	5100.48	5208.63	5519.91	5628.06	5120.52	5120.52	5120.52	5125.69	5193.5	5257.62	5270.89	5282.5	5285.84	5291.88	5299.36	5307.08	5312.16
Gas production	737.95	754.37	731.6	714.53	696.85	678.53	659.53	639.84	619.46	598.4	576.66	554.14	530.85	506.8	481.99	456.4	429.97	402.7	374.6	353.36
Coke Ovens	286.88	293.54	302.86	321.91	340.95	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360
Bagasse	306.43	315	341.7	367.8	393.9	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
Electricity	1.04E+04	1.04E+04	4.54E+04	3.98E+04	7.88E+04	4.65E+04	6.29E+04	2.86E+04	2.86E+04	2.86E+04	2.98E+04	3.69E+04	3.90E+04	4.52E+04	3.55E+04	4.09E+04	4.13E+04	4.16E+04	4.25E+04	4.73E+04
Economic Instruments																				
Oil Refineries	5071.39	5605.18	5766.03	5987.79	6440.19	6383.97	6965.8	7267.13	7574.09	7903.96	8275.49	8746.39	9322.66	9917.27	10506.9	11121.46	11755.57	12439.68	13132.74	13796.62
Gas production	737.95	754.37	731.6	714.53	696.85	678.53	659.53	639.84	619.46	598.4	576.66	554.14	530.85	506.8	481.99	456.4	429.97	402.7	374.6	353.36
Coke Ovens	286.88	293.54	286.21	278.87	271.53	264.19	263.79	460.65	654.69	845.75	966.24	994.41	1022.49	1049.81	1076.26	1121.9	1168.16	1215.32	1262.97	1311.62
Bagasse	0	0	0	0	51.19	102.38	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57	153.57
Electricity	1.19E+04	1.17E+04	1.17E+04	1.18E+04	1.18E+04	1.18E+04	1.19E+04	1.19E+04	3.89E+04	2.91E+04	3.36E+04	3.93E+04	2.20E+04	2.17E+04	2.84E+04	2.10E+04	3.26E+04	2.91E+04	2.24E+04	2.20E+04
Policy Reform																				
Oil Refineries	5100.48	5100.48	5100.48	5100.48	5208.63	5519.91	5628.06	5120.52	5120.52	5120.52	5125.69	5193.5	5257.62	5270.89	5282.5	5285.84	5291.88	5299.36	5307.08	5312.16
Gas production	737.95	754.37	731.6	714.53	696.85	678.53	659.53	639.84	619.46	598.4	576.66	554.14	530.85	506.8	481.99	456.4	429.97	402.7	374.6	353.36
Coke Ovens	286.88	293.54	302.86	321.91	340.95	360	360	360	360	360	360	360	360	360	360	360	360	360	360	360
Bagasse	306.43	315	341.7	367.8	393.9	283.5	275.63	267.75	259.87	420	420	420	420	420	420	420	420	420	420	420
Electricity	1.04E+04	1.04E+04	1.57E+04	1.78E+04	1.77E+04	1.76E+04	1.75E+04	1.74E+04	1.73E+04	1.72E+04	1.70E+04	1.70E+04	2.11E+04	2.11E+04	2.10E+04	2.09E+04	2.08E+04	2.08E+04	2.07E+04	2.06E+04

Transmission and distribution

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Oil																				
Base	3285.91	3285.91	3285.91	3285.91	3342.87	3492.97	3549.93	3042.39	3042.39	3042.39	3042.39	3096.98	3182.27	3182.27	3182.27	3182.27	3182.27	3182.27	3182.27	3182.27
Intensive Policy	3545.45	4070.15	4238.76	4468.41	4674.73	4151.06	4386.41	4655.18	4928.86	5227.13	5582.73	6153.13	6718.01	7282.91	7886.28	8413.61	9022.08	9691.26	10354.96	10989.66
Economic Instruments	3880.97	3880.97	3880.97	3880.97	3880.97	3974.11	3974.11	3466.57	3466.57	3466.57	3466.57	3494.29	3550.96	3606.45	3606.45	3606.45	3606.45	3606.45	3606.45	3606.45
Policy Reform	3545.45	4070.15	4238.76	4468.41	4674.73	4151.06	4386.41	4655.18	4928.86	5227.13	5582.73	6153.13	6718.01	7282.91	7886.28	8413.61	9022.08	9691.26	10354.96	10989.66
Electricity																				
Base	6888.89	7080.22	7267.56	7505.89	7748.78	7954.33	8158.22	8357.22	8555.44	8743.44	8958.00	9164.11	9359.00	9558.89	9745.00	10076.78	10398.89	10736.67	11061.89	11403.67
Intensive Policy	6882.78	7065.22	7210.22	7239.56	7333.11	7404.00	7473.33	7543.56	7609.22	7669.67	7748.44	7831.44	7911.22	7987.89	8062.00	8229.11	8388.33	8554.89	8723.78	8906.22
Economic Instruments	6891.00	7066.78	7214.33	7273.44	7389.89	7481.00	7571.67	7663.22	7750.89	7834.89	7935.33	8031.67	8125.56	8218.11	8310.33	8504.00	8689.78	8883.44	9079.67	9289.78
Policy Reform	6882.78	7070.44	7221.56	7257.11	7356.67	7433.67	7508.89	7585.22	7656.89	7723.00	7807.56	7892.44	7973.67	8051.78	8127.33	8295.89	8456.33	8623.56	8799.78	9139.44
Demand investment																				
Agriculture	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intensive Policy	0	0	4.49	8.53	12.15	15.61	19.25	22.7	25.85	27.04	29.61	30.62	32.61	33.7	34.91	38.04	40.5	45.41	46.95	49.27
Economic Instruments	0	0	0	1.76	5.47	10.02	12.82	15.35	16.17	16.64	23.37	25.09	27.28	29.11	31.16	34.13	36.53	41.86	43.57	45.59
Policy Reform	0	0	4.49	8.53	12.15	15.61	19.25	22.7	25.85	27.04	29.61	30.62	32.61	33.7	34.91	38.04	40.5	45.41	46.95	49.27
Residential																				
Base	20.8	15620.33	16064.13	16578.58	17032.47	17498.59	17981.6	18451.52	18942.28	19437.55	19934.88	20447.3	20950.22	21480.11	21935.25	22484.87	22960.48	23446.21	23996.11	24487.42
Intensive Policy	20.8	15309.4	15455.54	15667.62	15881.9	16119.63	16416.5	16663.47	16970.5	17234.73	17564.71	17867.99	18175.86	18541.22	18802.14	19210.47	19497.95	19841.53	20202.94	20509.54
Economic Instruments	20.81	15309.12	15457.29	15670.21	15877.91	16120.95	16421.67	16660.4	16972.42	17241.69	17564.06	17869.01	18163.52	18565.33	18813.89	19222.96	19511.18	19853.92	20213.81	20518.89
Policy Reform	20.8	15309.4	15455.54	15667.62	15881.9	16119.63	16416.5	16663.47	16970.5	17234.73	17564.71	17867.99	18175.86	18541.22	18802.14	19210.47	19497.95	19841.53	20202.94	20509.54
Industry																				
Base	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intensive Policy	0	0	75.85	168.21	259.3	350.3	439.73	529.71	617.19	704.84	798.97	891.21	982.82	1072.35	1160.53	1289.01	1418.93	1551.03	1683.86	1815.89
Economic Instruments	0	0	28.8	82.32	122.33	166.28	207.87	249.21	290.38	330.75	377.66	421.32	465.48	508.54	551.43	610.81	670.54	732.1	794.3	857.89
Policy Reform	0	0	75.85	168.21	259.3	350.3	439.73	529.71	617.19	704.84	798.97	891.21	982.82	1072.35	1160.53	1289.01	1418.93	1551.03	1683.86	1815.89
Commerce																				
Base	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Intensive Policy	1.2	1.2	13.96	22.56	31.13	38.92	46.63	54.29	61.9	69.46	85.02	111.58	137.97	164.17	190.22	222.56	255	287.54	320.23	353.03
Economic Instruments	0	0	13.91	22.45	31.02	39.05	162.11	192.48	222.66	252.58	284.57	316.3	347.79	379.03	410.01	450.03	490.19	530.47	570.97	611.65
Policy Reform	1.2	1.2	13.96	22.56	31.13	38.92	46.63	54.29	61.9	69.46	85.02	111.58	137.97	164.17	190.22	222.56	255	287.54	320.23	353.03

Energy costs by sector (R mill)

