<table>
<thead>
<tr>
<th>PART A</th>
<th>GLOBAL ENERGY TRENDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A FRAMEWORK FOR OUR ENERGY FUTURE</td>
</tr>
<tr>
<td>2</td>
<td>GLOBAL ENERGY TRENDS TO 2040</td>
</tr>
<tr>
<td>3</td>
<td>OIL MARKET OUTLOOK</td>
</tr>
<tr>
<td>4</td>
<td>NATURAL GAS MARKET OUTLOOK</td>
</tr>
<tr>
<td>5</td>
<td>COAL MARKET OUTLOOK</td>
</tr>
<tr>
<td>6</td>
<td>POWER SECTOR OUTLOOK</td>
</tr>
<tr>
<td>7</td>
<td>RENEWABLE ENERGY OUTLOOK</td>
</tr>
<tr>
<td>8</td>
<td>ENERGY EFFICIENCY OUTLOOK</td>
</tr>
<tr>
<td>9</td>
<td>FOSSIL-FUEL SUBSIDIES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART B</th>
<th>OUTLOOK FOR NUCLEAR POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>NUCLEAR POWER TODAY AND DECISIONS TO COME</td>
</tr>
<tr>
<td>11</td>
<td>PROSPECTS FOR NUCLEAR POWER TO 2040</td>
</tr>
<tr>
<td>12</td>
<td>THE IMPLICATIONS OF NUCLEAR POWER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PART C</th>
<th>AFRICA ENERGY OUTLOOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>ENERGY IN AFRICA TODAY</td>
</tr>
<tr>
<td>14</td>
<td>OUTLOOK FOR AFRICAN ENERGY TO 2040</td>
</tr>
<tr>
<td>15</td>
<td>AFRICAN ENERGY ISSUES IN FOCUS</td>
</tr>
<tr>
<td>16</td>
<td>BUILDING A PATH TO PROSPERITY</td>
</tr>
</tbody>
</table>

<p>| ANNEXES | |
|---------| |
| 1       | ANNEXES |</p>
<table>
<thead>
<tr>
<th>Page</th>
<th>Natural gas market outlook</th>
<th>Global overview</th>
<th>135</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Demand</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional trends</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sectoral trends</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resources and reserves</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas production trends</td>
<td>146</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outlook for gas supply security</td>
<td>158</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rising gas import needs</td>
<td>159</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A growing cast of gas suppliers</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implications for the main importing regions</td>
<td>166</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coal market outlook</td>
<td>171</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Overview</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional trends</td>
<td>176</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sectoral trends</td>
<td>179</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserves and resources</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trade</td>
<td>183</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pricing of internationally traded coal</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Costs and investment</td>
<td>189</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional insights</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td></td>
<td>China</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td></td>
<td>India</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Europe</td>
<td>199</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power sector outlook</td>
<td>201</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Context</td>
<td>202</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity demand</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity supply</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overview</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power generation capacity</td>
<td>208</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power generation</td>
<td>215</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Investment</td>
<td>217</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power generation costs</td>
<td>221</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity-related carbon-dioxide emissions</td>
<td>225</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electricity prices</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry</td>
<td>227</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residential</td>
<td>229</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional focus</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>230</td>
<td></td>
</tr>
</tbody>
</table>

Part A: GLOBAL ENERGY TRENDS

1. A framework for our energy future
   - Scope of the report
   - Methodological approach
     - Modelling framework
     - Defining the scenarios
   - Main non-policy assumptions
     - Economic growth
     - Demographic trends
     - Carbon-dioxide prices
     - Technology
   - Energy supply costs and prices
     - Oil prices
     - Natural gas prices
     - Coal prices

2. Global energy trends to 2040
   - Energy trends by scenario
   - Energy trends in the New Policies Scenario
     - Demand
     - Supply
     - Inter-regional trade
     - Energy investment
   - Energy-related CO2 emissions
     - Recent developments
     - Emissions and climate impact in the New Policies Scenario
       - 450 Scenario

3. Oil market outlook
   - Global overview
   - Demand
     - Regional trends
     - Sectoral trends
     - Trends by product
   - Production
     - Resources and reserves
     - Production prospects
   - Refining and trade
     - Trade in crude oil and oil products

World Energy Outlook 2014

© IEA/OECD, 2014
European Union 231
Japan 233
China 234
India 235
Middle East 236

