Index

| academic quality | 167 |
| academic sustainability | 12–13, 28–9, 33, 35, 36–41, 46, 107–8, 115 |
| activism, institutional | 112 |
| administrative organization | 75–6, 86, 239, 242–3 |
| Adomssent, M. | 91, 124, 125 |
| Agent of Change, university as | 42–4 |
| Agora | 159, 160, 263–4, 267–8 |
| air conditioners | 78 |
| air pollution | 130–131 |
| Allen, T.F.H. | 145, 277 |
| amenity values | 265, 269 |
| American College and University Presidents Climate Commitment (ACUPCC) | 57, 309 |
| ANU see Australian National University |
| architectural conservation | 131–2, 136 |
| Architectural Institute of Japan (AIJ) | 236 |
| architecture | educational 119–20 |
| trends | 232 |
| Arias, S. | 278, 295, 296 |
| ARWU (Academic Ranking of World Universities) | 47, 127, 132 |
| Asplund, C. | 221, 233 |
| assessment | 91, 104, 185–6 |
| Association for the Advancement of Sustainability in Higher Education (AASHE) | 33, 64, 107, 309 |
| AUDIO (Aspects, Upstream, Downstream, Issues, Opportunities) tool | 111 |
| audits | 74–5, 96–7, 100–101, 104 |
| Australian National University (ANU) campus as a classroom | 116–20 |
| change and mainstreaming | 108–13 |
| people, place and performance | 120–121 |
| sustainability programme | 113–16 |
| Baletić, B. | 219 |
| BC Hydro | 38, 43–4 |
| Becker, T. | 264 |
| BEE (Brown Energy Efficiency) contrast with ECP | 206–7 |
| development | 198–200 |
| software application | 200–201 |
| business intelligence and reporting | 202–4 |
| data entry | 201–2 |
| work flow facilitation | 202 |
| Belval Observatory | 20–21, 267–70 |
| Benneworth, P. | 259, 266, 270 |
| Beringer, A. | 124, 125 |
| biodiversity | 114–15, 118–19, 120 |
| Bioenergy Research and Demonstration Facility | 37, 38–9 |
| Boix Mansilla, V. | 143, 146, 275, 301 |
| Borongaj campus, Zagreb | 211, 216–22, 224, 229, 230 |
| bounded space | 4–5, 6, 17, 163, 285, 294 |
| branding | 186 |
| Brorson, T. | 90, 91 |
| Brown, H. | 8, 9 |
| Brown, T. | 51, 52 |
| Brown University | 17–18, 73, 194–6, 207–8 |
| BEE software application | 200–204 |
| determining sustainable energy path | 196–8 |
| ECI and BEE introductions | 198–200 |
| Emerald Cities Providence | 204–7 |
| ‘build to own’ | 68 |
| building energy demand | 54–6 |
| building retrofitting | 80–83, 135–6 |
built environment 49–50, 131–2, 134–5, 293
Bulkeley, H. 1, 276
Burke-Litwin change model 110
business-driven sustainable urban development project 179
campus
as a classroom 116–20
as component of higher education 125
as living laboratory for climate change mitigation 49–68
overview 12–16
at UBC 36–42
as spatial resource 238
campus building
energy management 14, 70–71, 85–6
challenges and opportunities 71–4
energy consumption 83–5
energy management system 74–83
environmentally sustainable 113–20
implications for university 158–67
campus buildings, retrofitting 80–83, 135–6
campus operations 134–5, 154–5
campus planning
Cornell University case 57–68
for efficiency improvement 56–7
emphasis on inner city development 52–3
for energy saving 54–6
Esch-Belval 154–5, 159–62, 165
space planning and management 53–4
see also Japan, campus planning;
physical campus planning
campus space 247
carbon dioxide emissions see emissions
carbon tax regime 33–4
case-based research 147–8
Castells, M. 296–7
CBECS (Commercial Buildings Energy Consumption Survey) 54, 56
Centennial Campus 15, 133, 135–6
Centre for Environment and Sustainability (GMV) 93, 99–100
Centre for Interactive Research on Sustainability (CIRS) 13, 33, 37–8, 39, 41
certification process 97–8