Fuel costs

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential Sector																				
Base Case	5404	5557	5687	5832	5989	6107	6248	6366	6507	6619	6754	6934	7171	7336	7607	7989	8154	8512	8862	9219
Intensive Policy	5404	5432	5816	6083	6358	6601	6847	7074	7304	7517	7789	8102	8480	8663	8856	9022	9173	9328	9470	9586
Economic Instruments	5404	5432	5342	5476	5617	5731	5851	5965	6278	6414	6684	6939	7108	7260	7480	7658	7977	8250	8428	8604
Policy Reform	5404	5423	5533	5737	5946	6140	6337	6510	6701	6880	7119	7421	7647	7891	8148	8367	8570	8771	8959	9123
Agricultural Sector																				
Base Case	3640	3644	3652	3680	3692	3699	3712	3732	3735	3736	3742	3757	3781	3781	3805	3870	3898	3966	4018	4084
Intensive Policy	1770	1787	1791	1809	1911	2040	2153	2258	2353	2429	2476	2585	2654	2725	2790	2805	2872	2886	2883	2889
Economic Instruments	3634	3658	3539	3481	3404	3330	3264	3209	3178	3153	3160	3191	3199	3216	3233	3242	3294	3348	3371	3416
Policy Reform	1770	1787	1741	1748	1843	1965	2071	2168	2259	2331	2376	2484	2533	2614	2689	2709	2783	2805	2809	2823
Commercial Sector																				
Base Case	2244	2302	2361	2439	2516	2585	2653	2719	2785	2850	2923	3021	3150	3228	3370	3594	3726	3953	4178	4406
Intensive Policy	2227	2286	2368	2432	2487	2525	2559	2585	2607	2621	2674	2752	2855	2876	2907	2944	2978	3011	3058	3096
Economic Instruments	2244	2302	2227	2266	2304	2331	2358	2385	2510	2543	2650	2746	2798	2849	2915	2988	3134	3254	3344	3435
Policy Reform	2227	2286	2222	2259	2291	2310	2326	2339	2349	2354	2402	2476	2524	2567	2622	2680	2733	2784	2848	2904
Transport Sector																				
Base Case	34082	35043	35931	36770	37963	39112	40354	41705	43020	44336	45647	47078	48606	50089	51624	53124	54655	56313	57993	59614
Intensive Policy	34082	35043	35966	36819	38023	39184	40436	41797	43119	44442	45766	47208	48746	50230	51758	53241	54771	56411	58075	59678
Economic Instruments	34082	35043	35931	36770	37963	39112	40354	41706	43039	44356	45681	47120	48643	50128	51659	53143	54688	56339	58006	59614
Policy Reform	34082	35043	35937	36784	37984	39140	40387	41745	43064	44385	45707	47147	48674	50163	51696	53184	54717	56362	58029	59636
Other Sectors																				
Base Case	812	838	870	895	915	935	969	992	1019	1047	1082	1106	1142	1167	1202	1246	1269	1298	1322	1352
Intensive Policy	810	818	820	820	812	803	789	775	757	732	705	684	662	650	638	626	611	594	574	569
Economic Instruments	810	818	820	820	812	803	789	775	757	732	705	684	662	650	638	626	611	594	574	569
Policy Reform	810	818	820	820	812	803	789	775	757	732	705	684	662	650	638	626	611	594	574	569
Industry Sector																				
Base Case	20580	21058	21527	22208	22862	23520	24152	24779	25369	25941	26629	27412	28424	29079	30121	32073	33438	35453	37462	39529
Intensive Policy	20580	21058	22443	22950	23540	24106	24646	25148	25598	26011	26657	27353	28220	28490	28830	29413	29993	30575	31158	31942
Economic Instruments	20580	21058	21293	21399	21628	21869	22111	22349	23196	23464	24210	24872	25252	25616	26066	26742	27879	28869	29723	30733
Policy Reform	20580	21058	21464	21789	22213	22712	23123	23513	23870	24107	24703	25373	25842	26282	26792	27515	28229	28938	29650	30726

Transmission and distribution costs (oil and electricity)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Residential Sector																				
Base Case	1818	1874	1921	1974	2031	2074	2126	2169	2221	2261	2311	2360	2405	2461	2507	2563	2609	2656	2704	2754
Intensive Policy	1818	1821	1834	1880	1934	1980	2028	2072	2119	2164	2209	2258	2306	2353	2392	2442	2489	2539	2588	2639
Economic Instruments	1818	1821	1815	1862	1912	1953	1996	2037	2081	2124	2167	2212	2256	2291	2340	2391	2439	2490	2539	2591
Policy Reform	1818	1826	1845	1897	1955	2009	2063	2110	2165	2217	2264	2316	2360	2413	2457	2509	2557	2608	2657	2708
Agricultural Sector																				
Base Case	1589	1590	1594	1606	1612	1614	1620	1627	1629	1630	1632	1635	1635	1635	1633	1643	1652	1663	1669	1679
Intensive Policy	1589	1590	1536	1505	1512	1532	1546	1555	1563	1582	1586	1614	1622	1642	1657	1654	1677	1708	1728	1754
Economic Instruments	1587	1596	1537	1506	1468	1466	1475	1486	1498	1512	1516	1528	1529	1536	1539	1541	1555	1572	1584	1602
Policy Reform	1589	1590	1536	1505	1512	1532	1546	1555	1563	1582	1586	1614	1622	1642	1657	1654	1677	1708	1728	1754
Commercial Sector																				
Base Case	787	808	829	856	883	907	931	954	978	1001	1026	1052	1077	1102	1126	1164	1203	1241	1280	1319
Intensive Policy	781	802	770	770	770	765	760	755	751	745	744	748	751	754	757	767	777	787	801	817
Economic Instruments	787	808	783	798	812	821	830	839	848	856	867	877	887	896	905	924	943	961	985	1010
Policy Reform	781	802	770	770	770	765	760	755	751	745	744	748	751	754	757	767	777	787	801	817
Transport Sector																				
Base Case	13800	14190	14550	14890	15373	15839	16342	16890	17423	17956	18488	19066	19682	20282	20900	21501	22120	22785	23459	24110
Intensive Policy	13800	14190	14550	14890	15373	15839	16342	16890	17423	17956	18488	19066	19682	20282	20900	21501	22120	22785	23459	24110
Economic Instruments	13800	14190	14550	14890	15373	15839	16342	16890	17423	17956	18488	19066	19682	20282	20900	21501	22120	22785	23459	24110
Policy Reform	13800	14190	14550	14890	15373	15839	16342	16890	17423	17956	18488	19066	19682	20282	20900	21501	22120	22785	23459	24110
Other Sectors																				
Base Case	185	192	202	208	211	214	223	227	233	239	248	252	261	264	274	287	290	296	299	305
Intensive Policy	185	185	182	177	169	160	149	138	126	110	93	79	65	56	47	38	28	17	5	0
Economic Instruments	185	185	182	177	169	160	149	138	126	110	93	79	65	56	47	38	28	17	5	0
Policy Reform	185	185	182	177	169	160	149	138	126	110	93	79	65	56	47	38	28	17	5	0
Industry Sector																				
Base Case	6372	6521	6695	6947	7184	7418	7639	7858	8056	8244	8513	8770	9002	9232	9454	9914	10369	10841	11316	11791
Intensive Policy	6372	6521	6587	6560	6588	6602	6607	6609	6603	6595	6616	6640	6640	6635	6632	6685	6738	6790	6842	6894
Economic Instruments	6372	6521	6598	6583	6624	6648	6666	6679	6683	6687	6719	6755	6766	6772	6780	6850	6919	6989	7058	7127
Policy Reform	6372	6521	6587	6560	6588	6602	6607	6609	6603	6595	6616	6640	6640	6635	6632	6685	6738	6790	6849	7058

Demand investment

Note that all apart from the Residential sector are comparative

R mill	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	202
Residential Sector																				
Base Case	20.35	15620.33	16064.13	16578.57	17032.46	17498.58	17981.59	18451.51	18942.27	19437.54	19934.87	20447.29	20950.21	21480.1	21935.24	22484.86	22960.47	23446.2	23996.1	24487.4
Intensive Policy	20.35	15309.12	15457.29	15670.21	15877.91	16120.95	16421.67	16660.4	16972.42	17241.69	17564.06	17869.01	18163.52	18540.87	18813.89	19222.96	19511.18	19853.92	20213.81	20518.8
Economic Instruments	20.35	15309.12	15457.29	15670.21	15877.91	16120.95	16421.67	16660.4	16972.42	17241.69	17564.06	17869.01	18163.52	18565.33	18813.89	19222.96	19511.18	19853.92	20213.81	20518.8
Policy Reform	20.35	15309.4	15455.54	15667.62	15881.9	16119.63	16416.5	16663.47	16970.5	17234.73	17564.71	17867.99	18175.86	18541.22	18802.14	19210.47	19497.95	19841.53	20202.94	20509.5
Agricultural Sector																				
Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Intensive Policy	0	0	4.49	8.53	12.15	15.61	19.25	22.7	25.85	27.04	29.61	30.62	32.61	33.7	34.91	38.04	40.5	45.41	46.95	49.2
Economic Instruments	0	0	0	0	3.01	6.83	8.6	10.11	10.2	9.97	10.7	10.8	11.68	12.23	12.98	14.63	15.42	16.09	16.51	16
Policy Reform	0	0	4.49	8.53	12.15	15.61	19.25	22.7	25.85	27.04	29.61	30.62	32.61	33.7	34.91	38.04	40.5	45.41	46.95	49.2
Commercial Sector																				
Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Intensive Policy	4.8	4.83	13.96	22.56	31.13	38.92	46.63	54.29	61.9	69.46	77.53	85.54	93.49	101.37	109.22	119.36	129.54	139.77	150.46	161.2
Economic Instruments	0	0	13.91	22.45	30.97	38.7	46.36	53.97	61.53	69.03	77.05	85	92.9	100.73	108.52	118.59	128.7	138.86	149.48	160.2
Policy Reform	1.2	1.2	13.96	22.56	31.13	38.92	46.63	54.29	61.9	69.46	77.53	85.54	93.49	101.37	109.22	119.36	129.54	139.77	150.05	160.3
Industry Sector																				
Base Case	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Intensive Policy	0	0	75.85	168.21	259.3	350.3	439.73	529.71	617.19	704.84	798.97	891.21	982.82	1072.35	1160.53	1289.01	1418.93	1551.03	1683.94	1817.
Economic Instruments	0	0	3.94	8.75	116.35	161.19	204.51	213.61	222.74	231.56	256.79	296.42	336.4	375.73	414.43	467.68	521.43	576.16	631.11	687.1
Policy Reform	0	0	75.85	168.21	259.3	350.3	439.72	529.71	617.2	704.84	798.97	891.21	982.82	1072.35	1160.53	1289.01	1418.93	1551.03	1683.86	1815.8

Total energy costs by sector (this includes fuels costs, demand investment, Transmission and distribution cots)