Renewable energy outlook 239
Recent trends and policies 240
Outlook by scenario 241
Renewables outlook by sector in the New Policies Scenario 243
Global and regional trends 243
Sectoral trends 244
Power generation 246
Transport 251
Industry and buildings 254
Avoided CO₂ emissions 255
Renewables outlook by source in the New Policies Scenario 257
Bioenergy 257
Hydropower 259
Wind power 261
Solar photovoltaics 264
Other renewables 270
Economics of renewables 271
Investment 271
Subsidies 274

Energy efficiency outlook 279
Introduction 280
Current status of energy efficiency 280
Recent progress 280
Recent policy developments 282
Outlook for energy efficiency 285
Trends by fuel 287
Trends by sector 291
Energy efficiency and competitiveness 300
How energy efficiency affects international competitiveness 301
Scope for energy efficiency to cut costs in energy-intensive industries 302
Impact of improved energy efficiency on economic competitiveness 308
Broader benefits 310
Household spending on energy 310
Fossil-fuel import bills 311
CO₂ emissions 312
Fossil-fuel subsidies 313
Overview 314

Identifying the problem 315
Defining fossil-fuel subsidies 315
Forms of subsidy and why they exist 315
Why reform is needed 317
Measuring their size 318
Methodology 318
Estimates of fossil-fuel subsidies in 2013 320
Impacts of fossil-fuel subsidies on clean energy technologies 324
Low-carbon power generation 324
Energy efficiency 326
Implementing reforms 328
Recent policy developments 329
Case studies of reform 329
Guidelines on best practice 340

Part B: OUTLOOK FOR NUCLEAR POWER 345
Nuclear power today and decisions to come 347
Context 348
Historical and current developments 348
Reactor technology and designs 353
Policy framework 356
Countries with existing programmes 358
Potential newcomer countries 361
Economics and financing 362
Economics of existing capacity 365
Economics of new builds 366
Financing 373
Facing public concerns 375
Issues across the lifecycle of nuclear power 377
Risk, perception and public opinion 381

Prospects for nuclear power to 2040 383
Introduction 384
New Policies Scenario 384
Approach and key assumptions 384
Nuclear power capacity and generation 386
Investment needs and associated costs 391
Regional trends 394
Low Nuclear Case 400
Developments that could slow the expansion of nuclear power 400
Assumptions 401
Nuclear power capacity and generation 402
High Nuclear Case 403
Assumptions 403
Nuclear power capacity and generation 404
Part C: AFRICA ENERGY OUTLOOK

Energy in Africa today
Context
Economy
Demography
Business environment and infrastructure
Governance
Access to modern energy
Access to electricity
Access to clean cooking facilities
Overview of energy demand
Power sector
End-use sectors
Overview of energy resources and supply
Oil and natural gas
Renewables
Other
Energy trade
Energy affordability

Outlook for African energy to 2040
Projecting future developments
Economic and population growth
Policy environment
Overview of energy demand trends
Outlook for the power sector
Electricity demand
Electricity supply
Electricity transmission and trade
Outlook for other energy-consuming sectors
Residential

Transport
Productive uses
Outlook for energy supply
Oil
Natural gas
Coal
Renewables
International energy trade
Crude oil
Oil products
Natural gas
Coal
Energy and the environment
Energy-related CO2 emissions
Deforestation and forest degradation

African energy issues in focus
Five features of Africa’s energy outlook
Electricity access: what is the path to power?
Biomass: here to stay?
Is oil the way forward for Nigeria?
South Africa: will energy diversity deliver?
Mozambique and Tanzania: how to get best value from gas?

Building a path to prosperity
Towards a better-functioning sub-Saharan energy sector
Three keys to Africa’s energy future
Investment in the region’s energy supply
Making the most of Africa’s resources
Regional energy co-operation and integration
An African Century Case
Africa’s energy choices in a global context
List of figures

Part A: GLOBAL ENERGY TRENDS

Figures for Chapter 1: A framework for our energy future
1.1 Total primary energy demand and GDP in selected countries, 1971-2012 40
1.2 Average IEA crude oil import price by scenario 49
1.3 Natural gas price by region in the New Policies Scenario 51
1.4 Coal price relative to gas price by region in the New Policies Scenario 52

