

Index

- Aarhus Convention 127–8, 131, 146–7, 149, 151, 162–3, 168–9
- Aaron, K. 226
- accounting, and impact assessments *see* full-cost accounting requirements for impact assessments
- Adams, S. 220
- Adgate, J. 58, 295
- Adger, W. 301
- agriculture and livestock grazing concerns, New Zealand 246–7 *see also* land use
- air quality concerns 57, 138–9
US Clean Air Act 138, 192, 196–7, 200
see also greenhouse gas emissions; pollution
- Algeria 4, 289
- Allen, D. 197, 277
- Alvarez, R. 196
- Amass, J. 261
- Amos, J. 175
- Anderson, K. 281
- Anderson, V. 242
- Andreeva, E. 42
- Argentina 4, 289
- Arnstein, S. 147–9, 162
- Arthur-Young, A. 249
- Australia 4, 37, 55, 289
- Ayres, R. 254
- Banisar, D. 127, 130, 140
- Barcella, M. 196
- Bargh, J. 266
- Barker, L. 84
- Battlement Mesa Health Impact Assessment *see under* health impact assessment (HIA), US
- Begos, K. 184
- Belarus 289
- Bhatia, R. 39, 41–2
- bias problem 201–6
see also regulation of shale gas production, federalism factors, US
- Birnie, P. 222
- Blake, M. 178
- Blevins, A. 97
- Boisson de Chazournes, L. 170
- Bows, A. 281
- Boyer, E. 204
- Bradsher, K. 4
- Brady, W. 144
- Braman, D. 203–4
- Brandt, A. 277
- Brasier, K. 182
- Brazil 4, 289
- Breyer, S. 201
- bridge fuel, natural gas as 273, 277–8
- Brown, D. 271–90, 304–6
- Brown, M. 269
- Bruch, C. 129
- Bryden, D. 158
- Buanomano, D. 205
- Buchele, M. 64
- Budlender, D. 214
- Bulgaria 289
- Bullis, K. 65, 190
- Burns, M. 223
- Canada
Environmental Impacts of Shale Gas Extraction in Canada report 185, 211–12
environmental, social, and health impact (ESHIA) assessment 37
greenhouse gas emissions 289

- low quality water sources, use of 64–5
- shale gas resources 3–4
- carbon, social cost of carbon (SCC) model 69–70, 72
- carbon dioxide fracturing 66
- carbon emissions 216, 273–4, 285
 - cumulative carbon dioxide emitters, global top ten 288
 - see also* greenhouse gas emissions
- Carlton, J. 53
- Carson, G. 193
- Chance, N. 42
- Chazan, G. 4
- Chevron, shale gas exploration 55, 264–5
- China 3, 4, 288–9
- Clark, H. 304
- clean-ups, lack of funding for, New Zealand 244
 - see also* New Zealand, sustainable management of onshore recovery of unconventional gas; pollution
- Cleetus, R. 259
- climate change
 - Intergovernmental Panel on Climate Change (IPCC) 28–9, 284–7
 - and shale gas *see* sustainable solution to climate change, shale gas as part of
 - UK Department of Energy and Climate Change (DECC) Consultation Paper 150–51, 154–7, 161–2
 - see also* environmental issues; greenhouse gas emissions
- coal to natural gas combustion shift effects 275–6, 281–2
 - see also* electricity; sustainable solution to climate change, shale gas as part of
- Cointe, B. 279
- Coleman, M. 46
- collaboration
 - benefits, health impact assessment (HIA), US 40, 43, 50
 - co-operative governance mechanism, need for, South Africa 227
 - and locally protective tools and collaboration 103–4, 114, 116
- community
 - Scottish Planning Policy Framework (NPF3), community consultation measures 163
 - UK Infrastructure Act and community compensation measures 155–7
 - see also* national interest
- community responses to local impacts, US 101–21, 299–300
- American Petroleum Institute (API) 111–12
- Appalachian Shale Recommended Practices Group (ASRPG) 111–13
- Colorado, noise restrictions for shale gas operations 109–10
- community engagement practices 110–14
- consensus-building processes 114–21
- consensus-building processes, interest and issues assessment 118
- consensus-building processes, management process 119–20
- economic development support 113
- environment and health and safety protection 113, 115
- land use regulation to promote community values 104–10, 116–17, 120
- local government zoning regulation 103, 105–9
- locally protective tools and collaboration 103–4, 114, 116
- Marcellus Shale Coalition (MSC) 111–12
- New York, *Wallach v. Town of Dryden* 110
- Pennsylvania constitutional guarantees 107–8

- Pennsylvania Environmental Council (PEC) recommendations 115–16, 119
- Pennsylvania, Environmental Rights Amendment, preservation of natural resources 106–8
- Pennsylvania Oil and Gas Act 104–9, 297
- Pennsylvania regulatory sanctions 108
- Pennsylvania Supreme Court, *Huntley & Huntley v. Borough of Oakmont* 105
- Pennsylvania Supreme Court, *Range Resources v. Salem Township* 105
- Pennsylvania Supreme Court, *Robinson Township v. Commonwealth of Pennsylvania* 105–9
- recommendations 120–21
- RESOLVE involvement in consensus process 119
- site-by-site permitting paradigm 115, 120–21
- ‘social license to operate’ 110–11
- stakeholder involvement 116–19
- sustainable development, fostering 102–4
- transparent communication, need for 103–4, 113–14, 120
- well siting permit process 115–17
- compensation
- Comprehensive Environmental Response Compensation, Pennsylvania 128–9
 - UK Infrastructure Act and community compensation measures 155–7
- confidentiality 175–7
- see also* transparency
- consensus-building processes 114–21
- see also* community responses to local impacts
- constitutional environmental rights 17–18, 20–28, 293–9, 301–5, 307
- continuous improvement principle suggestion 72
- see also* full-cost accounting requirements for impact assessments
- Copeland, C. 200
- Corburn, J. 41
- corporate ‘greenwashing’ concerns 27
- cost factors
- cheaper natural gas prices leading to higher rates of electricity consumption of 282
 - consumer cost reductions 259
 - cost-benefit analysis, need for, South Africa 228
 - cost-effectiveness of energy efficiency, energy efficiency and sustainability, US 257–61, 265–6
 - full-cost accounting requirements *see* full-cost accounting requirements for impact assessments
 - ‘funding bias’ criticisms of shale gas studies 204–5
 - health impact assessment (HIA), US 39–40, 50
 - price and non-pricing policies 269
 - renewable energy 258–9
- Coughlin, K. 262
- Craig, R. 194
- Crannell, J. 144
- credibility increase benefits 129–31, 140
- see also* public participation and sustainability, Pennsylvania
- Croatia 289
- cultural cognition of risk 203–5
- Curley, J. 99
- Dannenbergh, A. 36, 40–42
- Davis, C. 65, 71
- Daya-Winterbottom, T. 230–50, 301–2
- decision-making
- business decision making 56–7, 63
 - ‘delegated power’ and ‘citizen control’, UK 148–9