R mill	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agricultural Sector																				
Base Case	5228.818	5234.33	5245.83	5286.716	5303.619	5313.565	5331.712	5358.516	5364.107	5365.751	5374.1	5391.874	5415.677	5415.877	5438.022	5513.634	5550.544	5628.602	5687.298	5763.662
Intensive Policy	3359.07	3377.477	3331.618	3321.85	3435.689	3588.192	3718.361	3835.412	3941.773	4037.969	4091.946	4229.581	4307.82	4399.867	4482.332	4497.018	4588.726	4638.746	4657.839	4692.625
Economic Instruments	5220.901	5253.735	5076.22	4987.179	4874.567	4803.233	4747.608	4705.25	4686.502	4674.601	4686.773	4729.728	4739.464	4763.81	4784.372	4797.624	4864.828	4936.44	4970.874	5034.79
Policy Reform	3359.07	3377.477	3281.754	3260.985	3366.848	3512.518	3636.149	3745.993	3847.239	3940.274	3991.646	4128.696	4187.208	4289.148	4380.706	4400.922	4500.595	4557.923	4584.494	4625.76
Commercial Sector																				
Base Case	3030.882	3110.437	3189.642	3294.742	3399.162	3491.845	3583.752	3673.533	3762.396	3850.351	3949.826	4072.677	4227.065	4329.68	4496.581	4758.177	4928.752	5193.929	5457.977	5724.948
Intensive Policy	3012.766	3092.352	3151.832	3224.868	3287.721	3329.254	3365.541	3394.944	3419.478	3435.497	3495.759	3585.266	3700.084	3731.268	3773.65	3830.753	3885	3937.165	4010.055	4074.502
Economic Instruments	3030.882	3110.437	3024.08	3086.367	3147.347	3191.414	3234.932	3277.623	3418.994	3467.576	3593.269	3707.793	3777.471	3845.701	3928.831	4030.516	4205.935	4353.849	4479.121	4604.935
Policy Reform	3009.166	3088.722	3006.671	3051.896	3091.624	3113.933	3133.123	3148.496	3161.619	3168.793	3223.887	3309.402	3368.349	3423.006	3488.682	3566.145	3639.752	3710.379	3799.286	3881.112
Industry Sector																				
Base Case	26951.67	27578.75	28222.2	29154.24	30046.01	30937.69	31790.47	32637.17	33425.14	34185.56	35142.04	36182.79	37425.41	38311.23	39575.18	41986.3	43807.84	46293.69	48777.88	51319.96
Intensive Policy	26951.67	27579.17	29030.42	29509.06	30127.99	30707.56	31253.53	31757.44	32200.99	32606.55	33272.42	33993.72	34860.42	35124.39	35462	36097.81	36730.57	37365.29	38000.23	38835.56
Economic Instruments	26951.67	27579.17	27891.24	27981.74	28251.77	28517.45	28776.87	29028.13	29879.25	30150.67	30929.41	31627.12	32017.98	32388.08	32846.88	33592.05	34797.62	35857.39	36781.03	37860.08
Policy Reform	26951.67	27579.17	28050.87	28348.02	28801.28	29313.49	29729.93	30122.36	30473.1	30702.31	31319.27	32013.23	32482.29	32916.75	33424.4	34200.37	34966.23	35728.19	36498.95	37783.76
Other Sectors																				
Base Case	997.2861	1029.729	1071.407	1102.656	1125.608	1148.891	1192.591	1218.96	1252.037	1286.632	1330.537	1358.085	1403.366	1430.854	1475.447	1532.411	1558.962	1594.132	1620.543	1657.09
Intensive Policy	994.6104	1002.65	1002.158	997.2307	981.2573	962.6577	938.1593	913.0969	882.1357	842.8084	798.5948	762.9827	726.9265	705.7169	685.6876	664.0416	639.237	610.7261	579.2576	568.839
Economic Instruments	994.6104	1002.65	1002.158	997.2307	981.2573	962.6577	938.1593	913.0969	882.1357	842.8084	798.5948	762.9827	726.9265	705.7169	685.6876	664.0416	639.237	610.7261	579.2576	568.839
Policy Reform	994.6104	1002.65	1002.158	997.2307	981.2573	962.6577	938.1593	913.0969	882.1357	842.8084	798.5948	762.9827	726.9265	705.7169	685.6876	664.0416	639.237	610.7261	579.2576	568.839
Residential Sector																				
Base Case	7243.227	23050.7	23672.61	24383.89	25052.73	25680.08	26355.53	26986.26	27669.66	28317.54	29000.55	29741.4	30527.02	31276.87	32048.83	33037.06	33722.87	34614.74	35562.9	36460.44
Intensive Policy	7243.227	22561.86	23107.22	23632.64	24170.26	24702.49	25296.03	25806.62	26395.84	26922.89	27561.53	28228.98	28949.96	29557.09	30061.41	30687.1	31173.85	31720.89	32271.98	32743.38
Economic Instruments	7243.227	22561.86	22613.7	23008.41	23407	23805.13	24268.69	24661.96	25331.43	25779.6	26415.19	27019.74	27527.04	28115.55	28633.69	29271.22	29927.36	30593.97	31180.92	31714.06
Policy Reform	7243.227	22558.55	22833.72	23301.27	23782.51	24268.31	24816.18	25283.55	25836.6	26331.56	26947.84	27604.86	28182.69	28844.53	29407.28	30086.45	30624.91	31220.64	31819.37	32340.96
Transport Sector																				
Base Case	47881.64	49232.44	50481.1	51659.82	53336.13	54951.2	56695.6	58595.4	60442.43	62292.23	64134.92	66143.92	68287.74	70371.52	72524.42	74624.62	76774.43	79097.14	81451.66	83723.78
Intensive Policy	47881.64	49232.44	50591.94	51876.65	53655.92	55373.12	57217.35	59216.21	61158.79	63103.33	65052.4	67164.91	69410.4	71584.58	73818.31	76030.74	78309.05	80746.92	83217.72	85605.14
Economic Instruments	47881.64	49232.44	50485.08	51668.65	53452.61	55112.55	56900.3	58809.22	60683.98	62544.07	64425.9	66482.79	68660.68	70786.5	72973.14	75111.81	77328.54	79699.78	82095.95	84410.51
Policy Reform	47881.64	49232.44	50563.05	51841.98	53616.38	55329.01	57168.97	59164.25	61103.8	63045.72	64993.26	67104.51	69337.96	71517.42	73756.51	75973.38	78255.64	80697.66	83172.4	85561.99

Total externality costs by sector (R mill)

Rmill	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agricultutral Sector																				
Base Case	2661.795	2651.119	2632.1	2629.857	2622.133	2667.074	2671.39	2687.755	2699.73	2709.97	2723.088	2740.551	2742.561	2773.545	2804.049	2818.256	2859.969	2899.334	2902.713	2922.632
ntensive Policy	2640.899	2651.774	2578.023	2542.501	2516.912	2565.66	2514.687	2517.726	2506.97	2513.823	2563.271	2587.204	2616.579	2656.355	2736.177	2804.739	2858.364	2981.978	3087.366	3198.086
Economic nstruments	2619.325	2625.433	2550.88	2504.343	2481.383	2525.465	2529.22	2564.452	2670.584	2714.402	2747.631	2758.113	2752.859	2758.641	2775.273	2798.311	2824.84	2862.427	2873.361	2895.749
Policy Reform	2666.845	2674.125	2620.126	2608.627	2617.808	2682.522	2670.575	2669.183	2651.933	2650.605	2692.733	2715.689	2744.433	2792.232	2861.248	2928.066	2976.726	3095.153	3195.239	3295.884
Commercial Sector																				
Base Case	2104.265	2121.355	2144.456	2157.342	2190.927	2235.025	2281.859	2331.369	2389.763	2443.339	2518.815	2589.928	2651.39	2719.458	2775.401	2827.283	2936.178	3007.297	3058.254	3109.823
ntensive Policy	2021.956	2078.45	2022.921	1946.622	1886.976	1859.434	1772.502	1778.225	1769.974	1771.213	1783.963	1797.985	1805.353	1781.122	1805.092	1824.606	1852.072	1874.083	1895.758	1902.372
Economic nstruments	2032.548	2090.709	2068.234	2038.29	2047.123	2055.865	2069.59	2107.45	2130.852	2164.462	2205.483	2250.929	2296.583	2325.61	2368.465	2430.508	2500.655	2543.957	2569.369	2596.365
Policy Reform	2109.538	2157.663	2101.446	2066.138	2069.854	2070.169	2052.169	2040.374	2015.845	2001.235	1997.422	2010.549	2016.78	2008.704	2014.187	2026.172	2047.01	2061.474	2093.595	2116.246
ndustry Sector																				
Base Case	26547.62	26909.88	27291.44	27786.27	28370.87	29214.71	29948.59	30709.79	31492.57	32302.05	33291.55	34243.73	35106.36	36042.5	36851.7	38090.11	39701.84	41175.8	42487.46	43812.57
ntensive Policy	26293.51	26919.94	26893.18	26807.7	26784.1	27099.78	27071.04	27601.58	28164.88	28680.54	29325.87	29844.45	30305.27	30670.11	31253.67	32222.44	33195.68	34236.21	35261.94	35964.12
Economic nstruments	27881.32	28519.02	28504.88	27781.12	27456.73	27266.79	27147.45	27129.47	27102.59	27072.02	27325.55	27765.53	28191.18	28605.75	29028.2	29853.47	30676.07	31445.54	32074.2	32696.56
Policy Reform	26621.5	27191.27	27423.07	27609.93	28021.5	28803.2	29283.69	29731.1	30206.11	30322.88	30859.47	31370.58	31821.17	32300.06	32748.75	33667.82	34598.08	35588.93	36592.49	37573.79
Other Sectors																				
Base Case	1026.02	1056.096	1077.913	1107.368	1139.245	1176.456	1205.616	1244.481	1274.67	1305.622	1336.306	1376.918	1413.463	1452.377	1486.495	1531.308	1573.001	1610.202	1653.225	1693.48
ntensive Policy	1029.615	1047.921	1070.022	1093.79	1120.397	1149.57	1167.159	1197.346	1221.187	1243.837	1270.745	1301.066	1324.373	1350.922	1375.589	1399.209	1430.088	1458.158	1481.67	1507.464
Economic nstruments	1029.642	1047.86	1070.019	1093.786	1120.616	1149.887	1167.458	1197.604	1221.399	1244.03	1270.898	1301.189	1324.465	1349.564	1373.882	1397.937	1429.082	1457.56	1481.496	1507.464
Policy Reform	1029.615	1047.924	1070.022	1093.79	1120.412	1149.576	1167.159	1197.359	1221.194	1243.837	1270.753	1301.072	1324.385	1350.927	1375.589	1399.209	1430.088	1458.158	1481.67	1507.464
Residential Sector																				
Base Case	20271.53	20497.28	20884.56	21235.79	20735.51	19950.37	20309.69	20603.98	20914.34	20196.83	21545	21799.99	22068.84	22439.47	22733.29	22863.91	23093.01	21607.44	22167.87	21844.05
ntensive Policy	20203.72	20478.54	20928.84	21235.96	20630.3	19790.05	19974.3	20300.53	20580.23	19788.84	21097.36	21281.85	21475.02	21666.36	21912.69	20427.01	20506.84	20594.59	21144.54	20791.75
Economic nstruments	20125.11	20375.79	20791.4	21101.49	20585.21	19750.8	20074.71	20373.36	20655.68	19917.23	21230.44	21443.13	21708.74	22028.4	22340.34	22554.51	22766.03	21276.04	21851.77	21542
Policy Reform	20291.28	20405.78	20811.74	21083.87	20515.18	19599.88	19827.18	20013.6	20157.55	19253.68	20416.54	20606.58	20829.08	21074.7	21335.53	21481.3	21625.46	20107.05	20671.97	20345.34
Transport Sector																				
Base Case	24989.5	25494.08	25973.28	26510.99	27166.06	28371.29	29041.79	29750.52	30444.01	31142.37	31887.9	32652.87	33439.9	34313.44	35507.71	36506.96	37529.52	38701.49	39853.16	40916.44
ntensive Policy	24982.15	25516.77	26091.92	26692.59	27366.67	28639.26	29343.99	30101.22	30836.22	31565.79	32368.12	33166.23	33993.86	35377.02	36798.67	37844.94	39034.5	40317.6	41597.72	42764.19
Economic nstruments	24975.25	25503.66	26094.34	26697.32	27398.26	28683.46	29404.38	30160.7	30893.75	31625.63	32426.92	33227.58	34057.98	34933.72	36097.89	37182.52	38299.76	39570.51	40835.33	41986.67
Policy Reform	24992.11	25525.04	26107.55	26716.55	27404.85	28682.98	29402.18	30158.06	30889.52	31615.56	32416.06	33214.07	34043.56	35428.44	36844.02	37888.64	39076.96	40358.31	41637.06	42803.47