Figures for Chapter 2: Global energy trends to 2040
2.1 World total primary energy demand by scenario 55
2.2 Fuel shares in world primary energy demand in the New Policies Scenario 57
2.3 Primary energy demand growth by region and fuel type in the New Policies Scenario, 2012-2040 57
2.4 Incremental oil demand in selected non-OECD regions in the New Policies Scenario 59
2.5 Fuel shares in global final energy consumption in the New Policies Scenario 62
2.6 Primary energy demand by region in the New Policies Scenario 63
2.7 Primary energy demand growth by selected region in the New Policies Scenario 64
2.8 Energy demand and GDP per capita, and corresponding oil price in the New Policies Scenario 65
2.9 World energy demand by selected sector in the New Policies Scenario 69
2.10 Change in energy demand by sector and region in the New Policies Scenario, 2012-2040 70
2.11 Weighted average spending on energy end-use by region in the New Policies Scenario 72
2.12 Spending on energy end-use by selected region in the New Policies Scenario 72
2.13 Lifetimes of fossil-fuel and uranium resources 75
2.14 Change in energy production by region in the New Policies Scenario, 2012-2040 76
2.15 Change in oil production relative to the level in 2013 in the New Policies Scenario 79
2.16 World fossil-fuel production and trade in the New Policies Scenario 82
2.17 Value of net trade in fossil fuels in the New Policies Scenario 84
2.18 Cumulative global energy supply investment by fuel and type in the New Policies Scenario, 2014-2040 85
2.19 Global fossil-fuel energy-related CO2 emissions and total cumulative CO2 emissions in the New Policies Scenario 88
2.20 Cumulative energy-related CO2 emissions by region in the New Policies Scenario 89
2.21 Reduction in energy-related CO2 emissions in 450 Scenario relative to the New Policies Scenario 91
2.22 Cumulative CO2 emissions reduction by sector and region in the 450 Scenario relative to the New Policies Scenario 91
2.23 Average annual capacity additions of low-carbon technologies by scenario and cumulative CO2 savings in the power sector in the 450 Scenario relative to the New Policies Scenario 92

Figures for Chapter 3: Oil market outlook
3.1 World oil demand and oil price by scenario 97
3.2 Growth in world oil demand by region in the New Policies Scenario 100
3.3 Impact of fuel switching and efficiency on the change in global oil demand by sector in the New Policies Scenario, 2013-2040 102
3.4 World transport oil demand change by main products and sub-sector in the New Policies Scenario, 2013-2040 103
3.5 Discounted total annual costs of passenger light-duty vehicles in selected regions in the New Policies Scenario, 2020 105
3.6 Global demand for petrochemical feedstock by oil product in the New Policies Scenario 106
3.7 World oil demand growth by product in the New Policies Scenario 108
3.8 Schematic of the PRMS classification 113
3.9 Volumes of global conventional oil discovered by decade versus discoveries required in the New Policies Scenario 114
3.10 Change in oil production by selected region in the New Policies Scenario 115
3.11 Change in world oil production by type in the New Policies Scenario 118
3.12 Tight oil production by country in the New Policies Scenario 120
3.13 Oil production by type in Mexico in the New Policies Scenario 125
3.14 Conventional oil production in Iran in the New Policies Scenario 129
3.15 OPEC oil production by region and type in the New Policies Scenario 130
3.16 Asian imports versus Middle Eastern exports of crude oil in the New Policies Scenario 133

Figures for Chapter 4: Natural gas market outlook
4.1 World natural gas demand by scenario 137
4.2 Natural gas demand by selected region in the New Policies Scenario 138
4.3 Natural gas demand in the Middle East by sector in the New Policies Scenario 141
4.4 World natural gas demand by sector in the New Policies Scenario 143
4.5 Change in natural gas demand by sector in selected regions in the New Policies Scenario, 2012-2040 144
4.6 World natural gas production by type in the New Policies Scenario 147
4.7 Estimated methane emissions associated with oil and natural gas production, 2012 154
4.8 Change in natural gas production in selected countries in the New Policies Scenario 156
4.9 European natural gas imports by source 160
4.10 Share of top-five producers of oil and gas in total production in the New Policies Scenario 162
4.11 Inter-regional natural gas trade by pipeline and LNG in the New Policies Scenario 162
4.12 Inter-regional LNG exports by source in the New Policies Scenario 163
4.13 Natural gas imports by source to OECD Europe in the New Policies Scenario 167
4.14 Gas imports by source to selected Asian markets in the New Policies Scenario 168