- health impact assessment (HIA), US
36–7, 45–6, 50
- process involvement, Pennsylvania
132, 137, 141–2
- see also* public participation;
stakeholder participation
- Dellinger, M. 128–30
- Den Elzen, M. 280
- Dernbach, J. 1–30, 52–3, 76, 126, 167,
192, 293–308
- Detrow, S. 58, 175–7, 179
- Dominiczak, P. 144
- Doster, A. 95
- Douglas, H. 154
- Downing, Y. 230, 239, 248
- Drajen, M. 68
- drilling
- development impact on sustainable
housing in rural communities,
Pennsylvania 85–8
 - health impact assessment (HIA), US
42–51
 - horizontal drilling and unregistered
landowners, UK 153
 - Marcellus Shale Advisory
Commission (MSAC)
recommendations 180
 - Marcellus Shale Coalition (MSC)
111–12
 - moratorium 46–7, 242
 - permits 115–17, 138–40, 144, 155
 - public participation and
sustainability, Pennsylvania
133–7
 - technological advances 64
 - see also* fracturing; mining; wells
- drinking water sources, New Zealand
241
- see also* water
- Du Plessis, W. 214
- Dunkley, E. 156
- Durham, D. 52, 65
- Dymi, A. 84, 100
- economic development considerations
20–22, 84–5, 113
- Edenhofer, O. 247
- Efstathiou, J. 195, 204
- Egypt 289
- Ehrhardt-Martinez, K. 270
- electricity
- coal to natural gas combustion shift
effects 275–6, 281–2
 - generation costs 258, 266
 - Integrated Resource Plan for
Electricity, South Africa 218
- Elliott, R. 258
- Ellsworth, P. 204
- Ellsworth, W. 60
- employment effects 85–7, 195–6, 259,
263–5
- energy
- International Energy Agency (IEA)
73–4, 254–5, 257–8, 265–6
 - mix and sustainability, South Africa
216–21, 225
 - regulation, federalism factors, US
191–4
- energy efficiency and sustainability, US
253–70, 304–6
- American Council for an
Energy-Efficient Economy
(ACEEE) report 255, 258
 - barriers, overcoming 267–70
 - California Air Resources Board
report 268–9
 - Chevron claims on shale gas 264–5
 - consumer cost reductions 259
 - cost-effectiveness of energy
efficiency 257–61
 - electricity generation costs 258, 266
 - employment effects 259, 263–5
 - energy efficiency as invisible
resource 256–7
 - energy service companies (ESCOs)
254–5
 - greenhouse gas emissions and
pollution reduction 259, 263–4
 - historical impact of energy efficiency
256–7
 - incentive realignment, need for 268
 - International Energy Agency (IEA)
reports on energy efficiency
254–5, 257–8, 265–6
 - market barriers 267–9
 - non-energy benefits 260–61

- payback timescale 261
- policy options 268–9
- price and non-pricing policies 269
- ‘rebound effect’ 269–70
- renewable energy costs 258–9
- renewables compared to shale gas 261–4
- shale gas in energy efficiency context 264–7
- shale gas in energy efficiency context, cost effects 265–6
- shale gas in energy efficiency context, pollution concerns 266
- Engel, K. 192–3
- environmental issues
 - Comprehensive Environmental Response Compensation, Pennsylvania 128–9
 - corporate ‘greenwashing’ concerns 27
 - degradation, and sustainable development 20–24, 26–7
 - Department of Environmental Affairs (DEA) sustainability mandate, South Africa 222
 - environmental impact assessment 38–43, 52–3
 - federalism factors, US 195
 - and health and safety protection 113, 115
 - internalization of external environmental and social costs, need for 57–8
 - Karoo geological structure and biodiversity, South Africa 220–21
 - national environmental standards (NES), New Zealand 232–4, 240–41, 246, 248–9
 - New York State Environmental Quality Review Act (SEQRA) process 46
 - Pennsylvania Environmental Council (PEC) recommendations 115–16, 119
 - Pennsylvania, Environmental Rights Amendment 106–8
 - Resource Management Act (RMA), New Zealand *see* New Zealand, sustainable management of onshore recovery of unconventional gas, Resource Management Act (RMA)
 - Strategic Environmental Assessment (SEA), South Africa 212
 - sustainable housing in rural communities, Pennsylvania 84
 - transparency relevance to sustainability, Pennsylvania 167–72
 - US EPA’s *Study of Hydraulic Fracturing*. . . 72–3
 - see also* climate change; greenhouse gas emissions; pollution
- Epstein, P. 200
- Esch, M. 46
- Eshelman, R. 275
- ethical issues, sustainable solution to climate change 283–90
- EU
 - cumulative carbon dioxide emissions 288
 - energy savings in buildings 259–61
 - public concern on shale gas development 54–5
 - REACH regulation 170–71
 - Seveso Directives 169
 - see also* individual countries
- Ewing, I. 246
- expert information, biased assimilation of 203–5
- fair share, government’s fair share of safe global emissions 286–7
- see also* greenhouse gas emissions
- Farley, H. 253
- Feree, P. 196
- Ferguson, M. 266
- Feris, L. 214
- Ferrar, K. 179, 182
- flowback fluids, chemical identity protection 177–8, 185
- see also* transparency relevance to sustainability, Pennsylvania
- Fountain, H. 195

