Index

AAMA (American Automobile Manufacturers Association) 12, 33
abatement 110, 241
comparison of impact from vehicle production and operation 141
marginal costs of 143
optimal emissions abatement level 110–11
and voluntary agreements 184
abatement costs 134, 185
ACEA (European Automobile Manufacturers Association) 248
ADL (Arthur D. Little Inc. report to DOE) 60, 65
aerodynamics, improved 198
AFDC (Alternative Fuels Data Center) 40, 41, 42, 44, 47
Airbus 62
air transport 9, 73, 76
commercial hydrogen aircraft 62
energy demand 8, 231
in ERIS model 58
and EU Emissions Trading Scheme 137–8
Alberini, A. 183
Albrecht, J. 140, 141
alcohol fuel cell vehicles 79, 229
alcohol fuels 74, 90, 231
from biomass 70, 232
alcohol or petroleum FVC with on-board reformer 47
alcohol vehicles with ICEs 41–3
Alexander, M. 117
alternative fuels 40–43, 113, 125–6
excise duty exemption 161
tax policies 160–61
aluminium, in car manufacture 142
American Council for an Energy-Efficient Economy 176
‘Analytical Methods of Road Transport Sector Strategies to Reduce Greenhouse Gas Emissions’, OECD 113
annual circulation tax 145–7, 150–54
anthropogenic climate change 2
Argote, L. 62
Arnott, R. 168
Asia
GHG emissions 249
two-wheeled vehicles 12
see also Japan, China
atmospheric composition 2
Australia
agreement with automobile industry 193
excise duty exemption on biofuels 161
National Average CO₂ Emissions (NACE) targets 193
Ausubel, J.H. 16
autonomous energy efficiency improvements (AEEIs) 83
auto-thermal reformers 65
average standard value system 119
Japan 120
Azar, C. 16
Banerjee, J. 174
Baranzini, A. 191
Barreto, L. 1, 29, 30, 32, 57, 62, 65, 88, 89, 94, 143, 218, 233
barriers, to the deployment of advanced passenger car technology 240–42
battery electric vehicles 44–5, 250
Bergmann, H. 139
Bevilacqua Knight Inc. 46
biodiesel 42–3, 250
Japan 127, 128
USA 128
bioethanol 10, 41–2
blending with gasoline 42, 128
Brazil 127, 129
production costs 62, 63
production 42
USA 128
biofuels 11, 125–6, 132
carbon dioxide emissions 42
introduction 129
Japan 127
production 160
EU 126, 127, 251–2
production costs 161
regulation of 125–6
USA 128
biofuel vehicles with ICEs 41–3
biomass
alcohol from 70, 232
cellulose 42
harvesting and transport 232
production 231
resources 67
biomass feedstocks 10
methanol and ethanol from 79–80
biomass fuels, for electricity generation 88
biomass-to-alcohol production 231
Blok, K. 216
Boardman, B. 175
Bonsall 164
Brau, R. 183, 185
Brazil
bioethanol 127, 129, 160, 251
National Alcohol Programme 129
‘bridging’ technologies 16, 76, 78, 228
Buchner, B. 143, 218
Buonanno, P. 218
Button, K. 164, 167