Figures for Chapter 5: Coal market outlook
5.1 Share of world energy demand and electricity generation by fuel and scenario 173
5.2 Annual change in coal demand by key region 178
5.3 Incremental coal demand by key sector, region and decade in the New Policies Scenario 179
5.4 Share of world coal production by key country in the New Policies Scenario 182
5.5 Share of world coal trade by type and key country in the New Policies Scenario 185
5.6 Steam coal prices in coastal China, Europe and the United States in the New Policies Scenario 187
5.7 FOB cash costs and market volume for global seaborne steam coal trade in the New Policies Scenario 188
5.8 Average FOB cash costs for key steam coal exporters 189
5.9 World coking and steam coal production by type of mine in the New Policies Scenario 190
5.10 Share of China in global coal markets and China’s coal import dependence in the New Policies Scenario 191
5.11 Major coal mines and coal-fired power plants in China, 2013 193
5.12 Cash costs of steam coal to southern coastal China, 2020 194
5.13 United States power generation fuel mix in the New Policies Scenario 195
5.14 Coal deliveries to the power sector under contract in the United States by source as of 2013 196
5.15 Global coal trade by major importing regions in the New Policies Scenario 199

5.16 OECD Europe coal production, net imports and import dependency in the New Policies Scenario 200

Figures for Chapter 6: Power sector outlook
6.1 Electricity demand by region in the New Policies Scenario 204
6.2 World electricity and total final energy intensity in the New Policies Scenario 205
6.3 Annual electricity consumption per capita and share of electricity in total final energy consumption by selected region in the New Policies Scenario 207
6.4 World electricity consumption by sector in the New Policies Scenario 207
6.5 Power generation capacity flows by source in the New Policies Scenario, 2014-2040 210
6.6 Net change in world power generation capacity by fuel type and region in the New Policies Scenario, 2013-2040 211
6.7 World electricity generation by source in the New Policies Scenario 215
6.8 World electricity generation by source in the New Policies Scenario 216
6.9 Share of electricity generation by source and selected region in the New Policies Scenario 217
6.10 World investment in the power sector by region in the New Policies Scenario 218
6.11 Cumulative world investment in the power sector by generating type, 2014-2040 220
6.12 Cumulative global power sector investment by type and selected region in the New Policies Scenario, 2014-2040 221
6.13 Total power generation costs by selected region in the New Policies Scenario, 2020 222
6.14 Total power generation costs by selected region in the New Policies Scenario, 2040 223
6.15 Electricity-related CO₂ emissions and carbon intensity of electricity generation in the New Policies Scenario 226
6.16 Industrial electricity spending including taxes and savings due to energy efficiency improvements by selected region in the New Policies Scenario 228
6.17 Residential electricity spending including taxes and savings due to energy efficiency improvements by selected region in the New Policies Scenario 229
6.18 United States electricity generation by source and CO₂ intensity in the New Policies Scenario 230
6.19 European Union electricity generation by source and CO₂ intensity in the New Policies Scenario 232
6.20 Japan electricity generation by source and CO₂ intensity in the New Policies Scenario 234

World Energy Outlook 2014
Figures for Chapter 7: Renewable energy outlook

7.1 Share of global renewables consumption by sector in the New Policies Scenario
7.2 Share of global renewables consumption by sector and region in the New Policies Scenario
7.3 World renewable energy balances in the New Policies Scenario, 2040
7.4 Incremental global electricity generation from renewables by type in the New Policies Scenario
7.5 Incremental electricity generation from renewables by region in the New Policies Scenario, 2012-2040
7.6 Biofuels consumption in road transport by region in the New Policies Scenario
7.7 Heat demand provided by renewable sources in the buildings and industry sectors by region in the New Policies Scenario
7.8 Global CO₂ emissions avoided from greater use of renewables in the New Policies Scenario
7.9 Global bioenergy use by sector in the New Policies Scenario
7.10 Production of biofuels by type and total biofuels demand by region in the New Policies Scenario, 2020 and 2040
7.11 Hydropower capacity additions by region in the New Policies Scenario
7.12 Hydropower generation and share of total generation in the New Policies Scenario
7.13 Installed wind power capacity by type and region in the New Policies Scenario, 2040
7.14 Wind power capacity additions and replacements, and share of total generation by selected region in the New Policies Scenario
7.15 Solar PV capacity by type and region in the New Policies Scenario, 2040
7.16 Illustrative electricity load curve for high-demand summer day
7.17 Solar PV capacity additions and share of maximum PV output in peak demand by selected region in the New Policies Scenario
7.18 Global investment in renewables-based power capacity by source in the New Policies Scenario
7.19 Change in global renewables power subsidies, 2012 to 2013
7.20 Renewables power subsidies by source in the top-15 countries, 2013