Total social costs of energy (R mill), this includes externality costs and energy costs, included under externalities costs are all pollution costs

R mill	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Agricultutral Sector																				
Base Case	7891	7885	7878	7917	7926	7981	8003	8046	8064	8076	8097	8132	8158	8189	8242	8332	8411	8528	8590	8686
Intensive Policy	6000	6029	5910	5864	5953	6154	6233	6353	6449	6552	6655	6817	6924	7056	7219	7302	7447	7621	7745	7891
Economic Instruments	7840	7879	7627	7492	7356	7329	7277	7270	7357	7389	7434	7488	7492	7522	7560	7596	7690	7799	7844	7931
Policy Reform	6026	6052	5902	5870	5985	6195	6307	6415	6499	6591	6684	6844	6932	7081	7242	7329	7477	7653	7780	7922
Commercial Sector																				
Base Case	5135	5232	5334	5452	5590	5727	5866	6005	6152	6294	6469	6663	6878	7049	7272	7585	7865	8201	8516	8835
Intensive Policy	5035	5171	5175	5171	5175	5189	5138	5173	5189	5207	5280	5383	5505	5512	5579	5655	5737	5811	5906	5977
Economic Instruments	5063	5201	5092	5125	5194	5247	5305	5385	5550	5632	5799	5959	6074	6171	6297	6461	6707	6898	7048	7201
Policy Reform	5119	5246	5108	5118	5161	5184	5185	5189	5177	5170	5221	5320	5385	5432	5503	5592	5687	5772	5893	5997
Industry Sector																				
Base Case	53499	54489	55514	56941	58417	60152	61739	63347	64918	66488	68434	70427	72532	74354	76427	80076	83510	87469	91265	95133
Intensive Policy	53245	54499	55924	56317	56912	57807	58325	59359	60366	61287	62598	63838	65166	65794	66716	68320	69926	71601	73262	74800
Economic Instruments	54833	56098	56396	55763	55709	55784	55924	56158	56982	57223	58255	59393	60209	60994	61875	63446	65474	67303	68855	70557
Policy Reform	53573	54770	55474	55958	56823	58117	59014	59853	60679	61025	62179	63384	64303	65217	66173	67868	69564	71317	73091	75358
Other Sectors																				
Base Case	2023	2086	2149	2210	2265	2325	2398	2463	2527	2592	2667	2735	2817	2883	2962	3064	3132	3204	3274	3351
Intensive Policy	2024	2051	2072	2091	2102	2112	2105	2110	2103	2087	2069	2064	2051	2057	2061	2063	2069	2069	2061	2076
Economic Instruments	2024	2051	2072	2091	2102	2113	2106	2111	2104	2087	2069	2064	2051	2055	2060	2062	2068	2068	2061	2076
Policy Reform	2024	2051	2072	2091	2102	2112	2105	2110	2103	2087	2069	2064	2051	2057	2061	2063	2069	2069	2061	2076
Residential Sector																				
Base Case	27515	43548	44557	45620	45788	45630	46665	47590	48584	48514	50546	51541	52596	53716	54782	55901	56816	56222	57731	58304
Intensive Policy	27447	43040	44036	44869	44801	44493	45270	46107	46976	46712	48659	49511	50425	51223	51974	51114	51681	52315	53417	53535
Economic Instruments	27368	42938	43405	44110	43992	43556	44343	45035	45987	45697	47646	48463	49236	50144	50974	51826	52693	51870	53033	53256
Policy Reform	27535	42964	43645	44385	44298	43868	44643	45297	45994	45585	47364	48211	49012	49919	50743	51568	52250	51328	52491	52686
Transport Sector																				
Base Case	72871	74727	76454	78171	80502	83322	85737	88346	90886	93435	96023	98797	101728	104685	108032	111132	114304	117799	121305	124640
Intensive Policy	72864	74749	76684	78569	81023	84012	86561	89317	91995	94669	97421	100331	103404	106962	110617	113876	117344	121065	124815	128369
Economic Instruments	72857	74736	76579	78366	80851	83796	86305	88970	91578	94170	96853	99710	102719	105720	109071	112294	115628	119270	122931	126397
Policy Reform	72874	74757	76671	78559	81021	84012	86571	89322	91993	94661	97409	100319	103382	106946	110601	113862	117333	121056	124809	128365