CAFE regulations see Corporate Average Fuel Economy (CAFE) legislation
Calthrop, E. 167
Cameron, M. 167
Canada
Air Transport Association 195
Climate Change Plan 193
Fuel Consumption Guide 195
Government Industry Motor Vehicle Energy Committee 194
Memorandum of Understanding with motor industry 193, 194
Motor Vehicle Fuel Consumption Standards for Passenger Cars 121
Motor Vehicle Fuel Efficiency Initiative 194
Natural Resources Canada 194
regulation of passenger car fuel economy 121–2
Responsible Care Programme 187–8
transport sector agreement 193–4, 195–6
vehicle labelling 195
voluntary agreements to improve fuel efficiency 194–5
capital investment 107, 240
cap and trade emissions trading systems 136
Europe 135, 137
Cararro, C. 183, 185
CARB (California Air Resources Board) 49, 124, 176, 251
assessment of emissions 129–30
carbon capture and storage 68, 85
carbon dioxide 2, 115–16
and electricity generation 6
and fossil fuel combustion 3, 7
and transport 6
carbon dioxide emissions
biofuels 42
EU 163
from cars 116
progress in EU, Korea and Japan 197
from energy use, decomposition formula 4
global emissions from energy 5, 6, 7
impact of EU policy measures 161–3
per capita emissions 5–6
see also emissions
carbon emissions, for different passenger transport energy chains 69
see also emissions
carbon leakage 142
carbon monoxide 40, 115
carbon sequestration 86–7
carbon taxes 154
Carlson, E.J. 65, 66
Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index
fuel demand 157
particulate matter emissions 115, 116
production prices 241
diffusion curves 205
diffusion of technology 205
direct investment 107
direct market-based instruments 106–7, 134
distance based fees 170–71
distribution, and policy instruments 108
downstream emission trading systems 139
Doyle, T.A. 46
Dresner, S. 155, 156
drivetrain efficiencies, of car technology–fuel combinations 61
drivetrain technologies 230
driving distances, estimating future 33–4
Dublin, parking prices 168
dynamic efficiency, and policy instruments 108, 184
E3 scenarios 14, 15–16
ECMT (European Conference of Ministers of Transport) 52
eco-efficiency 113, 114
eco-labelling 177
economic development and expansion 4
economic growth 15, 27
and resource utilization 113, 114
economies in transition (EITs) 4
ECTOS (Icelandic New Energy organisation and EU project) 221
EEA (European Environment Agency) 32, 113, 114
EERE (Energy Efficiency and Renewable Energy) 45, 46, 47
efficiency, global average of end-use efficiencies 61
efficiency prospects 49–52
Ehrlich, P.R. 4
EIA (Energy Information Administration) 9, 12, 29, 51, 52, 74
elasticity estimates, OECD 158
electric hybrid system 65
electricity 10–11
development of sustainable 88–9
electricity generation and carbon dioxide 6
from hydrogen fuel cells 88
natural gas fired generation 87
using biomass fuels 88
electric vehicles 43–7
battery electric vehicles 44–5, 250
see also fuel cell vehicles
emissions
cost of abatement 110
global emissions and sequestration
no-policy scenario 97
sustainability scenario 87
optimal abatement level 110
see also carbon dioxide emissions;
carbon emissions; greenhouse gas emissions
emissions reduction, and taxes 146
emissions trading 134, 135–44, 218
allocation of permits to vehicle models 142
baseline and credit 136
baseline emissions 142
cap and trade 136
for commercial fleets 143
cross sectoral 140, 142
downstream 139
EU 137–8, 162, 252
grandfathering 191
midstream 139
project based or off-set systems 136
and technology diffusion 143
under Kyoto Protocol 112, 135, 144
upstream 140–43
end-use efficiencies 61
energy
global final-energy consumption 8
global transport energy demand 7–13
energy consumption
global 73
by transportation 93
energy efficiency regulation,
comparison of methods 119–20
energy intensity, developments 28
energy policy assessment, experience
curves in 63
energy prices, and technological
development 213–14
energy systems 1–2
sustainable 86–9
energy and transport system development, in the absence of sustainable development objectives 92–7
eengine combustion 198–9
‘Environmentally Sustainable Transport’ project, OECD 113
environmental policy, voluntary approach, design issues in 182–5
environmental policy instruments 109
environmental regulations 245
environmental stress, long-term 15
environmental taxes 145
and consumer preferences 160
EPA (Environmental Protection Agency), USA 57, 154, 176
Epple, D. 62
equality 27
ERIS (Energy Research and Investment Strategy Model) 28–9, 57–70, 218, 251
air transport in 58
assumptions in transport modelling 61–2
car technology component costs 65–6
drivetrain efficiencies 60
illustrative carbon emissions for different passenger transport energy chains 69
modelling fuel production technologies 66–70
no-policy scenario 236
passenger transport technologies 62
reference energy system 59
relative drivetrain efficiencies of car technology–fuel combinations 61
social planner view 233
surface transport in 58
technology dynamics, and costs 62–6
unsustainable development 236
ethanol 10, 79, 249–50
EU (European Union)
arbitrary fuels 124–5
biofuel production 126, 127, 251–2
carbon dioxide emissions 163
car prices and registration tax 149
CIVITAS initiative 221
emissions trading scheme 135–6, 162, 252
and the aviation sector 137–8
Energy Taxation Directive 160
European directive on labelling 148, 172–4
proposed improvements 175–6
reports on effectiveness 174–5
European directive on passenger car-related taxes 146
European directive on the promotion of the use of biofuels and other renewable fuels for transport 125
fiscal instruments to reduce emissions from passenger cars 146
impact of policy measures on passenger car sales and CO2 emissions 161–3
manufacturers voluntary agreement to reduce CO2 emissions 244
periodic circulation tax on vehicles 150
petrol prices 162
safety regulations 162
sale of fuel efficient new vehicles 197
sustainability policy 113
sustainable surface transport work programme 221
targets for R&D investment 210
taxes on alternative fuels 160
TERM project 113
transport R&D 220–21
vehicle emissions standard 157
voluntary agreement with manufacturers 161–2
Europe
fiscal measures on passenger cars 148
manufacturers’ position papers on carbon targets for passenger cars 245
European Automobile Manufacturers Association 196
European Climate Change Programme 137
European Commission
Expert Group on Fiscal Framework Measures 145
negotiated agreement with automobile industry to reduce passenger car emissions 196–200
strategy to reduce emissions from passenger cars 131, 132
European Conference of Ministers of Transport 164
European Research Framework Programmes 221
Ewringmann, D. 140
excise duty, exemption for alternative fuels 161
experience curves, in energy policy assessment 63