Figures for Chapter 8: Energy efficiency outlook

8.1 Annual change in primary energy intensity
8.2 Transmission and distribution loss rates
8.3 Factors contributing to global savings in primary energy demand in the New Policies Scenario relative to Current Policies Scenario
8.4 Global primary energy savings from energy efficiency by fuel and sector in the New Policies Scenario relative to the Current Policies Scenario, 2040
8.5 Global fossil-fuel demand and cumulative energy efficiency savings by fuel in the New Policies Scenario
8.6 Change in global final energy consumption by selected fuel, sector and contributing factor in the New Policies Scenario
8.7 Electricity demand for lighting in buildings by contributing factor
8.8 Market share in global passenger light-duty vehicle sales in the New Policies Scenario
8.9 Reduction in energy intensity in cement production by contributing factor in the New Policies Scenario, 2012-2040
8.10 Composition of value added in chemicals exports by country of origin, 2009
8.11 Estimated unit production cost of a plastic bottle and an aluminium beverage can in selected regions, 2013
8.12 Average estimated electricity prices for electric arc furnaces in selected countries, 2013
8.13 Change in energy spending and value added in the chemicals industry, 2000-2011
8.14 Diffusion of cumulative energy efficiency spending on cars worldwide through the manufacturing and services sectors in the New Policies Scenario, 2014-2040
8.15 Change in energy intensity and value added by sector in the Efficient World Scenario relative to the New Policies Scenario, 2030
8.16 Share of energy expenditures in household income in selected regions in the New Policies Scenario
8.17 Oil and natural gas import bills and avoided import bills due to energy efficiency by region in the New Policies Scenario
8.18 World energy-related CO₂ emissions abatement in the New Policies Scenario relative to the Current Policies Scenario

Figures for Chapter 9: Fossil-fuel subsidies

9.1 Economic value of global fossil-fuel subsidies by fuel
9.2 Example of the calculation of subsidies for oil products in Indonesia, 2013
9.3 Economic value of fossil-fuel consumption subsidies by fuel for
the top 25 countries, 2013 321
9.4 Value of fossil-fuel subsidies in selected countries and rate
of subsidisation of fossil fuels, 2013 323
9.5 Electricity generating costs in the Middle East, 2020 325
9.6 Payback periods to invest in more efficient energy-consuming
equipment in selected Middle East countries 328
9.7 Fossil-fuel subsidies by fuel in Egypt 332
9.8 Gasoline and diesel prices in Indonesia compared to spot prices in Singapore 335
9.9 Fossil-fuel subsidies by fuel in Nigeria, 2013 338
9.10 Critical steps of a process to reform fossil-energy subsidies 340

Part B: OUTLOOK FOR NUCLEAR POWER

Figures for Chapter 10: Nuclear power today and decisions to come
10.1 Reactor construction starts and timeline of events 349
10.2 Age profile of nuclear capacity by selected region 352
10.3 Overview of basic nuclear reactor technologies and their share of
construction starts 353
10.4 Status of nuclear power programmes, end-2013 357
10.5 Costs in the lifecycle of a nuclear power plant 364
10.6 Historical overnight cost of construction for nuclear power plants
in France and the United States 367
10.7 Historical construction times and capacity factors for nuclear power
plants by selected region 368
10.8 Sensitivity of nuclear generating costs to changes in parameters 370
10.9 Generating costs for selected new power plants under different fuel
cost and CO₂ price assumptions 371
10.10 Ownership of nuclear power generation assets, 2012 374