Emissions from energy production and use (M tonnes SO_x)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																					
Agriculture		0.02	0.02	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.02	0.02	0.021	0.021	0.021	0.021	0.021
Commerce		0.017	0.017	0.018	0.018	0.019	0.019	0.02	0.02	0.021	0.021	0.022	0.022	0.023	0.023	0.024	0.025	0.026	0.026	0.027	0.028
Transformation	Electricity	1.88	1.935	1.993	2.038	2.109	2.132	2.146	2.171	2.207	2.251	2.301	2.364	2.378	2.427	2.428	2.425	2.5	2.497	2.493	2.491
	Other	0.354	0.354	0.354	0.354	0.355	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.357	0.357	0.357	0.357	0.357	0.357	0.358	0.358
Industry		0.766	0.782	0.799	0.823	0.847	0.878	0.905	0.935	0.963	0.993	1.026	1.057	1.09	1.124	1.155	1.203	1.249	1.297	1.347	1.397
Other Demand		0.043	0.044	0.045	0.046	0.048	0.05	0.051	0.053	0.054	0.056	0.057	0.059	0.061	0.063	0.064	0.066	0.068	0.07	0.072	0.074
Residential		0.078	0.078	0.077	0.076	0.076	0.076	0.074	0.074	0.073	0.072	0.072	0.071	0.07	0.07	0.068	0.068	0.066	0.066	0.063	0.062
Transport		0.05	0.051	0.053	0.054	0.057	0.058	0.059	0.062	0.064	0.064	0.068	0.069	0.07	0.074	0.075	0.078	0.08	0.083	0.084	0.088
Intensive Policy																					
Agriculture		0.02	0.02	0.02	0.021	0.023	0.025	0.026	0.026	0.026	0.023	0.024	0.022	0.023	0.022	0.023	0.025	0.024	0.022	0.022	0.021
Commerce		0.015	0.015	0.015	0.014	0.014	0.015	0.015	0.016	0.015	0.016	0.016	0.017	0.018	0.017	0.018	0.018	0.019	0.019	0.019	0.019
Transformation	Electricity	1.867	1.921	1.91	1.843	1.801	1.769	1.664	1.686	1.706	1.726	1.756	1.768	1.771	1.754	1.776	1.804	1.831	1.862	1.889	1.9
	Other	0.354	0.354	0.354	0.354	0.355	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.357	0.357	0.357	0.357	0.358	0.358	0.358	0.358
Industry		0.766	0.782	0.789	0.822	0.844	0.873	0.913	0.949	0.989	1.027	1.067	1.108	1.149	1.19	1.228	1.294	1.356	1.422	1.49	1.535
Other Demand		0.044	0.045	0.047	0.049	0.052	0.054	0.056	0.06	0.063	0.066	0.07	0.074	0.078	0.081	0.085	0.088	0.092	0.096	0.1	0.104
Residential		0.078	0.078	0.079	0.08	0.08	0.081	0.083	0.083	0.084	0.083	0.083	0.083	0.083	0.085	0.086	0.086	0.086	0.085	0.085	0.086
Transport		0.05	0.051	0.053	0.054	0.057	0.058	0.059	0.062	0.064	0.064	0.068	0.069	0.07	0.074	0.075	0.078	0.08	0.083	0.084	0.088
Economic Instruments																					
Agriculture		0.02	0.02	0.02	0.021	0.023	0.023	0.026	0.028	0.032	0.032	0.034	0.033	0.033	0.033	0.033	0.033	0.033	0.034	0.034	0.034
Commerce		0.017	0.017	0.015	0.014	0.014	0.015	0.015	0.016	0.015	0.016	0.016	0.017	0.018	0.017	0.018	0.018	0.019	0.019	0.019	0.019
Transformation	Electricity	1.587	1.642	1.693	1.648	1.651	1.628	1.632	1.66	1.686	1.712	1.748	1.779	1.811	1.841	1.871	1.93	1.987	2.026	2.044	2.067
	Other	0.354	0.354	0.354	0.354	0.355	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.357	0.357	0.357	0.357	0.357	0.358	0.358
Industry		1.03	1.046	1.027	1.009	1.005	1.009	1.016	0.999	0.984	0.969	0.974	1	1.026	1.053	1.078	1.119	1.158	1.2	1.243	1.284
Other Demand		0.044	0.045	0.047	0.049	0.052	0.054	0.056	0.06	0.063	0.066	0.07	0.074	0.078	0.081	0.085	0.088	0.092	0.096	0.1	0.104
Residential		0.078	0.078	0.076	0.076	0.077	0.078	0.08	0.08	0.081	0.081	0.081	0.081	0.081	0.084	0.084	0.084	0.084	0.083	0.084	0.084
Transport		0.05	0.051	0.053	0.054	0.057	0.058	0.059	0.062	0.064	0.064	0.068	0.069	0.07	0.074	0.075	0.078	0.08	0.083	0.084	0.088
Policy Reform																					
Agriculture		0.02	0.02	0.02	0.021	0.023	0.025	0.026	0.026	0.026	0.023	0.024	0.022	0.023	0.022	0.023	0.025	0.024	0.022	0.022	0.021
Commerce		0.017	0.017	0.015	0.014	0.014	0.015	0.015	0.016	0.015	0.016	0.016	0.017	0.018	0.017	0.018	0.018	0.019	0.019	0.02	0.021
Transformation	Electricity	1.87	1.925	1.963	1.94	1.974	1.994	2.001	2.008	2.014	2.019	2.034	2.047	2.047	2.047	2.045	2.067	2.088	2.112	2.139	2.209
	Other	0.354	0.354	0.354	0.354	0.355	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.357	0.357	0.357	0.357	0.358	0.358	0.358	0.358
Industry		0.766	0.782	0.789	0.822	0.844	0.887	0.928	0.965	1.005	1.027	1.067	1.108	1.149	1.19	1.228	1.294	1.356	1.422	1.49	1.535
Other Demand		0.044	0.045	0.047	0.049	0.052	0.054	0.056	0.06	0.063	0.066	0.07	0.074	0.078	0.081	0.085	0.088	0.092	0.096	0.1	0.104
Residential		0.078	0.074	0.071	0.068	0.065	0.061	0.059	0.056	0.053	0.048	0.044	0.044	0.044	0.045	0.045	0.045	0.045	0.044	0.044	0.044
Transport		0.05	0.051	0.053	0.054	0.057	0.058	0.059	0.062	0.064	0.064	0.068	0.069	0.07	0.074	0.075	0.078	0.08	0.083	0.084	0.088

Emissions from energy production and use (M tonnes PM)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																				
Agriculture	0.093	0.093	0.093	0.095	0.096	0.096	0.097	0.097	0.098	0.099	0.099	0.1	0.1	0.101	0.101	0.101	0.102	0.103	0.104	0.105
Commerce	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009
Transformation	3.882	3.912	3.933	3.941	3.954	3.958	3.969	4.013	4.093	4.193	4.316	4.438	4.47	4.57	4.571	4.565	4.685	4.677	4.667	4.663
Other	1.484	1.484	1.484	1.484	1.489	1.686	1.686	1.686	1.686	1.686	1.686	1.687	1.687	1.707	1.858	1.943	2.027	2.16	2.293	2.385
Industry	0.738	0.755	0.774	0.796	0.822	0.849	0.879	0.905	0.932	0.96	0.989	1.015	1.046	1.072	1.097	1.156	1.214	1.275	1.336	1.4
Other Demand	0.071	0.075	0.076	0.079	0.081	0.082	0.084	0.088	0.091	0.092	0.094	0.098	0.1	0.103	0.105	0.108	0.111	0.112	0.115	0.117
Residential	0.54	0.542	0.545	0.544	0.547	0.547	0.549	0.551	0.55	0.552	0.553	0.551	0.551	0.551	0.55	0.548	0.544	0.543	0.539	0.539
Transport	3.752	3.857	3.963	4.099	4.237	4.386	4.536	4.689	4.84	4.995	5.164	5.335	5.507	5.681	5.855	6.039	6.224	6.41	6.594	6.781
Intensive Policy																				
Agriculture	0.093	0.093	0.099	0.101	0.1	0.099	0.095	0.094	0.091	0.099	0.111	0.121	0.131	0.139	0.148	0.16	0.172	0.202	0.227	0.256
Commerce	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Transformation	3.243	3.376	3.459	3.356	3.321	3.573	4.077	4.121	4.161	4.198	4.256	4.278	4.285	4.252	4.294	4.349	4.402	4.461	4.532	4.572
Other	1.484	1.484	1.484	1.484	1.484	1.686	1.686	1.686	1.686	1.686	1.686	1.687	1.687	1.87	2.073	2.131	2.236	2.367	2.501	2.59
Industry	0.738	0.755	0.755	0.754	0.754	0.753	0.739	0.727	0.713	0.698	0.684	0.672	0.658	0.644	0.631	0.617	0.604	0.589	0.577	0.566
Other Demand	0.07	0.071	0.071	0.071	0.07	0.07	0.068	0.066	0.064	0.062	0.059	0.056	0.051	0.048	0.042	0.038	0.034	0.029	0.023	0.017
Residential	0.54	0.547	0.562	0.574	0.551	0.516	0.524	0.533	0.539	0.506	0.552	0.556	0.561	0.565	0.569	0.509	0.509	0.51	0.528	0.512
Transport	3.752	3.857	3.963	4.099	4.237	4.386	4.536	4.689	4.84	4.995	5.164	5.335	5.507	5.681	5.855	6.039	6.224	6.41	6.594	6.781
Economic Instruments																				
Agriculture	0.092	0.094	0.089	0.085	0.091	0.098	0.095	0.096	0.116	0.129	0.133	0.138	0.137	0.14	0.14	0.136	0.137	0.139	0.141	0.142
Commerce	0.006	0.006	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Transformation	3.247	3.38	3.509	3.399	3.406	3.783	3.94	4.009	4.074	4.138	4.226	4.306	4.386	4.463	4.537	4.669	4.793	4.877	4.915	4.962
Other	1.484	1.484	1.484	1.484	1.484	1.686	1.686	1.686	1.686	1.686	1.686	1.686	1.687	1.687	1.803	1.875	1.956	2.082	2.21	2.294
Industry	0.738	0.755	0.736	0.718	0.698	0.679	0.66	0.643	0.625	0.605	0.585	0.568	0.549	0.53	0.513	0.495	0.476	0.457	0.439	0.42
Other Demand	0.07	0.071	0.071	0.071	0.07	0.07	0.068	0.066	0.064	0.062	0.059	0.056	0.051	0.048	0.042	0.038	0.034	0.029	0.023	0.017
Residential	0.54	0.546	0.561	0.573	0.55	0.515	0.523	0.531	0.537	0.505	0.551	0.555	0.561	0.566	0.573	0.576	0.579	0.519	0.538	0.524
Transport	3.752	3.857	3.963	4.099	4.237	4.386	4.536	4.689	4.84	4.995	5.164	5.335	5.507	5.681	5.855	6.039	6.224	6.41	6.594	6.781
Policy Reform																				
Agriculture	0.093	0.093	0.099	0.101	0.1	0.099	0.095	0.094	0.091	0.099	0.111	0.121	0.131	0.139	0.148	0.16	0.172	0.202	0.227	0.256
Commerce	0.006	0.006	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Transformation	3.874	3.908	3.962	3.98	4.03	4.073	4.111	4.147	4.183	4.22	4.257	4.297	4.363	4.428	4.495	4.569	4.646	4.722	4.8	4.928
Other	1.484	1.484	1.484	1.484	1.484	1.686	1.686	1.686	1.686	1.686	1.686	1.687	1.687	1.87	2.073	2.131	2.236	2.367	2.501	2.59
Industry	0.738	0.755	0.755	0.754	0.754	0.753	0.739	0.727	0.713	0.698	0.684	0.672	0.658	0.644	0.631	0.617	0.604	0.589	0.577	0.563
Other Demand	0.07	0.071	0.071	0.071	0.07	0.07	0.068	0.066	0.064	0.062	0.059	0.056	0.051	0.048	0.042	0.038	0.034	0.029	0.023	0.017
Residential	0.54	0.546	0.561	0.573	0.55	0.515	0.523	0.531	0.537	0.505	0.551	0.555	0.561	0.566	0.573	0.576	0.579	0.519	0.538	0.524
Transport	3.752	3.857	3.963	4.099	4.237	4.386	4.536	4.689	4.84	4.995	5.164	5.335	5.507	5.681	5.855	6.039	6.224	6.41	6.594	6.781