- fracturing
 - carbon dioxide 66
 - hydraulic 60–62, 65–6, 71–3, 172–8
 - toxic additives 65
 - and wastewater 52, 195
 - see also* drilling; technology advances
- France 260, 288–9
- Freedman, A. 285
- Frewer, L. 146–8
- Freyman, M. 58, 60
- Frieden, T. 170
- full-cost accounting requirements for
 - impact assessments 52–77, 294–6
 - air quality concerns 57
 - alternative technologies, consideration of 71–2
 - analytical tools to estimate costs and impacts of regulations 69–70
 - best management practices 65
 - business case for sustainability, lack of 63
 - carbon dioxide fracturing, technological challenges 66
 - continuous improvement principle suggestion 72
 - critical water-related risk in hydraulic fracturing 60–62, 66, 71
 - disclosure requirements 75
 - environmental and health risks 52–3
 - forensic accounting techniques 71
 - fracturing technologies minimizing water use, risk assessment 65–6
 - full-cost accounting system construction 70–74
 - implementation options 74–7
 - integration into business decision making system 56–7
 - internalization of external environmental and social costs, need for 57–8
 - International Energy Agency (IEA) ‘Golden Rules’ for shale gas development 73–4
 - KPMG, *Watered-down* assessment 60–62, 66, 71
 - natural resource damage assessment techniques 71
 - Pennsylvania experience, acid mine drainage 64
 - Pennsylvania experience, learning from 58–62
 - Pennsylvania experience, learning from, University of Pittsburgh’s Shale Gas Roundtable involvement 59–60, 67, 69
 - Pennsylvania experience, US Geological Survey into landscape consequences of natural gas extraction 68
 - profitability assessment 63
 - public concern on shale gas development 53, 55–6
 - recycling and water treatment technologies 64
 - reflexive regulation 76
 - regulatory progress, US 67–70, 72–3, 76–7
 - shale gas accessibility 54
 - shale gas development decision making and sustainability 56–8
 - shale gas resource estimates 53–4, 64
 - social cost of carbon (SCC) model 69–70, 72
 - stakeholder involvement effects 75–6
 - technology innovation concerns and possibilities 63–5, 71–2
 - toxic fracturing additives, use reduction measures 65
 - US EPA’s *Study of Hydraulic Fracturing*. . . 72–3
 - US experience as comparison 54–5
 - water quality concerns 57–8
 - water use and wastewater 52
 - well field pro forma financial statement 63
 - ‘funding bias’ criticisms of shale gas studies 204–5
 - see also* cost factors
- Funke, N. 219
- future development and sustainability 140–42, 148–9, 246–50, 293–308
- future emissions, projection of 277–8, 280
- see also* greenhouse gas emissions

- Galbraith, K. 65, 194
 Garcia, R. 95
 Garrett, R. 189
 Geller, H. 269
 Gerland, P. 22
 Germany 282–3, 288–9
 GHG *see* greenhouse gas emissions
 Gibson, R. 84
 Gilliland, D. 64
 Glazewski, J. 209–29, 301–3
 Goldman, G. 178
 Goldman, L. 295
 Goldstein, B. 165–86, 297–8
 Gottlieb, L. 39–40, 48
 government transparency issues, UK
 156–7, 160–62
 government's fair share of safe global
 emissions 286–7
 Gear, A. 155
 greenhouse gas emissions
 atmospheric concentration goal and
 ethical issues 284
 carbon emissions 216, 273–4, 285,
 288
 energy efficiency and sustainability,
 US 259, 263–4
 future emissions, projection of
 277–8, 280
 government's fair share of safe global
 emissions 286–7
 methane emissions 196–7, 276–8,
 281
 reduction commitment, US 275–6
 responsibility allocations 286–8
see also climate change;
 environmental issues; pollution
 Gross, S. 204
 groundwater contamination concerns,
 New Zealand 230, 248
see also water
 Grundy, K. 235
 Gruver, M. 57
- Halper, E. 53
 Hamburg, M. 169
 Hamilton, G. 64
 Hand, M. 262
 Hansen, E. 64
 Hansen, J. 29
 Hanson, D. 269
 Hardin, G. 57
 Harris, P. 38, 40–42
 Harris-Roxas, B. 34
 Havemann, L. 211
 Hayes, D. 195
 health
 Pennsylvania Department of Health
 (PADOH), health impact
 exclusion 180–81
 public concerns and lack of trust
 181–5
 risks, full-cost accounting
 requirements for impact
 assessments 52–3
 health impact assessment (HIA), US
 33–51, 294–6
 assessment stage 36
 Battlement Mesa Health Impact
 Assessment 43–6
 Battlement Mesa Health Impact
 Assessment, political conflicts
 45
 Battlement Mesa Health Impact
 Assessment, public concern
 issues 44–5
 Battlement Mesa Health Impact
 Assessment, stakeholder
 involvement 44–5
 benefits of 33–4
 collaboration benefits 40, 43, 50
 cost factors 39–40, 50
 decision-making phase 36–7, 45–6,
 50
 definitions 35, 49
 Environmental Health Impact
 Assessment 38–9
 environmental impact assessment
 (EIA), lack of health focus 41
 environmental, social, and health
 impact (ESHIA) assessments
 37–8
 evolution, and sustainability link
 37–9
 growth in US 39–40
 monitoring phase 37

- and National Environmental Policy Act (NEPA) 37–8, 48
- and natural gas drillings 42–6
- and natural gas drillings, challenges 48–51
- and natural gas drillings, legislative mandates 46–8
- New York regulation of water usage 48
- New York State Assembly
 - moratorium on gas drilling 46–7
- New York State Department of Health ‘public health review’ of shale gas development 47
- New York State Environmental Quality Review Act (SEQRA) process 46
- North Slope Borough (Alaska) HIA 42–3
- North Slope Borough (Alaska) HIA, environmental impact
 - assessment (EIA) concerns 43
- Pennsylvania regulations for water use and water quality 48
- political factors 45, 49
- prediction validity concerns 49
- process stages 36–7, 42, 44, 50
- scoping phase 36, 42, 50
- screening stage 36, 50
- Senate Bill 2697 and Environmental Conservation Law 47
- stakeholder involvement 44–5, 50
- state regulations and trends dealing with water use and quality 48
- training concerns 50
- versus environmental impact
 - assessment (EIA) 40–42
- Hoffman, A. and M. 221
- Holden, M. 175
- Hooper, D. 21
- horizontal drilling and unregistered landowners, UK 153
 - see also* drilling
- housing in rural communities *see* sustainable housing in rural communities, Pennsylvania
- Howarth, R. 196–7
- Human Rights Act considerations, UK 155
- Hungary 289
- hydraulic fracturing 60–62, 66, 71–3, 172–8
 - see also* fracturing
- impact assessments
 - full cost accounting *see* full-cost accounting requirements for impact assessments
 - health impact *see* health impact assessment (HIA), US
- Impact Fee, Pennsylvania 180
- incentives 150, 159, 200, 268
- India 288–9
- information
 - access, Right to Know Law, Pennsylvania 136
 - availability, stakeholder participation, UK 162–3
 - expert information, biased assimilation of 203–5
 - knowledge base expansion benefits 129–30, 140
 - Pennsylvania Act 13, failure to provide pertinent information 178–9, 184–5
- Infrastructure Act, UK 144–5, 150–57, 161–2
- Infrastructure Development Act, South Africa 225–6
- infrastructure requirements, sustainable housing in rural communities, Pennsylvania 95
- innovation 63–5, 71–2, 179
- interest group politics, effects of 193–4
 - see also* stakeholders
- Intergovernmental Panel on Climate Change (IPCC) 28–9, 284–7
 - see also* climate change
- International Energy Agency (IEA) 73–4, 254–5, 257–8, 265–6
 - see also* energy
- International Union for the Conservation of Nature and Natural Resources (IUCN) 25