Chalmers University of Technology 89, 93, 99, 174–6, 177, 188–9
campus as living laboratory for climate change mitigation 49–68
change 7, 8, 15, 110
community education 111–12
corporate synchronization 110–111
five pillars of 233
institutional 29–32, 67
institutional activism 112
and living laboratories 276–8
organizational 64–5
societal 17, 188–9
university as agent of 42–4
Chen, S. 83
Chiba University, Japan 240, 241, 243–4
Chilvers, J. 258, 261
China
developing green campuses 121
growth of higher education facilities and corresponding energy use 71–4
postsecondary enrolment 50
sustainable campus construction 70
university development 53
see also Tongji University;
University of Hong Kong
CIA 125, 129
Cité des Sciences, Belval 159, 162, 259–61, 268, 270
urban development
accessibility of new urban quarter 265–6
connecting research campus with development of city 266–7
environmental qualities and amenity values 265
housing 264
site and situation 261–4
cities
Emerald Cities Providence 204–7
and emergence of living laboratories 2–6
energy consumption 194
inner city development 52–3
integration with universities 215, 245, 266–7
interaction with universities 237, 250–251
physical campus planning as driver for development 232–4
sustainable development of 177–8
university role in transforming 3
City of Vancouver 43–4
city structure adapted to climate change project 178–9
civic engagement
integrated spaces for 158
classroom, campus as 116–20
Climate Action Plan 13–14
alignment with missions 64–5, 67
considerations 51–2
development and implementation 62–4, 66, 68
integration with education, research and outreach 65–6
sustainability target setting 58–62
Cole, R.J. 47, 78
collaborators, place for 224–7
commonalities between cases 279–81
communication 62–3, 64–5, 102–4, 197, 297
community
interaction with university 118–19, 245
perceptions of priority 114
projects benefitting 204–7, 236–52
Community Carbon Use Reduction at Brown (CCURB) 204
community cohesion 266, 268–70
community education 111–12
community engagement 12–16, 115–16, 243–5
compactness 53
competition brief 214
complexity 145–50, 281, 287–90, 300
connection to practice 147–8, 155
construction phases 227–9
continual improvement 104
education 100
operations 101–2
outreach 100–101
research 99–100
staff training 101
Continuous Optimization project 37–8, 44
Corcoran, P.B. 124, 125
Cornell University 57–8
Cornell Climate Action Plan 58–64, 66–7
initiatives 59–61
integration with education, research and outreach 65–6
organizational changes 64–5
corporate synchronization 110–111
Cortese, A.D. 91, 104, 124, 125
cost-benefit analyses 63
Cresswell, T. 277, 293
Croatia 211, 217, 221
see also University of Zagreb
curriculum reform 41–2
data collection
analysis and implementation 63–4, 184–5
and monitoring 67
data, energy consumption 74–86
data entry 201–2
data recording, manual 76
deep retrofitting 195, 204–6
degree programmes 150–151, 155–7
design of living laboratories
informing future 291–8
recommendations for 298–301
design thinking process 51–2, 68
DGNB certification 160, 161, 168, 264
differences between cases 279–81
digital meters 77
DiMaggio, P.J. 7, 47, 123
Disterheft, A. 91, 92, 104
ECI see Energy Conservation Initiative
Eco Management Audit Scheme (EMAS) 88, 90, 96, 98, 104
ecological surveys 118–19
economic downturn 50, 63, 120
EcoTREK 33, 37
ECP see Emerald Cities Providence
education
community 111–12
continual improvement 100
integration 65–6, 100, 134–5, 162–4, 174–6, 243–5
requisites for sustainable development 149–50, 156–8
Regenerative sustainable development of universities and cities