Faaij, A.P.C. 67
Farrell, A. 16
Faucon, R. 42
FHA (Federal Highway Administration), US 9, 12, 33
final energy use 9
fiscal measures 144–72
EU 161
Fischer–Tropsch (FT) process 40, 79
formaldehyde 42
fossil fuels 2, 6, 40
combustion and carbon dioxide 3, 7
France, Responsible Care Programme 188
FreedomCAR and Fuel Initiative, USA 220
free rider problem 182, 184, 185, 202
fuel
global production of different transport fuels 80
in global transportation 11
for passenger cars 99
price elasticities 134, 158
regulation of 125–9
shares in sustainable scenario 75
for sustainable transport 230
taxes on 154–63
Fuel Cell Bulletin 244
fuel cell technologies
penetration into the car travel market 78
R&D 236
fuel cell vehicles 16, 45–7, 62, 72–3, 74, 77, 93, 228, 237–8, 250
alcohol or petroleum FVC with on-board reformer 47
and hydrogen 45
hydrogen fuel cell vehicles 46–7
Japan 222
petroleum fuel cell vehicles 229
production costs 229
under a no-policy scenario 94
fuel consumption estimates of potential improvements 50
labelling, effectiveness 174
rates under no-policy scenario 95
rates under sustainability scenario 82
fuel economy 116
credits trading 132
labelling 148, 172
fuel efficiency 38, 113, 251
and greenhouse gas emissions 81–6
fuel prices, and CO₂ emissions 163
fuel production 57
for sustainable transport 79–81, 230–34
fuel production technologies, modelling 66–70
fuel taxes 145, 171
alternative fuels tax policies 160–61
differential between types 154–5, 156
impact on travel demand 157
road fuel duty escalator, UK 155–6
to fund road transport projects 159
Fulton, L. 128, 129, 161
future transport activity 23

GBG (Green Budget Germany) 159
GDP
global 4
per capita growth 26
generated traffic 117
Germany
change in numbers using public transport 159
change in road transport fuel consumption 159
chemical industry voluntary agreement 185
‘eco’ tax 159
emissions trading for the transport sector 140
Federal Environment Agency 140
Gini index 26
Glachant, M. 185
Glaister, S. 155
Goh, M. 165
Goodwin, P. 158
Goulder, L.H. 207, 217, 218, 241
Index