- invisible resource, energy efficiency as
256, 266–7
- Iran 289
- Ireland 289
- Irwin, F. 129
- Israel 289
- Italy 289
- Jacquet, J. 182
- Japan 288–9
- Jenkins, J. 52
- Johnson, J. 268
- Johnson, N. 59
- Johnston, I. 149
- Jordan, A. 301
- Kahan, D. 203–4
- Kaplan, T. 47
- Kavouras, D. 46
- Kay, D. 61
- Kemble, W. 195
- Kemm, J. 34–6, 41
- Khan, M. 176–7
- Kiger, P. 65
- King, G. 183–4
- Kirchgessner, D. 196
- Klinke, A. 170
- knowledge base expansion benefits
129–30, 140
see also information; public
participation and sustainability,
Pennsylvania
- Ko, P. 33–51, 294–6
- Kolb, B. 81–100, 182, 299–300
- Kotval, Z. 99
- KPMG, *Watered-down* assessment
60–62, 66, 71
- Krancer, M. 183
- Kravchenko, S. 128
- Kriesky, J. 177, 180
- Kristl, K. 125–42, 297–8
- Krupnick, A. 3, 68
- Krütli, P. 148
- Kulander, C. 68
- Lafferty, W. 301
- Laitner, J. 253–70, 304–6
- land use
- activities and district plans, New
Zealand 237–8
- agriculture and livestock grazing
concerns, New Zealand 246–7
- deep-level land use, UK 151–2, 154,
156–7, 160
- planning, and stakeholder
participation, UK 157–62
- regulation to promote community
values 104–10, 116–17, 120
- Lazarus, R. 294
- LeDoux, J. 205
- legislation
- cases *see under* individual countries
- governance framework for
sustainable energy, South Africa
221–6
- natural gas drillings, US 46–8
- see also* policies; regulation of shale
gas production, federalism
factors, US
- Leibbrandt, M. 215
- Levi, M. 197, 199
- Levine, M. 269
- Levinson, A. 269
- Levy, A. 46
- Liroff, R. 76, 111
- local authority plans, New Zealand
241–6
- local impacts *see* community responses
to local impacts
- long-term effects, concerns over
140–42, 148–9, 246–50
- Lung, R. 261
- McCarthy, J. 200
- McElfish, J. 101–21, 299–300
- McFeeley, M. 165, 174–5
- MacKay, H. 224
- McRae, G. 60
- Maherry, A. 220
- Malaysia 289
- Marcellus drilling *see* drilling
- market barriers 267–9
- Marston, J. 197
- May, J. 1–16, 127–8, 293–308
- Meinshausen, M. 29
- Menell, P. 192

- Merrill, T. 76, 148
methane emissions 196–7, 276–8, 281
see also greenhouse gas emissions
Mexico 4, 289
Miers, D. 151
Miller, S. 197, 277
Mindell, J. 34, 38
Minerals Planning Authority (MPA)
responsibilities, stakeholder
participation, UK 158–9
mining
acid mine drainage 64
Mines (Working Facilities and
Support) Act, UK 153–5
Pennsylvania, Surface Mining and
Conservation Act (SMCA)
138–9
see also drilling; wells
Moran, J. 55
moratorium 46–7, 55, 210–11, 226–7,
242
Morgan, J. 143–64, 297–8
Morgan, R. 38, 41
Morrisey, J. 48
Mors, E. ter 156
Muller, N. 199–200
Murtishaw, S. 269
Myers, N. 220
- national interest
assessment, federalism factors, US
199–201
national policy statements (NPS),
New Zealand 232–3, 240, 247–9
stakeholder participation, UK 154
see also community; individual
countries
natural gas as bridge fuel 273, 277–8
neighborhood character impacts 195–6
see also regulation of shale gas
production, federalism factors,
US
New Zealand, sustainable management
of onshore recovery of
unconventional gas 230–50,
301–2
Canterbury region, moratorium
request 242
clean-ups, lack of funding for 244
climate change and greenhouse gas
emissions 247–8
drinking water sources, effects on 241
East Coast basin, well drilling as
discretionary activity 243–4
*Environmental Defence Society v. The
New Zealand King Salmon
Company* 236–7, 241, 247
Fonterra milk production concerns
246
future sustainability 246–50
*Greenpeace of New Zealand Inc v.
Environmental Protection
Authority* 230
groundwater contamination concerns
230, 248
livestock grazing on landfarmed sites
246–7
local authority plans 241–6
McKnight v. NZ Biogas Industries
239
Manawatu-Wanganui region, well
drilling as controlled activity
243–4
national environmental standards
(NES) 232–4, 240–41, 246,
248–9
national policy statements (NPS)
232–3, 240, 247–9
*New Zealand Rail v. Marlborough
District Council* 236
*North Shore City Council v. Auckland
Regional Council* 235
Parliamentary Commissioner for the
Environment (PCE) 230, 241
Parliamentary Commissioner for the
Environment (PCE), reform
recommendations 246–7
*Ports of Auckland Ltd v. Auckland
City Council* 249
public liability insurance, lack of 244
public participation concerns 246
regional and district plans 233
Rylands v. Fletcher 248
seismic events 248
*Shirley Primary School v. Telecom
Mobil Communications* 239

- site monitoring, lack of provision 244
- spills and leaks, dealing with 244–5
- Taranaki region focus 231, 241
- Taranaki region, unconventional gas recovery as permitted activity 241–4
- Taranaki region, waste disposal 245
- Trio Holdings Ltd v. Marlborough District Council* 235–6, 239
- waste disposal 245–6
- Watercare Services Ltd v. Minhinnick* 235
- well design and construction 243–4
- well site location and water contamination 242–3
- New Zealand, sustainable management of onshore recovery of unconventional gas, Resource Management Act (RMA) and environmental law 231–40
- land use activities and district plans 237–8
- reform recommendations 247–8
- resource consent, civil and criminal enforcement 239–40, 248–9
- resource consent and discharge of contaminants into environment (regional plan) 238–40, 242, 247–8
- spills and leaks 245
- sustainable management, giving effect to 237–40
- sustainable management meaning and effect 234–7
- waste disposal 245–6
- Newhook, L. 249
- Nickerson, R. 202–3, 206
- Niemann, S. 269
- Nigeria 226
- Nolan, D. 249
- Nolon, S. 116–17
- non-energy benefits 260–61
 - see also* energy efficiency and sustainability, US
- non-fossil fuel generating facilities, need for 275, 278–83, 289–90
- Oates, W. 192
- Olson, M. 193–4
- Orford, A. 197
- Page, A. 151
- Pardy, B. 235
- Parry, J. 49
- Pasquier, M. 172
- payback timescale 261
 - see also* energy efficiency and sustainability, US
- Peel, J. 222–3
- Pennsylvania *see* US, Pennsylvania
- Perera, A. 70
- Perkins, D. 202
- permits 115–17, 138–40, 144, 155
 - see also* drilling
- Perry, S. 182
- Petrescu, G. 56
- Petroleum Exploration and Development Licenses (PEDLs), UK 152–4, 156
- Petron, G. 196–7
- Phillips, S. 53, 64
- Pidcock, R. 285
- Pitz, G. 202
- Poland 289
- policies
 - energy efficiency and sustainability, US 268–9
 - national policy statements (NPS), New Zealand 232–3, 240, 247–9
 - see also* legislation; regulation of shale gas production, federalism factors, US
- political factors, health impact assessment (HIA), US 45, 49
- pollution
 - air quality concerns 57, 138–9
 - polluter-pays principle 294
 - shale gas in energy efficiency context 266
 - spills and leaks, dealing with, New Zealand 244–5
 - US Clean Air Act 138, 192, 196–7, 200
 - US, Pennsylvania Air Pollution Control Act (APCA) 138–9

