

The Economics and Uncertainties of Nuclear Power

FRANCOIS LEVfiQUE

CAMBRIDGE
UNIVERSITY PRESS

Contents

<i>List of abbreviations</i>	<i>page viii</i>
Introduction	1
Part I Estimating the costs of nuclear power: points of reference, sources of uncertainty	7
1 Adding up costs	9
The notion of cost	10
Social, external and private costs	12
External effects relating to independence and security	13
The price of carbon	16
Decommissioning and waste: setting the right discount rate	23
Liability in the event of accident	34
Technical and financial production costs	36
Adding up the costs: the levelized cost method	39
2 The curse of rising costs	43
The rising costs of nuclear power	44
International comparisons	49
Is there no limit to escalating costs?	53
3 Nuclear power and its alternatives	64
The relative competitive advantage of nuclear power over gas or coal	66
The competitive advantages of nuclear power and renewable energies	72

Part II The risk of a major nuclear accident: calculation and perception of probabilities	79
4 Calculating risk	81
Calculating the cost of major accidents	81
Calculating the frequency of major accidents	86
Divergence between real-world observation of accidents and their frequency as predicted by the models	91
5 Perceived probabilities and aversion to disaster	102
Biases in our perception of probabilities	103
Perception biases working against nuclear power	111
6 The magic of Bayesian analysis	118
The Bayes-Laplace rule	118
Are we naturally good at statistics?	121
Choosing the right prior probability	123
Predicting the probability of the next event	125
What is the global probability of a core melt tomorrow?	132
Part III Safety regulation: an analysis of the American, French and Japanese cases	139
7 Does nuclear safety need to be regulated?	141
Inadequate private incentives	142
Civil liability	147
Civil liability for nuclear damage, in practice	149
A subsidy in disguise?	151
8 The basic rules of regulation	157
An engineer's view of safety regulation	157
Japanese regulation, an example to avoid	160
The Japanese regulator is a captive to industry	166
9 What goal should be set for safety and how is it to be attained?	172
Technology versus performance-based standards in the United States	174

Contents • vii

Choosing a goal for overall safety: words and figures	179
A French approach in complete contrast to the American model	186
Regulator and regulated: enemies or peers?	193
Pros and cons of American and French regulation	198
Part IV National policies and international governance	207
10 Adopting nuclear power	211
Atoms for peace	212
Pioneers and followers	216
Aspiring nuclear powers	222
11 Nuclear exit	226
German hesitation over a swift or gradual exit	226
In France early plant closure and nuclear cutbacks	235
12 Supranational governance: learning from Europe	244
Why is the national level not sufficient?	244
European safety standards	247
Europe's patchwork of liability	251
Coexistence fraught by conflicting views on nuclear power	256
13 International governance to combat proliferation: politics and trade	265
The IAEA and the NPT: strengths and weaknesses	266
Nuclear trade	269
Which model: the armament industry, or oil and gas supplies and services?	273
Export controls	282
Conclusion	296
Notes	302
<i>Index</i>	328