GPS (Global Positioning System) charging system, Switzerland 166
grandfathering, in emissions trading schemes 191
Green, C. 51
Greene, D. 41, 116
Greene, D.L. 245
greenhouse gas emissions abatement 111 and expenditure on R&D 209 from cars 248 regulation 129–31 historical increase in 4 optimal abatement 110–11 policy context for 112–15 tax on 98 and transport fuel efficiency 81–6 under no policy and sustainable development scenarios 237 see also emissions greenhouse gas emissions trading schemes, and excise duty exemption 161 greenhouse gases 2, 29 driving forces for increase in 4 and policy 4 policy instruments to reduce 105–33 and population 6 technology as a policy to mitigate 216 Griliches, Z. 215

Hakim, D. 130
Hall, B. 214
Hamelinck, C. 40, 67
Hamilton, C. 4
Hammar, H. 155
HASA–ECS 28
heavy-duty vehicles 62 toll systems for 164
Heins, B. 185
Henke, J.M. 42
Herring, H. 117
Higgins 167, 168
Higley, C.J. 180
Holdren, J.P. 4
homogenous charged compression ignition (HCCI) systems 39 Honda 49
Howarth, R.B. 190
hybrid-electric ICE technologies 228–9
IPAT identity 4, 6
IPCC (Intergovernmental Panel on Climate Change) 1, 2, 23, 57
IRF (International Road Federation) 9, 12

Jaffe, A. 207, 241

Japan
average standard value system 119, 120
biodiesel 127, 128
biofuels 127
car sharing 169
circulation tax 150–51
eco-labelling 177
Energy Conservation Law 118, 119, 120
environmentally responsible driving scheme 176–7
fuel cell vehicles 222
fuel economy labelling 172
fuel efficiency targets 118–19
greenhouse gas emissions trading simulation 138
green taxation scheme 149
Keidanren Voluntary Action Plan 187–9
‘Low Emission Vehicle guidebook’ 176
manufacturers’ position papers on carbon targets for passenger cars 245
Ministry of Infrastructure and Transport 151
NEDO (New Agency and Industrial Technology Development Organisation) 172
Pollution Control Agreements 185, 191–2
regulation of passenger car fuel economy 118–20
‘Top-Runner’ Programme 118, 119, 120, 251
and USA, joint statement of intent 243–4
voluntary emissions trading scheme 138
Japanese Automobile Federation 176
Japanese Automobile Manufacturers Association 196

Japan for Sustainability 119
Jensen, P. 200
Jonsson, H. 222
Jungmeier, G. 42

Karmali, A. 137
Karshenas, M. 205
Kavalov, B. 157, 240, 241
Keith, D. 16
Kelly, J.A. 164, 166, 168
Kemp, R. 230, 235
Kempton, W. 88
‘key technologies approach’ 63
Khanna, M. 180, 183, 184
Klaassen, G. 15
Kopp, R.J. 216, 220
Korean Automobile Manufacturers Association 196
Krarup, S. 183, 185
Kreutz, T.G. 67
Kure, S. 138
Kyoto Protocol 112
clean development mechanism 112
emissions trading established under Annex B 112
emission targets of countries in joint implementation 112
Kypreos, S. 28, 57, 143, 218
labelling 172–7
design 177
fuel economy labelling 172
Landwehr, M. 9
latent demand 117
Leport, D. 42
Letendre, S.E. 88
lifespan of vehicle 35
Lightfoot, H.D. 51
Lipman, T.E. 88
liquefied natural gas (LNG) 41, 249
liquid petroleum gas (LPG) 41, 161
loan and equity guarantees 210
low-carbon vehicle and fuel technology, measures to achieve 243
low-carbon vehicles, regulations to command sale of 244
Luettge, L. 185
Luiten, E. 216
Lyon, T.P. 190