- and water supply, South Africa 219–20, 222–5
- see also* environmental issues; greenhouse gas emissions
- population growth effects 22
- Portugal 289
- poverty concerns 22–3
- precautionary principle and
 - participatory democracy 170–71
- Prinn, R. 280
- property prices, impact on 156–7
 - see also* stakeholder participation, UK; sustainable housing in rural communities, Pennsylvania
- public concerns
 - as barrier, 145, 147–9, 151
 - confidential business information (CBI), and concern over secrecy 175
 - fear factors 205–6
 - full-cost accounting requirements for impact assessments 53, 55–6
 - health impact assessments *see* health impact assessment (HIA), US
 - health impact and lack of trust 181–5
 - public housing units and Faircloth Limit 89–90
 - public liability insurance, lack of, New Zealand 244
 - public participation and sustainability, Pennsylvania 125–42, 297–8
 - Aarhus Convention and procedural environmental rights 127–8, 131
 - appeal time frames 136–7
 - Clean Water Act and public participation 128
 - comparison with other permit regimes 138–40
 - Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) and public participation 128–9
 - credibility increase benefits 129–31, 140
 - decision-making process
 - involvement 132, 137, 141–2
 - future development lessons 140–42
 - gas permitting regime, differences from 138–40
 - General Principles of Sustainable Public Participation 131–3
 - knowledge base expansion benefits 129–30, 140
 - Marcellus shale gas drilling 133–7
 - National Environmental Policy Act (NEPA), Environmental Impact Statement (EIS) requirement 128
 - participation opportunity provision 131–2, 137
 - Pennsylvania, Air Pollution Control Act (APCA) 138–9
 - Pennsylvania Clean Streams Law 138
 - Pennsylvania Department of Environmental Protection (DEP) permit applications 133–7
 - Pennsylvania, Oil and Gas Act 104–9, 297
 - Pennsylvania Right to Know Law and information access 136
 - Pennsylvania, Solid Waste Management Act (1980) (SWMA) 138–9
 - Pennsylvania, Surface Mining and Conservation Act (SMCA) 138–9
 - public comment limitations and restrictions 134–9, 141
 - public participation process 126–33
 - transparency benefits 130–32, 140
 - see also* stakeholder participation, UK
 - Puko, T. 69
 - Quigley, J. 52–77, 294–6
 - Rabe, B. 192
 - Rabeler, K. 166
 - race-to-the-bottom concerns
 - and under-regulation 192–3, 198
 - see also* regulation of shale gas production, federalism factors, US
 - radioactivity 195
 - Rao, V. 7

- Read, A. 95
 'rebound effect' 269–70
 see also energy efficiency and sustainability, US
 recycling and water treatment technologies 64
 see also water
 Reed, M. 146–7
 regulation of shale gas production, federalism factors, US 189–208, 301–3
 bias problem 201–6
 biased assimilation of expert information 203–5
 biased assimilation and framing effects 205
 Clean Air Act and air pollution over state boundaries 192, 196–7, 200
 Clean Water Act and disposal of water-borne wastes 191
 comprehensive federal regulation, case for 194–201
 confirmation bias 202–3, 207
 cultural cognition of risk 203–5
 energy regulation 191–4
 environmental impacts 195
 fear factors 205–6
 'funding bias' criticisms of shale gas studies 204–5
 interest group politics, effects of 193–4
 market incentives, success of 200
 methane emissions 196–7
 national interest assessment 199–201
 neighborhood character impacts 195–6
 policymakers, advice to 206–7
 politicians, external pressures on 207
 risk assessment 201–7
 scientific literature, importance of focus on 206–7
 spillover effects 194–7
 under-regulation and 'race to the bottom' concerns 192–3, 198
 see also legislation; policies
 regulatory progress 67–70, 72–3, 76–7
 see also full-cost accounting requirements for impact assessments
 Reibstein, D. 266
 renewable energy 218–19, 258–9, 261–4
 Renn, O. 170
 RESOLVE involvement in consensus process 119
 see also community responses to local impacts
 resource estimates 53–4, 64
 see also full-cost accounting requirements for impact assessments
 Retief, F. 224
 Revesz, R. 193
 Richardson, N. 191, 198
 Rifkin, J. 260
 Riis-Christianson, M. 64–5
 Rio Declaration 23–4, 27, 57, 126–7, 131, 140, 146, 168, 294, 304, 306
 risk assessment 65–6, 201–7
 Rive, V. 250
 Rockström, J. 21
 Rogers, W. 144
 Romania 55, 289
 Romm, J. 278
 Ross, A. 146, 157
 Rowe, G. 146–8
 Ruppel, C. 60
 rural communities' housing *see* sustainable housing in rural communities, Pennsylvania
 Russia 4, 288–9
 Sachdeva, S. 242
 Sadler, B. 224
 Salkin, P. 33–51, 294–6
 Sandler, T. 194
 Sandman, P. 183
 Sands, P. 222–3
 Sarnoff, J. 193
 Sathaye, J. 269
 Schaefer, K. 62
 Scheyder, E. 66
 Schizer, D. 76, 148
 Schumacher, J. 48