educational architecture 108, 117, 119–20
electric vehicles 7, 59, 276, 300
electricity consumption 58–9, 83–5, 129–30, 134
Emerald Cities Providence (ECP) 204–7
emissions
Australian National University 115–16
Brown University 17, 195, 198, 204
Cornell University 57–8, 60, 63
Nagoya University 239
University of British Columbia 34, 37–8
University of Gothenburg 101
University of Hong Kong 129–31, 133, 135–7
Energy and Environmental Advisory Committee (EEAC) 196–8
Energy Conservation Initiative (ECI) 198–200
energy conservation initiatives
at Brown University 198–207
at Cornell University 60, 62
at Tongji University 74–86
energy consumption
in Chinese campuses 71–4
Hong Kong 129–31
Tongji University 74–5, 83–5
energy use quotas 79–80
measures for reducing 81–3
monitoring 76–8
public display system 78–9
in USA campuses 54–6
energy efficiency
 campus planning for improvement 56–7
in Chinese buildings 73, 130
diagnosis 80–83
as main driver 206
public display system 78–9
regulations 80
energy efficiency program development
194–6, 207–8
BEE software application 200–204
ECI and BEE introductions 198–200
Emerald Cities Providence 204–7
Energy and Environmental Advisory Committee 196–8
energy management system 74–5, 85–6
administrative organization 75–6, 86
campus energy monitoring platform 76–8
department and school charges 79–80
energy efficiency diagnosis 80–81
energy use quota 79–80
implementation steps 75
institutional framework development 78
Integrated Circuit (IC) card project 83
public display system 78–9
regulations 80
retrofitting 81–3
success of 85–6
energy saving
in Chinese buildings 71, 73
costs 81, 83
project delivery process 199
in USA campuses 54–6
energy use quota 79–80
environmental factors 206
environmental impact 52–7, 90–91, 205–6
environmental management system (EMS) 88–9, 103–4
environmental performance improvements 99–102
implementation 92–3
certification process 97–8
management and organization 93–5
recommendations and guidance 102–3
systematic process 95–7
role in fostering sustainability 89–92
environmental quality 265
EPD 129, 130, 131, 132
Esch-Belval 254–5
Belval Observatory 267–70
challenges and opportunities 162–4, 165
Cité des Sciences 259–67
planning 159–62
transition indicators 269
urban and regional development 255–9, 271
European Union 3, 90
evaluation of knowledge producing processes 180, 185–8
Evans, J. 1, 3, 5, 6, 8, 210, 258, 261, 291, 292, 294, 295, 300
excellence
  pursuit of 126–9, 136–8
  scientific 147–8
  at University of Hong Kong 132–6
experimentation
  attitude of 51
  engaging communities overview 12–16
  objects of 274
  role of universities in 1–2, 57, 210
  social 5
  spaces for 8, 30, 284
external actors, place for 224–7
financial crisis 50, 63, 120
flexibility, planning for 227–9
Fonds Belval 159, 161, 260, 263–4, 267–8
formulation of projects and processes 180, 181–4
framing, commonalities and differences 279–81
Frank Fenner Building 119–20
fuel mix and renewables initiatives 61, 130–131
Fukushima, Japan 130
Funtowicz, S. 148, 178
generation of projects and processes 180, 184–5
Geels, F. 6, 7, 8, 29, 174, 296
goals 151–2, 179–80, 198, 204–7, 241–3, 305–6
Giddens, A. 7, 31–2, 281, 293
Giere, T.F. 148, 293, 300
Global Reporting Initiative (GRI) 97
Global University Leadership Forum (GULF) 152–4, 167, 305–9
Grin, J. 7, 8, 9, 31, 274, 275, 278
Gross, M. 5, 148
Harvey, F. 123, 125
Hazelkorn, E. 126, 127, 128
Healey, P. 31, 32
Henri Tudor Public Research Centre 161, 259
Hesse, M. 255, 264
Hirsch Hadorn, G. 178, 180
Hodson, M. 9, 173
Hokkaido University, Japan 245–7, 250
Holmberg, J. 175, 188
Honeywell 39, 43
Hong Kong, environmental challenges
  built environment 131–2
  energy, emissions and air pollution 129–31
  water and waste management 131
housing 40, 223, 264
Hua, Y. 52, 65
ICT initiatives 4, 14, 136, 281, 284–5, 298
ideas 31–2
identity, university 158–67, 229–31
inertia 198
influence 289, 290, 295–8
information technology see ICT initiatives
inner city development 52–3, 204–7
innovation integration 174–6
institutional activism 112
institutional change 29–32, 67
institutional framework development 78
institutional innovation 32–6, 67
interdisciplinarity 5, 146–7, 156–8, 165, 190, 191
interest in sustainability 34, 121, 137
greenhouse gas (GHG) emissions see emissions
Greenhouse Science course 115–16
Gothenburg Consortium 177, 186
green development initiatives 41, 43–4, 60