Figures for Chapter 11: Prospects for nuclear power to 2040
11.1 Nuclear power generating costs for new plants in selected regions
in the New Policies Scenario, 2030 386
11.2 World installed nuclear power capacity by region in the
New Policies Scenario 387
11.3 Installed nuclear power capacity by key region in the
New Policies Scenario 387
11.4 Nuclear power capacity additions and retirements by key region
11.5 Global nuclear power capacity additions and retirements in the
New Policies Scenario 389
11.6 Nuclear power generation by region in the New Policies Scenario 390
11.7 Change in share of nuclear power generation and capacity by
selected region in the New Policies Scenario 391
11.8 Nuclear power capacity and share of generation by selected region
in the New Policies Scenario 395
11.9 EU nuclear power capacity in the New Policies Scenario and
retirement profiles under different lifetime extension assumptions 397
11.10 Nuclear power capacity in the Low Nuclear Case 402
11.11 Nuclear power capacity by region, by scenario and case 405
11.12 Global nuclear power capacity by scenario and case 406
11.13 Nuclear fuel cycle and competition from secondary sources options 407
11.14 Uranium demand in the New Policies Scenario by region 409
11.15 Uranium demand in the New Policies Scenario compared with
existing and planned production 410

Figures for Chapter 12: The implications of nuclear power
12.1 Change in global capacity and generation in the Low Nuclear Case
compared with the New Policies Scenario, 2040 414
12.2 World natural gas and steam coal trade in the New Policies Scenario
and Low Nuclear Case 415
12.3 Net energy self-sufficiency in selected regions in the New Policies Scenario
and the Low Nuclear Case 416
12.4 Power generation mix by selected region in the New Policies Scenario
and Low Nuclear Case 418
12.5 Natural gas and coal import bills by selected region in the
New Policies Scenario and Low Nuclear Case 419
12.6 Global energy-related CO₂ emissions and CO₂ emissions avoided by
nuclear in the New Policies Scenario 421
12.7 Cumulative CO₂ emissions avoided by nuclear power by selected
region in the New Policies Scenario, 1971-2040 421
12.8 Average cost of CO₂ emissions avoided by nuclear power by selected
region in the New Policies Scenario, 2014-2040 422
12.9 Change in global CO₂ emission indicators in the Low Nuclear Case
relative to the New Policies Scenario 423
12.10 World cumulative spent nuclear fuel discharged since 1971
in the New Policies Scenario 426

Part C: AFRICA ENERGY OUTLOOK

Figures for Chapter 13: Energy in Africa today
13.1 Map of Africa and main sub-regions for this study 435
13.2 GDP of sub-Saharan Africa and Germany (PPP terms), 2013 436

World Energy Outlook 2014

Table of Contents
13.3 Number of countries by level of national income and number of people in sub-Saharan Africa living on less than $1.25 per day 437
13.4 Growth in sub-Saharan trade by region 437
13.5 Duration of electrical outages and impact on business sales in selected countries 440
13.6 Number and share of people without access to electricity by country, 2012 445
13.7 Average electricity consumption per household in sub-Saharan Africa, 2012, and indicative consumption levels by appliance 447
13.8 Largest populations relying on the traditional use of solid biomass for cooking in sub-Saharan Africa by sub-region, 2012 448
13.9 Fuelwood consumption per capita per day in selected countries 449
13.10 Main fuel used by households for cooking 450
13.11 Population and per capita energy demand by country in sub-Saharan Africa, 2012 451
13.12 Sub-Saharan Africa primary energy mix by sub-region, 2012 452
13.13 Oil product demand growth by sub-region, 2000-2012 453
13.14 Electricity consumption in Africa by end-use sector and sub-region, 2012 454
13.15 Electricity demand met by back-up generators by sub-region, 2012 456
13.16 Transmission and distribution losses and loss rates, 2012 457
13.17 Installed grid-based capacity by type and sub-region 458
13.18 Car ownership in selected countries, 2012 460
13.19 Sub-Saharan Africa natural gas, coal and oil resources, end-2013 462
13.20 Global discoveries of oil and gas 463
13.21 Major energy infrastructure and main hydrocarbon basins 465
13.22 Sub-Saharan Africa oil production by country and total demand 468
13.23 Sub-Saharan Africa natural gas production by country and total demand 469
13.24 Existing hydropower capacity and potential in Africa 471
13.25 Indicative levelised costs of electricity for on-grid and off-grid technologies in sub-Saharan Africa, 2012 472
13.26 Crude oil exports from Africa’s west coast by destination 475
13.27 Africa’s major international energy trade flows by sub-region, 2012 477
13.28 Oil product price differentials between Nigeria, Angola and neighbouring countries, 2013 479
13.29 Kerosene price and subsidy in selected countries, 2013 479
13.30 Grid electricity prices by end-use sector in selected countries, 2013 480
13.31 Household energy spending as share of income 481