- scientific literature, importance of focus
on 206–7
- seismic events 195, 248
- Sharfstein, J. 169
- Shasteen, A. 175
- site monitoring, lack of provision, New Zealand 244
- site-by-site permitting paradigm 115, 120–21
see also community responses to local impacts
- Skowno, A. 220–21
- ‘slickwater’ 2
see also water
- Slovic, P. 148, 183
- Smith, C. 175
- Smith, D. 65
- Smith, L. 159
- Smith, P. 196
- Smith, Z. 253
- social cost of carbon (SCC) model 69–70, 72
- social costs 57–8, 181–3, 186
- social equity issues 84–5
- ‘social license to operate’ 110–11
- Soraghan, M. 205
- South Africa, proposed shale gas extraction 4, 209–29, 289, 301–3
BP v. MEC for Agriculture, Conservation, Environment and Land Affairs 213–14
- co-operative governance mechanism, need for 227
- Constitutional Court’s neglect of justifiable economic and social development, criticism of 214–15
- Constitution’s ‘Co-operative Government’ requirements 221
- cost-benefit analysis, need for 228
- Council for Scientific and Industrial Research (CSIR), Strategic Environmental Assessment (SEA) 212
- Department of Energy (DoE)
Integrated Energy Plan 217–18, 225
- Department of Environmental Affairs (DEA) sustainability mandate 222
- Department of Mineral Resources (DMR), Environmental Assessment (EA) process 223–4
- Department of Mineral Resources (DMR), Proposed Technical Regulations 211
- Department of Science and Technology (DST), Academy of Science of South Africa (ASSAf) study 211–12, 227
- Director: Mineral Development, Gauteng Region v. Save the Vaal Environment* 213
- energy consumption by energy type 217
- energy mix and sustainability 216–21, 225
- energy-intensive industries and carbon emissions 216
- environmental right 212–13
- exploration phase 210, 219, 228–9
- Fuel Retailers Association of Southern Africa v. Director-General* 214, 222–3
- Gini co-efficient (U.N. inequality index) 214–15
- Havemann Report 211
- Infrastructure Development Act 225–6
- Integrated Resource Plan for Electricity 218
- Karoo Basin report 211
- Karoo geological structure and biodiversity 220–21
- legislative and governance framework for sustainable energy 221–6
- Minerals and Petroleum Resources Development Act (MPRDA) 210, 221–3
- moratorium on issuing of shale gas licenses 55, 210–11, 226–7
- National Energy Act 217–18, 225

- National Environmental Management Act (NEMA) and sustainability 222–4, 226
- National Framework for Sustainable Development 219
- recommendations 226–8
- Right of Access to Information 215
- Right to Just Administrative Action 215
- Right to Sufficient Water 215
- Strategic Environmental Assessment (SEA) 223–4, 227
- sustainability as Constitutional requirement for decision making 212–15
- ‘unproved technically recoverable resource’ (TRR) estimate 216–17, 226
- Water Act and water licensing regime 224–5
- water supply and pollution concerns 219–20, 222–5
- White Paper on Energy Policy* 218
- White Paper on Renewable Energy* 218–19
- South Korea 289
- Spain 289
- Spence, D. 189–208, 301–3
- Spickett, J. 42
- spillover effects 194–7
see also regulation of shale gas production, federalism factors, US
- spills and leaks, dealing with, New Zealand 244–5
see also pollution
- Spotts, P. 195
- Stafford, P. 160–61
- stakeholder involvement 44–5, 50, 75–6, 116–19, 193–4
- stakeholder participation, UK 143–64, 297–8
- Aarhus Convention adoption effects 146–7, 149, 151, 162–3
- debate opportunities, need for 162–3
- decision making, ‘delegated power’ and ‘citizen control’ 148–9
- deep-level land use 151–2, 154, 156–7, 160
- Department of Communities and Local Government (DCLG) consultation criticism 161
- Department of Energy and Climate Change (DECC) Consultation Paper 150–51, 154–7, 161–2
- government transparency issues 156–7, 160–62
- horizontal drilling and unregistered landowners 153
- Human Rights Act considerations 155
- information availability requirements 162–3
- Infrastructure Act 144–5, 150, 161–2
- Infrastructure Act, access rights 151–5
- Infrastructure Act, community compensation measures 155–7
- land-use planning 157–62
- land-use planning, called-in applications 159
- long-term effects, concerns over 148–9
- Minerals Planning Authority (MPA) responsibilities 158–9
- Mines (Working Facilities and Support) Act, Working Facilities Order 153–5
- ‘national interest’ considerations 154
- permit requirements 144
- Petroleum Act 152, 154
- Petroleum Exploration and Development Licenses (PEDLs) 152–4, 156
- property prices, impact on 156–7
- public concern as barrier 145, 147–9, 151
- public engagement opportunities, restricted 151, 162–3
- public involvement process 147–8
- recent measures 150–57
- recommendations 162–3
- Scottish Planning Policy Framework (NPF3), community consultation measures 163

- sustainable development processes 145–9
- tax regime and incentives 150, 159
- Town and Country Planning Act 158
- Town and Country Planning Act, notification responsibilities 160–62
- trespass law 144, 150, 153, 157
- US comparison and differences 144, 152, 155
- see also* public participation
- Stallworthy, M. 146
- Stares, D. 101–21, 299–300
- Steinemann, A. 49
- Steinzor, N. 182
- Stevens, A. 49
- Stewart, R. 192
- Steyl, G. 220
- Stringer, L. 147–8
- sustainability
 - business case, lack of 63
 - development processes, UK 145–9
 - energy mix and sustainability, South Africa 216–21
 - future of 140–42, 148–9, 246–50, 293–308
 - and health impact assessment 37–9
 - National Environmental Management Act (NEMA), South Africa 222–4, 226
 - National Framework for Sustainable Development, South Africa 219
 - New Zealand *see* New Zealand, sustainable management of onshore recovery of unconventional gas
 - and public participation *see* public participation and sustainability, Pennsylvania
 - and shale gas development decision making 56–8
 - transparency relevance *see* transparency relevance to sustainability, Pennsylvania
- sustainable development 4–5, 17–30
 - challenges 27
 - corporate ‘greenwashing’ concerns 27
 - development and/or environment focus 26–7
 - and economic growth 20, 22
 - ecosystems research 20–22
 - environmental degradation 20–24, 26–7
 - environmental issues and greenhouse gas emissions 18–19, 22–3, 28
 - greenhouse gas emissions calculation and carbon budget 28–9
 - human well-being concerns 20, 25
 - integrated decision making as key action principle 24
 - ‘planetary boundaries’ 21
 - population growth effects 22
 - poverty concerns 22–3
 - resource consumption effects 21–2
 - shale gas development benefits 22
 - shale gas development concerns 22–3
 - sustainable development definition and objectives 19–20
 - sustainable development overview 19–27
 - transition acceleration urgency 28–30
- sustainable housing in rural communities, Pennsylvania 81–100, 299–300
 - commuting distances 95
 - developer capacity, lack of 92
 - economic development considerations 84–5
 - effects of increased housing demand 82–5
 - employee waves and differing housing needs 86–7
 - environmental impacts 84
 - financial crisis and housing bubble collapse 91
 - flexible response, need for 96
 - gas industry employment requirements 85
 - homelessness (couch surfing) issues 89
 - hotel room shortage 91
 - housing impact responses 92–4
 - housing quality issues and rent rises 88–9
 - infrastructure requirements 95