International Sustainable Campus Network (ISCN) 101, 133, 152–4, 159–61, 167, 274, 301, 305–9

ISCN/GULF Sustainable Campus Charter 152–4, 167, 305–9

issue-driven interdisciplinarity 5, 190, 191

Japan, campus planning 236–7

challenges and opportunities

campus as spatial resource 238
developing local community 239
falling birth rate 238
in low carbon emission society 238–9

connecting university with town 245–7

raising quality of campus space 247

restoration of urban environment 247–9

creating a town in same way as campus

integration for sustainable development 243–5

interaction between university and community 245

Kashiwa-no-ha International Campus Town Initiative 240–241, 242

Urban Design Center Kashiwa-no-ha 241–3

lessons learned from case studies 249–51

toward the building of a living laboratory 252

Jasanoff, S. 9, 143, 144, 146, 148, 275, 276, 300–301

Jiggins, J. 9, 178

Joe Coenen 160

joint knowledge production

attributes 179, 180–181, 190

boundaries 285–6

framing, commonalities and differences 279–81

guidelines for 180–181, 190

institutions 282–3

lessons learned at Mistra Urban Futures 181–8, 190

physical locations 284

projects and processes for 178–81, 188, 190–191, 287–9

rules 283–4

sites for complex problems 281

social processes and networks for 287–90

for sustainable development of cities 177–8

virtual sites 284–5

Karvonen, A. 3, 5, 6, 123, 134, 210, 291, 292–3, 294, 295, 300

Kashiwa-no-ha Campus, Japan 240–245, 250

Keen, M. 107, 180

KLARA (chemical register system) 102

Klein, J.T. 146, 178, 180

Knorr-Cetina, K. 5, 145

knowledge

conceptions of 276–7

relation with place 281–2, 291–5

situated 16, 148, 163, 180

travel of, in networks 295–8

knowledge co-creation and sharing 67–8, 273–301

knowledge production 276–7

as collective process 9

epistemological approach 5–6

joint approach to 178

processes 287–9

reconception of 143–4, 145–50

towards a knowledge city/region 267–71

see also joint knowledge production

Konno, N. 51, 281

Krohn, W. 5, 148

Kyushu University 4

laboratories

handling of chemicals 102

science, energy use 79–80

Lake-Source Cooling (LSC) 59

land use improvement initiatives 60, 63

Latour, B. 145, 297

leadership 34, 88, 112, 194–5

learning environment 222–4
Index

learning, social 6–10, 51–2, 189
LEED (Leadership in Energy and Environmental Design) certification 39, 60, 65, 135–6, 196, 198
living laboratories campus as 12–16, 36–42, 49–68
definition 4
emergence and nature of 2–6
future design and study of influence, scalability and travel of knowledge in networks 295–8 recommendations for 298–301 relation of knowledge and place 291–5
HKU as future 134–5
for joint knowledge production 278–86
purpose of 1–2
socio-technical transitions 6–10, 276–8
toward the building of 252
for urban transformations 176–81
Living Labs Network 4
Local Interaction Platforms (LIPs) 177–8
Lozano, R. 91, 104
Lyle Center, California 4
mainstreaming 112–13
Management Committee of Sustainable Campus Construction 75–6
Marginson, S. 126, 138
Martello, M.L. 144, 148
Marvin, S. 9, 173
Meehan, B. 112
meeting spaces informal 186
transdisciplinary 178
Memoranda of Understanding (MOU) 43–4, 208
Meusburger, P. 256, 285, 292, 297–8
M’Gonigle, M. 3, 6, 10, 11
middle management approach 93, 103
Ministry of Education of China 72, 85
missions, university 19, 64–5, 167
Mistra Urban Futures 188–91, 288
lessons learned from joint knowledge-producing processes evaluation 185–8
formulation 181–4
generation 184–5
as living laboratory example 176–81
Modern Green Development 41, 43–4
Mohrman, K. 126–7
monitoring building 136
of change 276, 278, 285
data 67, 85
energy 74–5, 76–9, 279–80
impacts 268–9
and knowledge production 289–90
multi-level governance project 178, 182–3, 185–8
mutual trust 184, 186
Nagoya University 239
National Research Council 123, 125
networks for joint knowledge production 287–90
travel of knowledge in 295–8
niches 29–30, 45–6, 296
akin to organizational fields 47
experimental 30–32, 39
for innovation 6–7, 10, 148, 274, 276, 293
for knowledge and learning 174
niche management 7–8
within niches 45
sustainability 44
njirić, H. 217, 219–20, 224, 229
Nonaka, I. 13, 51, 148, 236–7, 281, 282, 292
Nowotny, H. 8, 143, 178
nuclear power 129–30, 238
Oeberg, G. 146, 167
OMniRide 59
operational sustainability 12–13, 28–9, 33, 35, 36–41, 46, 107–8, 115
operations campus 154–5
continual improvement 101–2
integration 134–5, 162–4
organizational change 64–5
Orr, D. 116–17
outreach
continual improvement 100–101
integration 65–6, 134–5