McDonald, A. 62, 66
Mansfield, E. 207, 214
manufacturers, incentives for 242–3
Manzini, P. 182, 184
Marie-Lilliu, C. 9
marine transport 9
Mariotti, M. 182, 184
MARKAL (MARKet ALlocation Model) 143
market-based instruments 108, 134–79
market failures 90, 241
Massachusetts Institute of Technology 49
Matsuno, Y. 191
Maxwell, J.W. 184, 190
Mayeres, I. 157, 246
Mehlin, M. 162, 163
Menanteau, P. 172
Menon, A. 165
methane 115–16
methanol 41, 79, 249
methanol-based steam reformers 65
midstream emission trading systems 139
Miketa, A. 219, 233
Millock, K. 182, 184
Minimum Energy Performance Standard (MEPS) 119
minimum standard value system for machinery and equipment 119
US 120
Montero, J.P. 135, 143
‘motorization rates’ 12
see also vehicle ownership
Moura, F. 88
MRI (Mitsubishi Research Institute) 138
MTBE (oxygen fuel additive) 128
Musters, A.P.A. 117

Nakićenović, N. 16, 23, 24, 25, 28, 30, 60, 203, 237
National Academy of Sciences 49
natural gas 10, 11, 93, 126, 231
advantages 40
natural gas vehicles with ICEs 40–41
negotiated agreements 107, 108
negotiated environmental (or voluntary) agreements 180–81, 192–201, 244–5
Netherlands 185, 192
Neij, L. 63
Netherlands
impact of labelling directive on CO₂ emissions 175
negotiated environmental agreements 185, 192
registration tax reduction 149
‘washing machine’-style vehicle label 173
nitrogen oxides 39, 115, 249
and aviation 137
nitrous oxide 40, 41, 43, 116
non-petroleum fuels, global consumption 10–11
no-policy scenario
comparison with sustainable scenario 236–40
fuel consumption rates under 95
global emissions and sequestration from all sources 97
technologies and fuels, passenger car travel 94
Norway, toll road scheme 166
nuclear energy 87, 89

OECD 180, 182, 185, 188, 190
elasticity estimates 158
‘Environmentally Sustainable Transport’ project 113
Environmental Policy Committee’s Task Force on Transport 113
guidelines for voluntary agreements 200
compared with automobile industry NEA 201
Working Group on ‘Analytical Methods of Road Transport Sector Strategies to Reduce Greenhouse Gas Emissions’ 113

OECD countries 4
road transport emissions 6–7
Öeko-Institut e. V 192
Index

Ogden, J.M. 60, 65, 66
Ogushi, T. 138
oil resources 72, 73, 93
Olson, M. 181
optimal emissions abatement level 110
Owens, B. 218, 219