- interconnected housing markets 88–92
- Marcellus development impact 85–8
- oversupplied housing market effects 85
- oversupply risks 96
- Pennsylvania Act 13 impact fee 92–5, 98–9
- Pennsylvania Housing Affordability and Rehabilitation Enhancement Fund (PHARE) 92–3
- pre-existing housing needs, solutions from 98
- public housing units and Faircloth Limit 89–90
- recommendations 94–9
- rental price rises 87–90
- residential facilities (man camps) 97
- senior/disabled housing shortage 90–91, 97
- single family housing 91–2
- social equity issues 84–5
- subsidized housing 89–90
- sustainability three pillars 83–5
- temporary housing considerations 96–7
- US Housing Act, subsidized rent payments 89–90
- Williamsport Housing Strategy 94
- young professional housing needs 98
- sustainable solution to climate change, shale gas as part of 271–90, 304–6
 - atmospheric greenhouse gas concentration goal and ethical issues 284
 - atmospheric stabilization goal, global benefits 284–5, 287
 - carbon dioxide emissions from natural gas, oil, and coal combustion 273–4
 - cheaper natural gas prices leading to higher rates of consumption of electricity 282
 - climate change problem, understanding extent of 278–9
 - ‘climate sensitivity’ problems 280–81
 - coal to natural gas combustion shift effects 275–6, 281–2
 - cumulative carbon dioxide emitters, global top ten 288
 - ethical analysis 283–90
 - greenhouse gas emissions, a government’s fair share of safe global emissions 286–7
 - greenhouse gas emissions in Pennsylvania 272, 274
 - greenhouse gas emissions, projection of future 277–8, 280
 - greenhouse gas emissions reduction commitment, US 275–6
 - greenhouse gas emissions, responsibility allocations and distributive justice 287–8
 - Intergovernmental Panel on Climate Change (IPCC), carbon emissions budget 285
 - Intergovernmental Panel on Climate Change (IPCC), on ethical concepts 284
 - Intergovernmental Panel on Climate Change (IPCC), sustainable development and equity 286–7
 - methane gas decay rate 278
 - methane gas leakage rates, concerns over 276–8, 281
 - natural gas as bridge fuel 273, 277–8
 - non-fossil fuel generating facilities, need for 275, 278–83, 289–90
 - Pennsylvania climate change action plan 274–5
 - President’s Climate Action Plan 275–6
 - United Nations Framework Convention on Climate Change (UNFCCC) and 2°C warming limit 279–80, 283, 285–6
 - US National Academy of Sciences, *America’s Climate Choices* 284
 - Switzerland 289
 - tax incentives 150, 159
 - technology advances 63–5, 71–2, 179 *see also* fracturing
 - Thompson, C. 184
 - Tollefson, J. 29, 197, 277
 - Townsend, M. 149

- toxic fracturing additives, use reduction measures 65
- trade secret designation for
 hydrofracturing agents 172–8
see also transparency relevance to sustainability, Pennsylvania
- transition acceleration urgency 28–30
- transparency
 benefits, and public participation 130–32, 140
 government transparency issues, UK 156–7, 160–62
 transparent communication, need for, community responses to local impacts 103–4, 113–14, 120
- transparency relevance to sustainability, Pennsylvania 165–86, 297–8
- Colorado, confidential information access contrast 175
- confidential business information (CBI), and public concern over secrecy 175
- Deepwater Horizon disaster, and dispersant use 176
- doctor's confidentiality provision challenge 176–7
- environmental management 167–72
- flowback fluids, chemical identity protection 177–8, 185
- FracFocus (national hydraulic fracturing chemical registry) 175
- Impact Fee 180
- Marcellus Shale Advisory Commission (MSAC)
 recommendations 180
- Oil and Gas Industry Guidance on Voluntary Sustainability Reporting* 171–2
- Pennsylvania Act 13, failure to provide pertinent information 178–9, 184–5
- Pennsylvania Act 13, responsibility to obtain pertinent information 179–81
- Pennsylvania Act 13, transparency limitations 172–81, 184–5
- Pennsylvania Department of Health (PADOH), health impact exclusion 180–81
- precautionary principle and participatory democracy 170–71
- psychosocial stress factors 181–3, 186
- public health impact and lack of trust 181–5
- public involvement, importance of 167–8, 185
- recommendations 184–6
- Robinson Twp v. Commonwealth of Pennsylvania* 166, 176–7, 181
- shale gas development evolution 183–4
- state constitution violation claim 181
- technology improvements, effects of 179
- trade secret designation for hydrofracturing agents 172–8
- US Center for Sustainable Shale Development 172
- US Emergency Planning and Community Right-to-Know Act (EPCRA), trade secrets disclosure 174, 176
- US Environmental Protection Agency (EPA), declassification of CBI designations 176
- US Environmental Protection Agency (EPA), mission statement 169
- US Food and Drug Administration (FDA), transparency to public health 169
- US Occupational Safety and Health Act, toxic substance information disclosure 174
- US Toxic Substances Control Act (TSCA), trade secret disclosures 176
- US worker right-to-know laws 170
- trespass law, UK 144, 150, 153, 157
- Turkey 289
- Ubinger, J. 101–21, 299–300
- UK