partnerships
Gothenburg Consortium 177, 186
public-private 221
public-private-academia 241–3, 245
Town-Gown 264
UBC 43–4

people, performance and place 120–121
Perry, B. 3, 256, 294

physical campus planning 209–12
challenges
continuity and flexibility in construction phases 227–9
environment for new learning experience 222–4
place for external actors and collaborators 224–7
sustainable identity 229–31
as driver for city development 232–4
questions and answers 221–2
University of Copenhagen 212–16
University of Zagreb 216–21
see also campus planning

physical locations 281, 284, 292–3
place
for external actors 224–7
people and performance 120–121
relation with knowledge 281–2, 291–5
Plan-Do-Check-Act (PDCA) model 89–90
Polk, M. 180
Powell, W.W. 7, 47, 123
power 31
practice integration 174–6
President’s Climate Commitment Implementation Committee (PCCIC) 57–8, 59, 64
President’s Sustainable Campus Committee (PSCC) 64, 65
problem framing, commonalities and differences 279–81
professional bureaucracy 92
project formulation 180, 181–4
public display system 78–9
public investment coordination 212–14
public-private-academia (PPA) partnership 241–3, 245
public-private (PPP) partnership 221
purchasing 101–2
pursuit of excellence competing priorities or synergies 128–9
and sustainable development 136–8
university rankings 127–9
world-class universities 126–7

QS 127, 132, 134
quality control 147, 289–90, 298–301
quality of life (QOL) 237, 239, 241, 243–5, 250–252

rankings 15, 123–4, 127–9
Ravetz, J.R. 148, 178, 277
‘real implementation fields’ 3
reflexivity 289–90
regenerative sustainability concept 28
regimes 6–7, 29–31, 33, 46, 47, 296
regulations 80, 283–4
reporting 91, 96–7, 202–4
research
continual improvement 99–100
integration 65–6, 134–5, 162–4, 174–6, 243–5
recommendations for future 298–301
for reconciliation between pursuit of excellence and sustainable development 136–8
requisites for sustainable development 149–50
University of Hong Kong 134
University of Luxembourg 155–8
Research and Partnerships Office 35–6
resources 31–2, 207
retrofitting of campus buildings 80–83, 135–6
deep 195, 204–6
Robinson, J. 5, 27, 143, 174, 178, 191, 300
Romm, J.J. 123, 125
Rorty, R. 277, 292
rules see regulations
Sakusyukotoni River, Japan 246–50
Salmi, J. 126, 127
Sammalisto, K. 91–2
Index

Savino, M. 126, 127
Saxenian, A.-L. 256, 257
scalability of knowledge 295–8
Science City campus, Zurich 118
Science City North Copenhagen 211, 212–16
science laboratories, energy use 79–80
scientific excellence 147–8
sites for complex problems 281
situated knowledge 16, 148, 163, 180
Skorton, D. 57, 64
Smith, A. 31, 296
social cohesion 151–2, 158
social equity 205–6
social learning
  design thinking process 51–2
  importance of 6–10
  for urban change 189
social norming 197
social processes 287–90
Socialization, Externalization,
  Combination and Internalization (SECI) model 51
societal change 17, 188–9
socio-technical transitions 6–10, 274, 275–8
solar panels 59
solar water heating system 81–2
space planning and management 53–4, 60, 62, 226–7
staff engagement 114
staff training 96, 101
Starke, J. 3, 6, 10, 11
steam to hot water project 37, 39
Steyaert, P. 9, 178
storytellers 187
structuration theory 7, 31, 293
Sustainability Academic Strategy (SAS) 33, 34–5
sustainability in higher education 124–6, 151–4
sustainability programme 113–16
sustainability target setting 58–62
Sustainable Building Science Program 40–41
sustainable development
  of cities 177–8, 245
  emergence of living laboratories for 2–6
  experimenting for 1–2
  fostering across multiple scales 16–21
  integration for 243–5
  and pursuit of excellence 136–8
Sustainable Energy and Environmental Initiatives Office (SEEI) 196, 199, 203–4
Swiss Federal Institute of Technology (ETH) 118
Takeuchi, H. 51, 148, 282, 292
Tan, H.W. 71, 73, 75, 78–9, 83
target setting for sustainability 58–62
Tarrach, R. 153–4
teaching 134
Tongji University 70–71
  in context of Chinese universities 71–4
  energy and water consumption status 84–5
  energy consumption at 83–5
  energy efficiency regulations
  energy management system 74–83
  energy use in other kinds of campus buildings 85
  energy use structures 81
Integrated Circuit (IC) card project 83
retrofitting student bathrooms 81–3
success of energy management system 85–6
Toope, S. 34, 35
top-down approach 92, 104
towns
  connection with university 245–9
  creating in same way as campus 240–245
transdisciplinary processes 179, 181, 183
transformation
  achieving institutional change 29–32
  components of 10–11
  societal 273–301
  urban 173–91
transition theory 7–8, 29–31, 278, 295–6
transportation 40, 59–60, 155
trust, mutual 186
Tsang, D. 129, 130
Regenerative sustainable development of universities and cities