Pakes, A. 214
paper industry, innovation in 216–17
parking policy 167–8
equity concerns 168
parking prices, Dublin 168
parking pricing, to reduce passenger
car use 167–9
Parry, I.W.H. 208, 209
Parsons, E. 67
particulate matter emissions, diesel 115
passenger cars 9–10
barriers associated with deployment of advanced technologies 240–42
carbon dioxide emissions from 116
command and control instruments for 115–31
design of taxes and charges (fiscal measures) 144–7
and emission abatement 112–13
fiscal measures in Europe 148
fuel economy, regulation 118–23
parking pricing to reduce use 167
R&D 220
‘rebound effect’ 116
regulation of greenhouse gas emissions 129–31
sales, impact of EU policy measures 161–3
shift from ICE technologies 76
sustainability in 76–9
technologies and fuels, in no-policy scenario 94
technology and fuels for sustainability scenario 77
passenger demand, global scenario 31
passenger motor vehicles 65
passenger road transport, policy instruments to reduce GHGs from 105–33
passenger transport, future demand and sustainable development 29–36
passenger transport energy chains, carbon emissions for 69
passenger transport technologies 62
passenger transport technology choice, impact of climate change policies on 98–100
passenger vehicle market, development of global 36
passenger vehicle technology, developments 228–30
patents 208, 213–14
PATH programme, USA 213
Paul Scherrer Institute 28
pay-as-you-drive vehicle insurance 170–71
PCAST 236
periodic taxes 150
personal mobility levels 14
Peteves, S.B. 157, 240, 241
petroleum consumption in transport 11
importance of 230–31, 240
production 80
petroleum fuel cell vehicles 60, 76, 78, 229
petroleum fuels 39–40, 126
petroleum products 9
transition from 72
petrol excise duty 248
petrol prices, EU 162
Plotkin, S.E. 245
policy 16, 17–18, 52, 71, 92, 131
and greenhouse gases 4
see also climate change policies
policy context, for greenhouse gas emissions from transport 112–15
policy instruments
administrative and political feasibility 108
applied to greenhouse gas mitigation 106–11
command and control 106, 115–31
criteria for evaluation 107–8
direct investment 107
direct market-based 106–7
distribution 108
dynamic efficiency 108
environmental effectiveness 108
evaluation of 107–10
indirect market-based 107
information 107
investment in research, development and demonstration (RD&D) 107
public R&D 208–20
R&D as 108
regulation 106
static economic efficiency 107
taxonomy of environmental policy instruments 109
three dimensional policy selection matrix 111
to reduce GHGs from passenger road transport 105–33
voluntary or negotiated agreements 107
policy measures 236
Pollution Control Agreements, Japan 185, 191–2
polymer electrolyte membrane (PEM) technology 45
Popp, D. 213, 214
population 31
global growth 26
and greenhouse gases 6
Portugal, reduction of purchase tax 149
PowerShift programme 161
price sensitivity, of consumers 168
private automobile see passenger cars
private passenger transport in developed regions 12
estimated number of vehicles 13
global 12–13
private sector, R&D, financial and fiscal support mechanisms in 210
project based or off-set systems, emissions trading systems 136
Proost, S. 157, 246
public agreements 189–92
and environmental issues 190
weaknesses 190
public transport 29, 34
charge reduction 166
and congestion charging 166–7
public voluntary programmes/schemes 180, 190
purchase choices, and information 172
PZEVs (Partial zero emissions vehicles) 124
R&D 100, 203–23, 252–3
automobile industry 203
catalytic financial measures 210
costs and benefits 218
direct financial measures 210
economic rationale for public 206–8
EU targets for 210
financial and fiscal support mechanisms in the private sector 210
government support for 207, 243
effectiveness 216–17
indirect fiscal measures 210
International Energy Agency review of energy R&D 217
investment in 241
and market forces 205
modelling in climate change policy 218–20
monitoring of programmes 217
NRC assessment of R&D programme implemented by US Dept of Energy 211–13
passenger cars 220
as a policy instrument 108
public, as a policy instrument 208–20
public good nature of 222, 241
returns to R&D and R&D spillovers 215
transport 220–22
underinvestment in 208
USA, renewable electric R&D programme 218–19
rail freight price reduction 166
rail transport 9, 11
real options method 218
rebound effect 116, 117
generated traffic 117
induced travel 117
latent demand 117
Redmond, L. 135, 136
reference energy system, ERIS model 59
regenerative braking 48
registration tax 145, 146–7, 149, 252
regulation 106, 108
to command sale of low carbon vehicles 244