Emissions from energy production and use (M tonnes NO_x)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																					
Agriculture		0.073	0.072	0.072	0.072	0.072	0.071	0.071	0.071	0.071	0.07	0.07	0.07	0.069	0.068	0.068	0.068	0.067	0.067	0.068	0.067
Commerce		0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
Transformation	Electricity	0.51	0.525	0.541	0.553	0.572	0.578	0.582	0.588	0.599	0.611	0.624	0.64	0.646	0.658	0.658	0.657	0.677	0.676	0.675	0.674
	Other	0.105	0.106	0.106	0.106	0.106	0.107	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.109	0.109	0.109	0.109	0.109
Industry		0.127	0.13	0.132	0.136	0.141	0.147	0.151	0.155	0.16	0.165	0.171	0.176	0.182	0.188	0.193	0.201	0.209	0.218	0.226	0.235
Other Demand		0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.008
Residential		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.008
Transport		0.354	0.366	0.376	0.385	0.396	0.409	0.426	0.44	0.453	0.468	0.482	0.501	0.516	0.531	0.551	0.565	0.584	0.602	0.62	0.639
Intensive Policy																					
Agriculture		0.073	0.072	0.07	0.07	0.067	0.066	0.066	0.067	0.068	0.07	0.07	0.071	0.072	0.073	0.074	0.074	0.074	0.077	0.078	0.079
Commerce		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Transformation	Electricity	0.506	0.521	0.517	0.5	0.488	0.478	0.446	0.452	0.458	0.463	0.471	0.475	0.475	0.47	0.477	0.484	0.492	0.5	0.507	0.511
	Other	0.105	0.106	0.106	0.106	0.106	0.107	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.109	0.109	0.109	0.109	0.11	0.11
Industry		0.127	0.13	0.129	0.137	0.139	0.144	0.151	0.155	0.161	0.167	0.175	0.179	0.186	0.191	0.196	0.204	0.218	0.227	0.236	0.245
Other Demand		0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009
Residential		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Transport		0.354	0.366	0.376	0.385	0.396	0.409	0.426	0.44	0.453	0.468	0.482	0.501	0.516	0.531	0.551	0.565	0.584	0.602	0.62	0.639
Economic Instruments																					
Agriculture		0.073	0.073	0.07	0.07	0.067	0.065	0.063	0.062	0.061	0.06	0.06	0.059	0.06	0.059	0.059	0.059	0.06	0.059	0.061	0.061
Commerce		0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Transformation	Electricity	0.507	0.521	0.535	0.523	0.524	0.517	0.517	0.525	0.532	0.539	0.549	0.557	0.566	0.575	0.582	0.598	0.613	0.624	0.629	0.636
	Other	0.105	0.106	0.106	0.106	0.106	0.107	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.109	0.109	0.109	0.109
Industry		0.127	0.13	0.129	0.13	0.122	0.123	0.123	0.124	0.123	0.123	0.127	0.129	0.134	0.136	0.141	0.147	0.154	0.161	0.168	0.176
Other Demand		0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009
Residential		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Transport		0.354	0.366	0.376	0.385	0.396	0.409	0.426	0.44	0.453	0.468	0.482	0.501	0.516	0.531	0.551	0.565	0.584	0.602	0.62	0.639
Policy Reform																					
Agriculture		0.073	0.072	0.07	0.07	0.067	0.066	0.066	0.067	0.068	0.07	0.07	0.071	0.072	0.073	0.074	0.074	0.074	0.077	0.078	0.079
Commerce		0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Transformation	Electricity	0.508	0.522	0.532	0.525	0.535	0.54	0.542	0.544	0.546	0.547	0.551	0.553	0.554	0.553	0.552	0.558	0.563	0.568	0.574	0.585
	Other	0.105	0.106	0.106	0.106	0.106	0.107	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.109	0.109	0.109	0.109	0.11	0.11
Industry		0.127	0.13	0.129	0.137	0.139	0.146	0.153	0.158	0.163	0.167	0.175	0.179	0.186	0.191	0.196	0.204	0.218	0.227	0.236	0.244
Other Demand		0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009
Residential		0.01	0.01	0.009	0.009	0.009	0.008	0.008	0.008	0.008	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Transport		0.354	0.366	0.376	0.385	0.396	0.409	0.426	0.44	0.453	0.468	0.482	0.501	0.516	0.531	0.551	0.565	0.584	0.602	0.62	0.639

Emissions from energy production and use (M tonnes CO_2)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																					
Agriculture		5.156	5.134	5.129	5.147	5.141	5.119	5.115	5.093	5.072	5.053	5.031	5.018	4.995	4.969	4.932	4.933	4.929	4.924	4.927	4.914
Commerce		1.728	1.773	1.817	1.878	1.938	1.99	2.043	2.095	2.145	2.194	2.251	2.309	2.362	2.418	2.471	2.554	2.639	2.723	2.809	2.895
Transformation	Electricity	158.24	158.968	159.347	159.347	160.715	164.733	168.967	173.036	177.686	182.069	188.016	193.842	199.145	205.071	209.756	214.301	223.584	232.01	236.386	241.14
	Other	33.939	34.073	34.073	34.073	34.147	34.674	34.742	34.742	34.742	34.742	34.742	34.83	34.969	34.984	35.102	35.169	35.233	35.337	35.441	35.512
Industry		70.851	72.426	73.971	76.267	78.469	81.246	84.028	86.791	89.506	92.179	95.271	98.235	101.261	104.239	107.144	111.698	116.345	121.112	125.945	130.91
Other Demand		4.676	4.781	4.887	5.035	5.19	5.363	5.525	5.691	5.858	6.027	6.206	6.394	6.579	6.768	6.947	7.145	7.359	7.567	7.779	7.987
Residential		7.437	7.419	7.384	7.355	7.317	7.269	7.22	7.167	7.1	7.013	6.934	6.856	6.766	6.68	6.581	6.478	6.363	6.219	6.102	5.975
Transport		41.322	42.533	43.638	44.594	46.082	47.473	49.012	50.706	52.346	53.99	55.587	57.355	59.261	61.115	63.036	64.849	66.738	68.791	70.879	72.875
Intensive Policy																					
Agriculture		5.156	5.134	4.948	4.803	4.875	5.011	5.069	5.078	5.095	5.163	5.173	5.267	5.29	5.361	5.413	5.377	5.453	5.55	5.622	5.694
Commerce		1.724	1.774	1.52	1.477	1.446	1.472	1.496	1.519	1.544	1.568	1.596	1.624	1.651	1.676	1.702	1.748	1.794	1.84	1.787	1.724
Transformation	Electricity	159.524	164.164	162.696	156.82	152.935	149.005	136.904	138.768	140.522	142.18	144.733	145.721	146.06	144.572	146.485	148.889	151.216	153.77	156.005	156.83
	Other	33.939	34.073	34.073	34.073	34.141	34.674	34.742	34.742	34.742	34.742	34.75	34.86	34.964	35.111	35.269	35.314	35.396	35.498	35.603	35.672
Industry		70.85	72.426	72.643	75.074	76.746	79.325	82.497	85.633	88.719	91.705	95.199	98.513	101.869	105.131	108.301	113.586	118.944	124.434	129.929	134.828
Other Demand		4.68	4.807	4.941	5.117	5.302	5.505	5.716	5.926	6.141	6.363	6.61	6.855	7.103	7.344	7.587	7.851	8.119	8.39	8.664	8.922
Residential		7.437	7.356	7.371	7.484	7.542	7.6	7.691	7.76	7.844	7.921	7.967	8.024	8.051	8.063	8.122	8.135	8.147	8.145	8.135	8.12
Transport		41.322	42.533	43.638	44.594	46.082	47.473	49.012	50.706	52.346	53.99	55.587	57.355	59.261	61.115	63.036	64.849	66.738	68.791	70.879	72.875
Economic Instruments																					
Agriculture		5.14	5.173	4.95	4.805	4.659	4.688	4.764	4.825	4.907	4.991	5.017	5.067	5.068	5.102	5.114	5.09	5.139	5.198	5.241	5.293
Commerce		1.857	1.906	1.52	1.477	1.446	1.472	1.496	1.519	1.544	1.568	1.596	1.624	1.651	1.676	1.702	1.748	1.794	1.84	1.787	1.724
Transformation	Electricity	159.674	164.304	168.652	164.896	165.097	161.211	160.853	163.236	165.5	167.701	170.708	173.367	176.106	178.732	181.267	186.224	191.154	194.524	196.094	197.982
	Other	33.939	34.073	34.073	34.073	34.141	34.674	34.742	34.742	34.742	34.742	34.742	34.787	34.879	34.969	35.059	35.115	35.178	35.276	35.376	35.441
Industry		70.85	72.426	70.739	68.925	67.109	65.296	63.569	64.3	64.998	65.658	67.236	69.421	71.623	73.773	75.86	79.329	82.83	86.429	90.052	93.769
Other Demand		4.68	4.807	4.941	5.117	5.302	5.505	5.716	5.926	6.141	6.363	6.61	6.855	7.103	7.344	7.587	7.851	8.119	8.39	8.664	8.922
Residential		7.437	7.356	7.296	7.407	7.5	7.6	7.691	7.76	7.844	7.921	7.967	8.024	8.051	8.084	8.122	8.135	8.147	8.145	8.135	8.12
Transport		41.322	42.533	43.638	44.594	46.082	47.473	49.012	50.706	52.346	53.99	55.587	57.355	59.261	61.115	63.036	64.849	66.738	68.791	70.879	72.875
Policy Reform																					
Agriculture		5.156	5.134	4.948	4.803	4.875	5.011	5.069	5.078	5.095	5.163	5.173	5.267	5.29	5.361	5.413	5.377	5.453	5.55	5.622	5.694
Commerce		1.857	1.906	1.52	1.477	1.446	1.472	1.496	1.519	1.544	1.568	1.596	1.624	1.651	1.676	1.702	1.748	1.794	1.84	1.886	1.932
Transformation	Electricity	159.789	164.446	167.653	165.454	168.219	169.739	170.245	170.753	171.139	171.436	172.549	173.36	173.122	172.855	172.37	173.746	175.066	176.548	178.196	181.686
	Other	33.939	34.073	34.073	34.073	34.141	34.674	34.742	34.742	34.742	34.742	34.75	34.86	34.964	35.111	35.269	35.314	35.396	35.498	35.603	35.672
Industry		70.85	72.426	72.643	75.074	76.746	81.477	84.774	88.034	91.244	91.705	95.199	98.513	101.869	105.131	108.301	113.586	118.944	124.434	129.891	133.937
Other Demand		4.68	4.807	4.941	5.117	5.302	5.505	5.716	5.926	6.141	6.363	6.61	6.855	7.103	7.344	7.587	7.851	8.119	8.39	8.664	8.922
Residential		7.437	7.009	6.684	6.46	6.172	5.895	5.657	5.396	5.152	4.903	4.631	4.652	4.646	4.661	4.652	4.658	4.639	4.625	4.613	4.598
Transport		41.322	42.533	43.638	44.594	46.082	47.473	49.012	50.706	52.346	53.99	55.587	57.355	59.261	61.115	63.036	64.849	66.738	68.791	70.879	72.875