UBC see University of British Columbia
UBC Sustainability Initiative (USI) 28
United States of America (USA) campus operations spend 54
ergy demand 54–6
postsecondary enrolment 50
see also Cornell University
universities
challenges and opportunities for
forward-looking 164–7
city connections 215, 245, 266–7
city interactions 237, 250–251
connection with town 245–9
and emergence of living laboratories
2–6
fostering sustainable development overview 16–21
as integrators 174–6
mission alignment 64–5
perspectives on engagement 273–5
rankings 15, 123–4, 127–9
recommendations for future research 298–301
reconception of knowledge production 143–4, 145–50
role
environmental management systems 89–92
sustainability, suitability for 28–9, 49–50
in transforming cities 3
urban and regional development 255–9
sustainability in 124–6
world-class 123, 126–7
University of British Columbia (UBC) 27–9, 117–18, 137
as Agent of Change 42–4
campus as living laboratory 36–42
campus build-out 40
challenges 45–6
institutional innovation 32–6
transformative institutional change 29–32
University of Copenhagen comparison with University of Zagreb 211
coordinating public investments 212–14
integration with city 215
physical campus planning 221–34
planning process 214
project future 215–16
Science City North 211, 212–16
University of Gothenburg 88–9, 104
environmental performance improvements
education 100
operations 101–2
outreach 100–101
research 99–100
staff training 101
implementation of EMS 92–8
organizational chart 94
University of Hong Kong (HKU) 124
architectural conservation 136
building retrofitting 135–6
challenges 136–8
environmental challenges 129–32
as exceptional case 132–3
as a future living laboratory 134–5
green design 135
information technology 136
research and teaching 134
research for reconciliation 136–8
University of Kassel, Germany 258
University of Luxembourg 144, 254–5, 270–271
Belval Observatory 267–70
campus operations, management and planning 154–5
Cell for Sustainable Development 152, 154, 157
challenges and opportunities 150–158, 164–7
Cité des Sciences Belval 158–67, 259–67
instituting sustainability at 151–4
Open Course programme 156–7
research, education and learning 155–8
spaces for social cohesion and civic engagement 158
Strategic Action Plan on Sustainable Development 151–2
University of Tokyo Kashiwa Campus 243–4
University of Zagreb campus Borongaj 211, 216–17
changing perception of ‘outside the city’ 217–18
comparison with University of Copenhagen 211
physical campus planning 221–34
the plan 219–20
planning process 218–19
turning vision into a program 221
Urban Design Center Kashiwa-no-ha (UDCK) 241–3
urban development of Cité des Sciences 261–7
role of universities in 255–9
urban empowerment project 179
urban environment restoration 247–9
urban games project 179
urban transformations 173–91
US Energy Information Administration (EIA) 56
Usher, A. 126, 127
Vergragt, P. 8, 9
virtual sites 284–5
Warf, B. 278, 295, 296
waste management 38–9, 82–3, 102, 117, 130
water consumption 70, 84–5
water heating system, solar 81–2
water management 33, 37–9, 59, 83–4, 119–20, 131, 247–9
water reuse system 82–3
wedges 63
world-class universities 123, 126–7
Wyatt, J. 51, 52
Xu, Y.L. 71, 73
Yale University 119, 137