energy efficiency, comparison of methods 119–20
environmental 245
fuel 125–9
greenhouse gas emissions from passenger cars 129–31, 132
passenger car fuel economy 118–23
Japan 118–22
passenger car fuel economy standards, China 122
pollutant gases from cars 115
technology 124–5
regulatory capture 184, 185
Reijnders, L. 232
renewable energy sources 38, 87, 89
Requate, T. 207, 243
reserves-to-production ratios 15
resource availability 57, 67
Resources for the Future forum 209
resource utilization, and economic growth 113, 114
Responsible Care Programmes 186
comparison in French and Canadian chemical industries 187–8
US 186–7
Riahi, K. 1, 24, 233
risk capital 210
road pricing 164
Singapore 165
UK 165–6
road transport 12
and greenhouse gas emissions trading schemes 138–9
private automobile travel 9
road transport emissions 8
growth 7
OECD countries 6–7
Roehrl, R.A. 24
Rogner, H.H. 57, 67, 231
rolling resistance 198, 230
Ross, M. 198
Rowse, J. 168
rural areas, reduction of transport charges 166
Ryan, L. 42, 150, 161, 163
safety regulations, EU 162
Sagar, A.D. 204, 214
Saliini, F. 182, 184
Samuelson, P. 181
Sandler, T. 181
Sanyal, P. 216
SASOL 40
Sauer, A. 123, 200
Schafer, A. 8, 30, 32, 33, 41, 51, 116
Schneider, S.H. 217, 218
Schrattenholzer, L. 1, 62, 66, 219, 233
Schumpeter, J.A. 204
Seebregts, A. 63
Segerson, K. 183, 184
self-regulation 186
SFA Pacific 40
Shapouri, H. 42
Shelton, W. 67
Simbeck, D.R. 67
Singapore, electronic road pricing system 165
socioeconomic inequality 15
Solomon, B.D. 174
South Asia, petroleum resources 78
spark ignition vehicles 39
Special Report on Emissions Scenarios 23–4
storyline B2 24, 28, 30
world regions in 25
storylines 24
static economic efficiency 107
Steiger, W. 39
Stern, T. 110, 111, 157
Stoneman, P. 205
’stop and go’ ICE technology 48
sulphur dioxide emissions, reduction 135
supply-side policy instruments 108
surface transport, in ERIS model 58
sustainable development 1, 71, 227
and climate change 1–7
and future demand for passenger transport 29–36
role of transport in 13–18
and transport 23
sustainable development objectives, in energy and transport system development in the absence of 92–7
sustainable development scenarios, IIASA–ECS definition 15–16
sustainable energy system 86–9
sustainable scenario, shares of transportation technology and fuels 75
sustainable transport, fuel production for 79–81, 230–34
sustainable transport and no policy scenarios comparison 236–40
comparison of shares of petroleum, alcohol and hydrogen 239
Swart, R. 23, 24, 25, 28, 30, 203, 237
Switzerland Association of Car Importers, self regulation declaration 191
Energy Law 191
GPS charging system 166
Mobility Car Sharing 169
synthesis gas 249
synthetic liquid fuels 10
Talvitie, A. 30
tank-to-wheels emissions from car travel, global, sustainability scenario 84
impact 68, 69, 83–6
taxes and charges (fiscal measures) 134, 144–71, 252
adjustment of vehicle taxes to reduce carbon dioxide 151
circulation tax 145, 146
design for passenger cars 144–7
and emissions reduction 146
environmental taxes 145
equity issues 147
on fuel 144, 145, 154–63, 171
on greenhouse gas emissions 98
registration tax 145, 146–7, 149
revenue from 171
and technologies and fuels for passenger car travel 99–100
user charges as fuel tax 113
VAT 148–9
on vehicle acquisition 147–50
on vehicle ownership 150–54
on vehicles 144, 171
tax policies, alternative fuel 160–61
tax reduction, for advanced fuel vehicles 148
Taylor, G. 209
technological change characteristics of 204–6
and energy prices 213–14
social acceptance 205
technological development and climate change 203
and diffusion 27–8
technology barriers associated with advanced passenger car technologies 240–42
choice of 16
diffusion of 205
future developments in transport 227–34
for passenger car travel, and tax 99
passenger vehicle technology developments 228–30
as a policy to mitigate GHGs 216
regulation of 124–5
required to meet 140g/km CO₂ emissions target 198–9
technology diffusion, indicators, USA 207
technology diffusion curve 206
technology dynamics, and costs 62–6
Ten Brink 140
TERM project, EU 113
TfL (Transport for London) 166
Thomas, C.E. 60, 65, 66
toll systems for heavy duty vehicles 164
Norway 166
‘Top-Runner’ Programme, Japan 118, 119, 120, 251
Toyota 49
tradable fuel economy credits 121
traffic demand management 113
transaction costs 185
transmission and distribution technologies 67
transmissions, improved 199
transport and carbon dioxide 6
car travel demand 9
future technology developments 227–34
future global energy consumption by 73, 93
global energy demand 7–13
historical energy use 9
Index