Emissions from energy production and use (M tonnes CH4)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																					
Agriculture		0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0.024	0.024	0.025	0.025	0.027	0.027	0.027	0.028	0.028	0.029	0.03	0.03	0.031	0.032	0.033	0.033	0.036	0.037	0.037	0.039
Other Demand		0	0	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Residential		0.024	0.024	0.025	0.025	0.025	0.025	0.025	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.021	0.02	0.02	0.02
Transport		0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.01	0.01	0.011	0.011	0.011	0.011
Intensive Policy																					
Agriculture		0.007	0.007	0.007	0.007	0.008	0.009	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.006
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0.002	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0.024	0.024	0.026	0.028	0.031	0.031	0.032	0.032	0.033	0.033	0.034	0.033	0.033	0.033	0.034	0.034	0.035	0.036	0.036	0.036
Other Demand		0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Residential		0.024	0.024	0.025	0.025	0.026	0.026	0.026	0.026	0.025	0.026	0.026	0.027	0.028	0.028	0.028	0.028	0.028	0.027	0.027	0.027
Transport		0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.01	0.01	0.011	0.011	0.011	0.011
Economic Instruments																					
Agriculture		0.007	0.007	0.007	0.007	0.008	0.009	0.009	0.01	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0.024	0.024	0.032	0.043	0.03	0.038	0.048	0.05	0.051	0.052	0.052	0.054	0.054	0.055	0.057	0.058	0.06	0.063	0.065	0.067
Other Demand		0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Residential		0.024	0.024	0.023	0.023	0.024	0.024	0.024	0.024	0.024	0.024	0.025	0.026	0.027	0.027	0.027	0.026	0.026	0.026	0.026	0.026
Transport		0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.01	0.01	0.011	0.011	0.011	0.011
Policy Reform																					
Agriculture		0.007	0.007	0.007	0.007	0.008	0.009	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.006
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.003	0.003	0.003
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0.024	0.024	0.026	0.028	0.031	0.026	0.027	0.027	0.028	0.033	0.034	0.033	0.033	0.033	0.034	0.034	0.035	0.036	0.036	0.036
Other Demand		0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Residential		0.024	0.023	0.023	0.022	0.021	0.02	0.02	0.019	0.017	0.017	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Transport		0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.01	0.01	0.01	0.01	0.011	0.011	0.011	0.011

Emissions from energy production and use (M tonnes N2O)

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																					
Agriculture		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Demand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Intensive Policy																					
Agriculture		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
Other Demand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Economic Instruments																					
Agriculture		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
Other Demand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Policy Reform																					
Agriculture		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transformation	Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry		0	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
Other Demand		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transport		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002

Total electricity consumption (PJ/ Annum)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																				
Coal	612.29	630.72	650.47	665.66	695.04	717.65	736.37	753.74	771.56	788.27	809.51	828.99	848.2	866.2	883.52	915.5	941.97	974.29	1005.94	1038.5
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	1.48	2.14	1.77	6.29	6.15	5.4	5.2
Pumped Storage	4.98	4.98	4.98	4.98	4.98	4.92	3.32	4.98	4.98	4.98	7.09	10.12	10.25	10.25	11.3	11.3	8.24	8.34	8.92	9.19
Hydro SA	5.42	5.37	5.33	5.28	5.23	5.19	5.14	5.12	5.05	5.01	5.01	4.9	4.9	4.9	4.85	4.85	4.85	4.85	4.85	4.85
Hydro SADC	32.09	32.09	32.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solar Thermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	45.65	46.17	46.82	47.48	48.13	48.78	49.43	50.1	50.74	51.4	52.04	52.7	53.13	53.56	53.99	54.43	55.1	55.3	55.73	56.17
Total	700.43	719.33	739.69	766.49	796.47	819.63	837.35	857.03	875.42	892.75	916.74	939.8	959.57	979.48	998.89	1030.94	1059.54	1092.02	1123.93	1157
Intensive Policy																				
Coal	609.38	627.35	621.7	599.37	585.28	571.09	527.14	534	540.4	546.43	555.72	559.3	560.52	555.11	562.02	570.75	579.19	588.49	596.72	599.77
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	4.41	6.52	9.68	9.68	9.68	10.73	10.73	10.73	10.73	10.73	10.73
Hydro SA	5.42	5.37	5.6	5.83	6.06	6.29	6.51	6.74	6.97	7.2	7.43	7.55	8.3	9.06	9.81	10.56	11.32	12.07	12.83	13.58
Hydro SADC	32.09	32.09	32.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09
Wind	0	0	12.28	26.16	40.04	53.92	55.95	55.95	55.95	55.95	55.95	61.41	68.8	82.68	83.59	90.98	98.37	105.76	113.15	127.03
Biomass	0	0	7.38	10.66	13.93	26.54	81.41	81.41	81.41	81.41	81.41	81.41	81.41	81.41	81.41	81.41	81.41	81.41	82.7	83.99
Solar Thermal	0	0	3.69	5.33	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45	18.45
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65
Total	696.95	714.87	732.8	740.5	756.91	769.44	782.61	789.7	796.33	802.59	814.22	826.54	835.9	845.13	854.75	871.62	888.21	905.65	923.32	942.29
Economic Instruments																				
Coal	609.36	627.33	644.31	629.69	630.53	615.52	614.17	623.41	632.21	640.76	652.44	662.93	673.63	683.89	693.76	712.69	731.43	744.12	749.94	757.11
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	7.09	10.25	10.25	10.25	11.3	11.3	11.3	11.3	11.3	11.3
Hydro SA	5.42	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.42	5.42	5.95	6.47	7	7.52	8.05	8.57	9.1
Hydro SADC	32.09	32.09	32.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09
Wind	0	0	0	13.88	27.76	41.64	41.64	41.64	41.64	41.64	41.64	41.64	41.64	41.64	41.64	41.64	41.64	48.55	62.42	76.3
Biomass	0	0	0	0	0	16.04	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87	27.87
Solar Thermal	0	0	0	0	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65

Total	697.5	715.42	732.4	742.66	761.01	775.92	786.4	795.64	804.44	812.99	826.78	840.48	851.18	861.97	873.41	892.87	912.13	932.26	952.47	974.05
Policy Reform																				
Coal	608.79	627.3	640.03	631.3	642.28	648.31	650.33	652.34	653.88	655.06	659.48	663.25	662.24	661.09	659.27	665.74	671.94	678.9	686.57	709.03
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	7.09	10.25	10.25	10.25	11.3	11.3	11.3	11.3	11.3	11.3
Hydro SA	5.42	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.37	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26
Hydro SADC	32.09	32.09	32.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09	43.09
Wind	0	0	3.07	6.15	9.22	12.3	15.37	18.44	21.52	24.59	27.67	30.74	36.52	42.3	48.07	53.85	59.63	65.4	71.18	76.96
Biomass	0	0	2.16	4.31	6.45	8.61	10.76	12.91	15.06	17.22	19.37	21.52	25.56	29.61	33.65	37.69	41.74	45.78	49.83	53.87
Solar Thermal	0	0	0	0.68	1.37	2.05	2.73	3.41	4.1	4.78	5.46	6.15	7.3	8.46	9.61	10.77	11.92	13.08	14.23	15.39
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65	45.65
Total	696.93	715.39	733.35	741.53	758.41	770.36	778.28	786.19	793.65	800.74	813.18	825.91	835.87	845.71	855.9	873.35	890.53	908.46	927.11	960.55

Total installed capacity (GW)

GW	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Base																				
Coal	34.15	32.17	32.17	32.17	32.17	32.17	32.17	32.17	32.17	32.55	32.93	33.5	34.52	34.17	34.17	35.32	35.74	36.38	37.66	37.66
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75
Pumped Storage	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	2.25	2.25	2.25	2.58	2.58	2.91
Hydro SA	0.88	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.86	0.86	0.86	0.85	0.85	0.85	0.82	0.82	0.82	0.81	0.81	0.81
Hydro SADC	1.07	1.07	1.07	1.07	1.07	1.07	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solar Thermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3.99	6.69	6.79	6.09	6.69	6.79	6.9	7	7.1	7.21	7.3	7.39	7.5	8.51	8.95	9	9.05	9.34	9.39	9.44
Total	41.67	42.39	42.49	41.79	42.39	42.49	42.96	43.06	43.15	43.64	44.11	44.76	45.89	46.55	47.63	48.83	50.05	51.3	52.63	53.01
Intensive Policy																				
Coal	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	2.25	3.25	3.25	3.25	3.58	3.58	3.58	3.58	3.58	3.58
Hydro SA	0.88	0.88	0.9	0.92	0.94	0.96	0.98	1	1.02	1.04	1.06	1.05	1.12	1.18	1.25	1.32	1.38	1.45	1.52	1.58
Hydro SADC	1.07	1.07	1.07	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Wind	0	0	1.77	3.77	5.77	7.77	8.06	8.06	8.06	8.06	8.06	8.85	9.92	11.92	12.05	13.11	14.18	15.24	16.31	18.31
Biomass	0	0	0.31	0.46	0.59	1.13	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.5	3.56
Solar Thermal	0	0	0.34	0.5	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72	1.72
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99
Total	41.67	41.67	44.11	46.81	50.18	52.74	55.37	55.39	55.41	55.43	55.49	57.27	58.41	60.47	61	62.13	63.26	64.39	65.58	67.7
Economic Instruments																				
Coal	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	33.52	33.52	33.52	33.52	33.52	33.52	33.52
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	2.25	3.25	3.25	3.25	3.58	3.58	3.58
Hydro SA	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.86	0.86	0.91	0.96	1	1.05
Hydro SADC	1.07	1.07	1.07	1.07	1.07	1.07	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Wind	0	0	0	0	0	0	2	4	6	6	6	6	6	6	6	6	6	6	6	6
Biomass	0	0	0	0	0	0	0	0	0.68	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
Solar Thermal	0	0	0	0	0	0	0	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82