Figures for Chapter 14: Outlook for African energy to 2040
14.1 Growth in GDP and GDP per capita by region in the New Policies Scenario 485
14.2 Population growth in sub-Saharan Africa by sub-region 486
14.3 Total primary energy demand and demand per capita in sub-Saharan Africa in the New Policies Scenario 490
14.4 Primary energy demand in sub-Saharan Africa by fuel in the New Policies Scenario 491
14.5 Electricity demand in sub-Saharan Africa and the share from those that gain access in the New Policies Scenario 494
14.6 Electricity generation by fuel in sub-Saharan Africa in the New Policies Scenario, 2012 and 2040 496
14.7 Electricity generation by fuel in the New Policies Scenario 498
14.8 Change in residential energy demand by fuel in sub-Saharan Africa in the New Policies Scenario, 2012-2040 502
14.9 Electricity demand per electrified household in sub-Saharan Africa in the New Policies Scenario 503
14.10 Vehicle stock in sub-Saharan Africa by type in the New Policies Scenario 504
14.11 Oil demand in transport in sub-Saharan Africa in the New Policies Scenario 504
14.12 Final energy consumption in productive uses in sub-Saharan Africa in the New Policies Scenario 505
14.13 Change in GDP by sector and related energy use in the New Policies Scenario 506
14.14 Oil production in sub-Saharan Africa in the New Policies Scenario 507
14.15 Net present value of oil developments at different risk levels using post-2030 cost assumptions 508
14.16 Oil production in sub-Saharan countries other than Nigeria and Angola in the New Policies Scenario 509
14.17 Natural gas production in sub-Saharan countries in 2012 and change to 2040 in the New Policies Scenario 514
14.18 Destination of gas production in sub-Saharan Africa in the New Policies Scenario 516
14.19 Increase in renewables-based capacity by sub-region and type in sub-Saharan Africa in the New Policies Scenario, 2012-2040 518
14.20 Sub-Saharan hydropower capacity and remaining potential in the New Policies Scenario 522
14.21 Sub-Saharan Africa crude oil exports and imports in the New Policies Scenario 525
14.22 Import dependence for selected oil products in sub-Saharan Africa (excluding South Africa) in the New Policies Scenario 526
14.23 LNG exports from sub-Saharan Africa in the New Policies Scenario 527
14.24 Indicative delivered costs of LNG from selected sources to Europe and main Asian import markets, 2025

14.25 Energy-related CO₂ emissions by selected country and region in the New Policies Scenario

Figures for Chapter 15: African energy issues in focus

15.1 Population without access to electricity by sub-region in sub-Saharan Africa in the New Policies Scenario

15.2 Electricity access by region in sub-Saharan Africa in the New Policies Scenario

15.3 Electricity demand from the population gaining access to electricity in sub-Saharan Africa in the New Policies Scenario

15.4 Optimal split by grid type in Nigeria and Ethiopia, based on anticipated expansion of main transmission lines

15.5 Indicative levelised costs of electricity for on-grid, mini-grid and off-grid technologies in sub-Saharan Africa, 2012