per capita energy consumption by region 10
R&D 220–22
role in sustainable development 13–18, 23
transportation technologies by share of total transport energy demand 231
modelling 58–62
shares in sustainable scenario 75
transport demand in industrialized regions 31
scenario 30–33
transport demand management 164, 245
transport energy consumption, future ‘no-policy’ scenario 96
sustainability scenario 72–6
transportation technologies by share of 231
transport and energy system development, in sustainable development objectives 92–7
transport fuel efficiency, and greenhouse gas emissions 81–6
transport modelling, assumptions in 61–2
transport R&D, EU 220–21
transport systems 1–2
travel behaviour, and taxation 148
travel demand 233
reduction 245
Turton, H. 4, 29, 30, 32, 57, 62, 65, 88, 94, 204, 218
two-wheeled vehicles 31
Asia 12

Ueda, S. 127

UK
carbon dioxide based annual circulation tax 150
Climate Change Levy 185
company cars 170
Dept of Transport 167
fuel escalator 155–6
HM Revenue and Customs 170
labelling 174
London, congestion charge 165–6,
road pricing 165–6

uncertainty 97, 98
and high risk investment 241
UNDP (United Nations Development Programme) 26
UNFCCC (United Nations Framework Convention on Climate Change) 112, 126
unilateral agreements 186–9
unilateral commitments 180
UN (United Nations) 1, 113
upstream emission trading systems 140–43

USA
acid rain programme 135
biodiesel 128
bioethanol production 128, 251
biofuels 128
CARB (California Air Resources Board) 49, 124, 129–30, 176, 251
Clean Air Act 128, 135
Climate Change Action Plan (CCAP) 190
Climate Change Technology Initiative (CCTI) 213
Corporate Average Fuel Economy (CAFE) legislation 121, 122, 132, 244, 251
diffusion indicators 207
DOE (Department of Energy) 44, 47, 150
eyearly reduction credits 191
electricity industry and R&D 216
energy scenarios for transport sector 245
EPA (Environmental Protection Agency) 44, 47, 57, 154, 176, 184
FHA (Federal Highway Administration) 9, 12, 33
FreedomCAR and Fuel Initiative 220
fuel economy listings 176
fuel taxes 154
‘Income Tax Credit for Alcohol used as Fuel’ 161
Interagency Analytic Team 216
and Japan, joint statement of intent 243–4
minimum standard value system for machinery and equipment 120
National Highway Traffic Safety Administration 121
National Research Council 51, 121
assessment of R&D programme
implemented by US Dept of
Energy 211–13
Office of Technology Assessment 51
PATH programme 213
reduction of GHG emissions 191
reformulated petrol programme 128
regulation
of greenhouse gas emissions in
passenger cars 129
of passenger car fuel economy 121
renewable electric R&D programme
218–19
Responsible Care Programme 186–7
tax on bioethanol 161
tax reduction for hybrid and electric
vehicles 150
tradable fuel economy credits 121
Zero Emission Vehicle (ZEV)
Program 124
voluntary agreements 107–8, 180–202,
244–5
between governments 105–6
categories of 180–81
design issues in environmental policy
182–5
economic efficiency of 183
empirical examples 185–201
environmental effectiveness 184
literature reviews on 183
with manufacturers, EU 161–2
OECD design recommendations
182–3
OECD guidelines 200
theoretical context of 181
weaknesses of 185
VTPI (Victoria Transport Policy
Institute) 116, 134, 157, 171
Wachs, M. 159
WBCSD (World Business Council for
Sustainable Development) 31
Weathervane 216
Webb, K. 188
Weiss, M.A. 49, 60, 65, 66
Weitzman, M.L. 134
Wellington, F. 123, 200
well-to-tank emissions 84
well-to-wheels emissions 83–6
sustainable development scenario
85–6
‘no-policy’ scenario 92–3
comparison of scenarios 238
Williams, R.H. 2
WWF (World Wildlife Fund) 182
Yagishita, T. 127
Zahavi, Y. 30
Zero Emission Vehicle (ZEV) Program
124–5, 132, 251