- Berkeley v. Sec'y of State for the Env't* 149
- Bocardo v. Star Energy UK Onshore Ltd* 153
- BP Petroleum Devs Ltd v. Ryder* 155
- cumulative carbon dioxide emissions 288
- Department of Communities and Local Government (DCLG) consultation criticism 161
- Department of Energy and Climate Change (DECC) Consultation Paper 150–51, 154–7, 161–2
- greenhouse gas emissions 289
- Infrastructure Act 144–5, 150–57, 161–2
- Mines (Working Facilities and Support) Act, Working Facilities Order 153–5
- Nationally Significant Infrastructure Projects regime 158
- Petroleum Act 152, 154
- Petroleum Exploration and Development Licenses (PEDLs) 152–4, 156
- Scottish Planning Policy Framework (NPF3), community consultation measures 163
- stakeholder participation *see* stakeholder participation, UK
- Town and Country Planning Act 158
- trespass law 144, 150, 153, 157
- Ukraine 288
- unconventional shale gas development 1–4
- under-regulation and 'race to the bottom' concerns 192–3, 198
- see also* regulation of shale gas production, federalism factors, US
- Unger, D. 54
- United Nations Conference on Environment and Development (Rio Declaration) 23–4, 27, 57, 126–7, 131, 140, 146, 168, 294, 304, 306
- United Nations Conference on Sustainable Development 18, 303–4
- United Nations Environment Program, on ecosystems 20
- United Nations Framework Convention on Climate Change (UNFCCC) 28, 306
- and 2°C warming limit 279–80, 283, 285–6
- United Nations Global Environmental Compact 171
- 'unproved technically recoverable resource' (TRR) estimate, South Africa 216–17, 226
- Upton, S. 235
- US
- American Council for an Energy-Efficient Economy (ACEEE) report 255, 258
- American Petroleum Institute (API) 111–12
- Appalachian Shale Recommended Practices Group (ASRPG) 111–13
- Atomic Energy Act and nuclear energy regulation 193
- California Air Resources Board report 268–9
- Canterbury v. Spence* 184
- Center for Sustainable Shale Development 26, 172
- Clean Air Act 138, 192, 196–7, 200
- Clean Water Act 128, 138–9, 191
- Colorado, noise restrictions for shale gas operations 109–10
- community responses to local impacts *see* community responses to local impacts, US
- cumulative carbon dioxide emissions 288–9
- Deepwater Horizon disaster, and dispersant use 176
- Emergency Planning and Community Right-to-Know Act (EPCRA) 174, 176

- energy efficiency and sustainability
 - see* energy efficiency and sustainability, US
- Energy Policy Act 144
- Environmental Protection Agency (EPA) 72–3, 169, 176
- federalism factors *see* regulation of shale gas production, federalism factors, US
- Food and Drug Administration (FDA) 169
- FracFocus (national hydraulic fracturing chemical registry) 175
- gas pipeline infrastructure 3
- Geological Survey into landscape consequences of natural gas extraction 68
- greenhouse gas emissions 275–6, 289
- health impact assessment *see* health impact assessment (HIA), US
- Housing Act 89–90
- low quality water sources, use of 64–5
- Marcellus Shale Advisory Commission (MSAC) recommendations 180
- Marcellus Shale Coalition (MSC) 111–12
- National Academy of Sciences, *America's Climate Choices* 284
- National Environmental Policy Act (NEPA) 37–8, 48, 128, 294
- New York regulation of water usage 48
- New York State Assembly moratorium on gas drilling 46–7
- New York, *Wallach v. Town of Dryden* 110
- North Slope Borough (Alaska) HIA 42–3
- Occupational Safety and Health Act 174
- President's Climate Action Plan 275–6
- property rights to gas reserves 3
- regulatory progress 67–70, 72–3, 76–7
- Resource Conservation and Recovery Act 191
- Safe Drinking Water Act 144, 191, 199
- Senate Bill 2697 and Environmental Conservation Law 47
- shale gas as percentage of gas production 3
- Surface Mining Control and Reclamation Act 138, 199
- technically recoverable shale gas resources 4
- Texas, Barnett shale play 2
- Toxic Substances Control Act (TSCA) 176
- UK comparison and differences, stakeholder participation 144, 152, 155
- worker right-to-know laws 170
- US, Pennsylvania
 - acid mine drainage 64
 - Air Pollution Control Act (APCA) 138–9
 - Clean Streams Law 138
 - climate change action plan 274–5
 - constitutional guarantees 107–8
 - Department of Environmental Protection (DEP) permit applications 133–7
 - Environmental Rights Amendment, preservation of natural resources 106–8
 - greenhouse gas emissions 272, 274
 - Oil and Gas Act 104–9, 297
 - Pennsylvania Act 13 impact fee 92–5, 98–9
 - Pennsylvania Environmental Council (PEC) recommendations 115–16, 119
 - Pennsylvania experience, learning from 58–62, 67, 69
 - Pennsylvania Housing Affordability and Rehabilitation Enhancement Fund (PHARE) 92–3
 - public participation *see* public participation and sustainability, Pennsylvania

- regulations for water use and water quality 48
- regulatory sanctions 108
- Right to Know Law 136
- Solid Waste Management Act (SWMA) 138–9
- Supreme Court, *Huntley & Huntley v. Borough Council of Borough of Oakmont* 105
- Supreme Court, *Range Resources v. Salem Township* 105
- Supreme Court, *Robinson Township v. Commonwealth of Pennsylvania* 105–9
- Surface Mining and Conservation Act (SMCA) 138–9
- sustainable housing in rural communities *see* sustainable housing in rural communities, Pennsylvania
- transparency relevance to sustainability *see* transparency relevance to sustainability, Pennsylvania
- wellheads, rise in number of 3
- Van Tonder, G. 220
- VanBriesen, J. 178–9
- Veerman, J. 49
- Villeneuve, J. 172
- Viñuales, J. 27–8
- Volcovici, V. 273, 276
- Wachinger, G. 182–3
- Wald, M. 200
- Walker, J. 193
- Walter, S. 248
- Wang, Z. 3
- Ward, P. 64
- Warr, B. 254
- Wasilewski, P. 74
- waste disposal 138–9, 245–6
- water
- drinking water sources, New Zealand 241
 - fracturing technologies minimizing water use, risk assessment 65–6
 - fracturing and wastewater 52, 195
 - groundwater contamination
 - concerns, New Zealand 230, 248
 - hydraulic fracturing 60–62, 65–6, 71–3, 172–8
 - KPMG, *Watered-down* assessment 60–62, 66, 71
 - New York regulation of water usage 48
 - quality concerns 57–8
 - recycling and water treatment technologies 64
 - ‘slickwater’ 2
 - state regulations and trends dealing with water use and quality 48
 - supply and pollution concerns, South Africa 219–20, 222–5
 - US Clean Water Act 128, 138–9, 191
 - well site location and water contamination, New Zealand 242–3
- Weaver, A. 223
- Weiss, E. 25, 306
- well field pro forma financial statement 63
- wells
- design and construction, New Zealand 242–4
 - siting permit process, community responses to local impacts 115–17
 - see also* drilling; mining
- Wernham, A. 37–9, 42–3
- Wethe, D. 64
- Wildavsky, A. 203–4
- Williamson, J. 81–100, 182, 299–300
- Wilson, J. 178–9
- Witter, R. 44
- Wolf, S. 174
- Wood, J. 166
- World Bank, environmental, social, and health impact (ESHIA) assessment 37
- World Business Council for Sustainable Development (WBCSD) 171
- World Commission on Environment and Development, *Our Common Future* 20, 190

- World Health Organization (WHO),
health impact assessment (HIA)
38–9
- Worrell, E. 260
- Xianglin, L. 262
- Yergin, D. 53
- zoning, local government zoning
regulation 103, 105–9
see also zoning, community
responses to local impacts