15.6 Technology mix for mini-grid and off-grid power generation in sub-Saharan Africa in the New Policies Scenario, 2040

15.7 Household energy consumption for cooking by fuel in sub-Saharan Africa in the New Policies Scenario

15.8 Population with and without clean cooking access in sub-Saharan Africa in the New Policies Scenario

15.9 Primary fuel/technology used by households for cooking in sub-Saharan Africa in the New Policies Scenario

15.10 Nigeria and Angola conventional oil production in the New Policies Scenario

15.11 Comparison of planned projects in Nigeria and Angola

15.12 Average daily oil production and distribution in Nigeria, 2013

15.13 Gas production in Nigeria in the New Policies Scenario

15.14 Electricity demand growth by sector in South Africa in the New Policies Scenario

15.15 South Africa mine-by-mine coal supply curve and the average coal export price, 2013

15.16 Levelised costs of power generation by fuel and technology in South Africa

15.17 Main gas fields and infrastructure in Mozambique and Tanzania

15.18 Gas consumption and export in Mozambique and Tanzania in the New Policies Scenario

15.19 Indicative capital intensity and gas utilisation for different large-scale uses of gas

Figures for Chapter 16: Building a path to prosperity

16.1 Policy actions and outcomes in the African Century Case

16.2 Investment in energy supply in sub-Saharan Africa

16.3 Shares of investment by sector in sub-Saharan Africa in the New Policies Scenario

16.4 Relationship between indicators for governance and for gross capital formation in sub-Saharan Africa

16.5 Relationship between indicators for governance and for quality of electricity supply in sub-Saharan Africa

16.6 Ownership structure of oil and gas output, and power generation capacity in sub-Saharan Africa

16.7 Estimated fiscal revenue from hydrocarbon extraction in sub-Saharan Africa in the New Policies Scenario

16.8 GDP growth in sub-Saharan Africa in the African Century Case and the New Policies Scenario

16.9 Increase in regional electricity generation and trade in sub-Saharan Africa in the African Century Case versus the New Policies Scenario, 2040

16.10 Country-by-country growth in electricity consumption per capita in sub-Saharan Africa by scenario

Table of contents

Part A: GLOBAL ENERGY TRENDS

Tables for Chapter 1: A framework for our energy future

1.1 Real GDP growth assumptions by region

1.2 Population assumptions by region

1.3 CO₂ price assumptions in selected regions by scenario

1.4 Recent developments and key conditions for faster deployment of clean energy technologies

1.5 Fossil-fuel import prices by scenario

Tables for Chapter 2: Global energy trends to 2040

2.1 World primary energy demand by fuel and scenario

2.2 World primary energy demand by fuel in the New Policies Scenario

2.3 World primary energy demand by region in the New Policies Scenario

2.4 Number of people without access to modern energy services by region, 2012

2.5 Energy net import/export shares by fuel and region in the New Policies Scenario

2.6 Energy- and climate-related indicators by Scenario

Tables for Chapter 3: Oil market outlook

3.1 Oil and liquids demand by region and scenario

3.2 Oil demand by region in the New Policies Scenario

© IEA/OECD, 2014
Part B: OUTLOOK FOR NUCLEAR POWER

Boxes for Chapter 10: Nuclear power today and decisions to come
10.1 Getting the most out of existing nuclear plants 350
10.2 Non-proliferation of nuclear weapons 352
10.3 Looking ahead to Generation IV technologies 355
10.4 Ownership of nuclear power generation assets 374
10.5 The accident at Fukushima Daiichi and lessons learned 376

Boxes for Chapter 11: Prospects for nuclear power to 2040
11.1 Help wanted 389

Part C: AFRICA ENERGY OUTLOOK

Boxes for Chapter 13: Energy in Africa today
13.1 China’s increasing investment in African energy 438
13.2 Africa’s energy sector data 442
13.3 Defining modern energy access for this study 443
13.4 Major hydrocarbon basins in sub-Saharan Africa 464

Boxes for Chapter 14: Outlook for African energy to 2040
14.1 Modelling energy demand and supply in sub-Saharan Africa 489
14.2 Charcoal production and the size of the market 520
14.3 Natural gas flaring in sub-Saharan Africa 530

Boxes for Chapter 15: African energy issues in focus
15.1 Bottled gas: half-full or half-empty? 550
15.2 Will Nigeria’s Petroleum Industry Bill see the light of day? 554
15.3 Tackling oil theft 557
15.4 Karoo Basin shale – a domestic gas source for South Africa? 564
15.5 Building up a customer base for natural gas 573

Boxes for Chapter 16: Building a path to prosperity
16.1 Power tariffs: trapped between affordability and cost recovery? 587
16.2 Botswana – a model for resource governance? 592
16.3 The West Africa Gas Pipeline: partial delivery of its promise 594

List of spotlights

Part A: GLOBAL ENERGY TRENDS
Are warning signs appearing on the horizon for oil production? 78
The importance of efficiency in coal-fired power plants 180

What could revolutionise electricity supply? 214
Solar PV: declining costs and value with increasing deployment 268
Can energy efficiency make the production of bottles and cans competitive in high-cost regions? 303
How do subsidies to fossil fuels compare with those to renewables and nuclear power? 326

Part B: OUTLOOK FOR NUCLEAR POWER
Can SMRs lead to a new view of nuclear economics? 393
Should nuclear power be considered imported or indigenous energy? 417

Part C: AFRICA ENERGY OUTLOOK
Falling back on back-up generators 456
Why does oil production not directly reflect resource potential? 508
With grid or without? The varied dynamics of expanding electricity access in Nigeria and Ethiopia 540
The nexus of governance and energy sector reforms: a key to poverty reduction and economic growth? 582