Total	41.5	41.5	41.5	41.5	41.5	41.5	43.87	46.21	48.89	49.39	49.39	49.39	49.39	49.43	50.41	50.41	50.46	50.84	50.88	50.93
Policy Reform																				
Coal	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	34.15	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52	33.52
Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Storage	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	2.25	3.25	3.25	3.25	3.58	3.58	3.58	3.58	3.58	3.58
Hydro SA	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hydro SADC	1.07	1.07	1.07	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Wind	0	0	0.44	0.89	1.33	1.77	2.22	2.66	3.1	3.54	3.99	4.43	5.26	6.1	6.93	7.76	8.59	9.43	10.26	11.09
Biomass	0	0	0.09	0.19	0.27	0.36	0.46	0.55	0.64	0.72	0.82	0.91	1.08	1.25	1.42	1.6	1.76	1.94	2.11	2.28
Solar Thermal	0	0	0	0.06	0.13	0.19	0.25	0.32	0.38	0.45	0.51	0.57	0.68	0.79	0.9	1	1.11	1.22	1.33	1.44
Other renewables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99	3.99
Total	41.67	41.67	42.2	43.18	43.77	44.36	44.97	45.57	46.16	46.75	47.4	48.96	50.07	51.19	52.63	53.74	54.84	55.97	57.08	58.19

Total power sector costs (R mill)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	202
ase																				
oal	16,962.61	15,557.57	15,745.52	15,896.06	16,180.60	16,406.22	16,891.17	17,385.05	18,052.36	19,066.75	19,443.97	19,757.75	21,413.70	22,205.22	23,266.88	25,345.61	25,804.89	27,892.23	29,966.01	32,056.7
as	2.50	2.50	2.50	2.50	3.48	2.25	2.00	1.75	1.50	1.25	302.62	302.37	302.12	1,178.67	1,480.99	1,480.45	1,486.97	1,486.77	1,787.31	1,787.0
umped torage	101.48	101.48	101.48	101.48	101.48	101.48	101.48	101.48	101.48	101.48	1,376.29	3,288.50	3,288.50	3,288.50	3,925.90	3,925.90	4,563.30	4,563.30	4,563.30	4,563.3
ydro SA	78.19	77.85	77.51	77.16	76.82	76.47	76.13	75.96	75.44	75.10	75.10	72.03	72.03	72.03	71.68	71.68	71.68	71.68	71.68	71.6
ydro SADC	138.32	138.32	138.32	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.7
ind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
omass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
olar hermal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ther newables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ther	999.69	1,079.94	1,094.32	1,108.98	1,123.34	1,137.86	1,152.23	1,166.92	1,181.25	1,195.77	1,265.31	1,280.04	1,287.16	1,294.26	1,356.40	1,363.65	1,371.11	1,377.88	1,440.10	1,447.3
otal	18,282.79	16,957.66	17,159.65	17,371.90	17,671.44	17,910.00	18,408.73	18,916.88	19,597.75	20,626.07	22,649.01	24,886.41	26,549.23	28,224.40	30,287.57	32,373.01	33,483.67	35,577.58	38,014.12	40,111.7
tensive Policy																				
oal	14,973.43	13,536.26	13,630.22	13,505.27	13,913.18	13,794.48	13,435.42	13,485.76	13,531.44	13,574.14	13,642.72	13,664.81	13,667.83	13,617.43	13,665.62	13,728.18	13,788.42	13,855.12	13,913.88	13,932.6
as	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
umped torage	2,056.38	2,056.04	2,057.77	2,106.91	2,108.63	2,110.37	2,112.10	2,113.83	2,115.57	2,117.29	3,185.28	5,010.13	5,015.84	5,021.55	5,635.94	5,641.66	5,647.37	5,653.08	5,658.79	5,664.5
ydro SA	134.66	134.66	454.07	744.20	1,034.33	1,324.46	2,281.91	2,281.91	2,281.91	2,281.91	2,281.91	2,377.98	2,508.06	2,752.30	2,768.22	2,898.29	3,028.37	3,158.44	3,310.17	3,576.0
ydro SADC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ind	0.00	0.00	1,311.12	2,743.25	4,126.02	5,459.42	5,647.70	5,647.70	5,647.70	5,647.70	5,647.70	6,113.06	6,645.62	7,608.60	7,697.64	8,171.04	8,624.72	9,058.69	9,472.93	10,213.5
omass	41.01	41.01	507.86	709.19	904.36	1,594.08	4,694.57	4,694.57	4,694.57	4,694.57	4,752.02	4,780.74	4,780.74	4,780.74	4,780.74	4,780.74	4,780.74	4,780.74	4,827.91	4,873.2
olar hermal	0.00	0.00	1,099.80	1,573.65	4,966.24	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.31	5,683.3
ther newables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ther	1,129.60	1,129.54	1,144.62	1,151.51	1,174.92	1,191.38	1,261.95	1,262.27	1,262.61	1,262.93	1,263.26	1,263.59	1,264.68	1,265.76	1,266.85	1,267.94	1,269.02	1,270.11	1,272.84	1,275.5
otal	18,335.08	16,897.51	20,205.46	22,533.98	28,227.68	31,157.50	35,116.96	35,169.35	35,217.11	35,261.85	36,456.20	38,893.62	39,566.08	40,729.69	41,498.32	42,171.16	42,821.95	43,459.49	44,139.83	45,218.9
conomic Instruments																				
oal	16,075.09	14,826.54	14,964.36	14,835.51	14,837.95	14,706.26	14,689.52	14,762.04	14,830.56	14,896.76	14,838.34	14,922.14	15,009.51	15,092.75	15,172.81	15,342.18	15,525.56	15,648.17	15,700.90	15,780.8
as	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
umped torage	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	1,410.69	3,322.90	3,322.90	3,322.90	3,960.30	3,960.30	3,960.30	3,960.30	3,960.30	3,960.3
ydro SA	78.19	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	76.00	76.00	79.97	83.95	87.93	91.90	95.88	99.85	103.8
ydro SADC	138.32	138.32	138.32	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.7
ind	0.00	0.00	0.00	244.24	488.48	732.72	732.72	732.72	3,029.73	3,344.20	3,645.00	3,932.12	4,437.97	4,910.10	5,348.51	5,753.19	6,124.15	6,583.00	7,130.75	7,644.7

iomass	0.00	0.00	0.00	0.00	0.00	1,372.56	1,642.22	1,642.22	1,642.22	1,642.22	1,765.38	1,778.45	1,801.46	1,823.02	1,842.95	1,861.36	2,872.58	3,585.90	3,738.72	3,883.3
olar hermal	0.00	0.00	0.00	0.00	145.66	145.66	145.66	145.66	145.66	1,255.24	1,406.69	1,551.48	1,781.20	1,995.40	2,194.49	2,378.10	2,546.56	2,699.56	2,837.39	2,959.7
ther enewables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ther	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	959.67	960.30	961.65	963.3
otal	17,387.15	16,138.26	16,276.08	16,438.87	16,831.21	18,316.32	18,569.24	18,641.76	21,007.29	22,497.54	24,289.34	26,728.48	27,574.43	28,369.53	29,748.40	30,528.45	32,266.44	33,718.83	34,615.28	35,481.9
olicy Reform																				
oal	16,964.08	15,565.18	15,676.60	15,591.30	15,688.18	15,739.01	15,752.43	15,765.67	15,774.19	15,779.23	15,663.32	15,692.37	15,676.19	15,658.43	15,634.35	15,688.00	15,738.89	15,796.82	15,861.08	16,069.1
as	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
umped torage	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	135.88	1,410.69	3,322.90	3,322.90	3,322.90	3,960.30	3,960.30	3,960.30	3,960.30	3,960.30	3,960.3
ydro SA	78.19	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	77.85	74.78	74.78	74.78	74.78	74.78	74.78	74.78	74.78	74.7
ydro SADC	138.32	138.32	138.32	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.72	185.7
Vind	0.00	0.00	382.25	753.57	1,113.95	1,463.40	1,801.87	2,129.40	2,446.01	2,751.68	3,046.42	3,330.22	3,848.11	4,350.61	4,837.67	5,309.35	5,765.59	6,206.44	6,631.86	7,041.8
iomass	0.00	0.00	174.84	345.46	512.19	674.89	833.55	987.72	1,138.27	1,284.76	1,427.06	1,565.46	1,819.65	2,068.38	2,311.15	2,548.35	2,779.73	3,005.62	3,225.59	3,439.8
olar hermal	0.00	0.00	15.03	57.43	99.80	142.22	184.63	226.96	269.38	311.79	354.15	396.57	471.13	545.70	620.26	694.80	769.37	843.93	918.50	993.0
ther enewables	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
ther	918.66	918.66	918.66	1,099.52	1,273.86	1,442.25	1,604.40	1,760.07	1,909.74	2,053.18	2,190.17	2,321.13	2,534.85	2,740.47	2,938.35	3,128.15	3,310.20	3,484.18	3,650.41	3,808.5
otal	18,235.13	16,835.89	17,519.43	18,246.73	19,087.43	19,861.22	20,576.33	21,269.27	21,937.04	22,580.09	24,355.38	26,889.15	27,933.33	28,946.99	30,562.58	31,589.45	32,584.58	33,557.79	34,508.24	35,573.1