CONTENTS

	Página
Preface I	
Miguel Ángel Ballesteros Martín	
Preface II Arturo Gonzalo Aizpiri	
Prologue	
Time to reassess energy cards	15
This is a time of unprecedented uncertainty for the energy sector	15
The pressure and challenge to further develop and transform the energy system is immense	15
Business as Usual is not an option	16
The energy transformation is the backdrop of a changing energy map	16
Introduction Claudio Aranzadi	
Definition	19
The "trilemma" amongst objectives in global energy strategy. Competi-	
tion and cooperation	21
Union	22
The global dimension of the greenhouse gas abatement policy	25
Energy security	30
Energy factors: global energy and competitiveness	32
Competition and cooperation	34 36
The articles contained in this publication	36
Chapter I	
Geostrategic and geopolitical considerations regarding energy Francisco José Berenguer Hernández	45
Some considerations about the "energy security" concept	46
Concept	46
Attention and Concern	47

	Página
Validity of the concept	48
Energy security in global strategic thinking	51
Spain	52
The European Union	53
The North Atlantic Treaty Organisation	54
United States of America	54
The United Kingdom of Great Britain	55
France	55
China	56
The Russian Federation	56
Conclusion	57
Energy in geostrategy	57
Energy in geopolitics at the start of the XXI century	63
General Trends	63
The continuous thrusting of the emerging economies	63
Greater political instability and uncertainty in high production zones	65
Search for new zones for the exploiting of hydrocarbons	67
Diversification of routes	68
Redefinition of nuclear and renewable energies	70
Unconventional techniques of extracting hydrocarbons	72
USA strategic retraction-expansion	74
Partial conclusions	76
Points of potential regional friction	77
Strait of Ormuz	77
The Caucuses	79
The Caspian Sea	80
The China by-pass towards the Indian Ocean	82
The succession in Algeria	83
The future of Egypt, Syria, Tunisia or Libya The Strait of Malacca	84 85
The eastern Mediterranean. Israel as an energy power	85
The legal insecurity in populist governments	86
The excess strengthening of Arabia, Qatar and the Arab Emirates	00
in the international context	88
The role of Russia	89
Charter II	90
Chapter II	
Spanish energy security in a changing scenario	93
Introduction	94
An international, fragmented and transitional regime	94
Physical security vectors: dependency and vulnerability	102
Economic security sectors: Energy intensity and competitiveness	115
Conclusions	121
Acronyms	123
Chapter III	
Cyber security in the emerging systems of the electrical sector Jorge Cuéllar Jaramillo	125
The smart distribution grid	127
The smart distribution grid	127

	Página
Forces that lead to Smart Networks	128
Supply security	128
Ecology and the protection of the environment	129
The market	129
Optimisation of the distribution system operations	129
What are Smart Grids?	130
The current electrical supply system	132
Architect and characteristics of the current system	132
Reliability	133
ICT security requirements in the electrical supply	136
Integrity	137
Privacy	137
Confidentiality	139
Availability	139
Cyber security rules in the current electrical supply system	140
Stuxnet	140
Stuxnet relatives: Flame, Duqu, Gauss and Madi	141
Other attacks on SCADA centres and on the Smart Grid	142
Other attacks on SCADA centres and on the Smart on a	145
The role of icts in smart grid	146
The characteristics of Smart Grid	146
ICT Security in the Smart Grid of the future	148
Security Measures in Smart Grids	150
Facilitate the security processes	150
Build secure systems	152
Evaluate the security and the processes	152
Respond	152
Challenges	153
Technical aspects of operation and of infrastructure	153
Operating aspects of the infrastructure and related processes	155
Education, dissemination and awareness rising	155
Information exchange	156
Standards, guides and regulation	157
Research and development of new solutions	157
Protection of the privacy of personal data	157
Conclusions	158
Bibliography	159
Dibliography	1 3 7
Chapter IV	
Geopolitical impact of the development of unconventional hydro-	
carbons	163
Mariano Marzo	
Introduction	165
Unconventional oil Preliminary technical considerations	166
	166
What does unconventional mean?	166
Main types of unconventional oil	166
Estimate of resources and their production costs (without inter-	1/0
nalising the CO₂.costs)	168
	170
a counterbalance to the Middle East	172
Oil production between 2012 and 2035. Non-conventional as a tempo- rary alternative to the hegemony of OPEC and the Middle East	17/
rary atternative to the negembory of UPEC and the Middle East	176

	Página
Oil production has already peaked. Unconventional oil gains prominence	176
The production from the non-OPEC countries increases until the	
late twenties and it then stagnates and declines	177
The revolution began in the U.S. LTO spreads to other countries	
but loses steam from the early thirties	179
Middle East grows in significance in OPEC. Venezuela maintains its position thanks to extra-heavy oils	181
Ten-years ahead, OPEC will again occupy a key position and the	
Middle East will stand as the only source of cheap oil	182
Iraq, Brazil, Canada, Kazakhstan, USA and Venezuela will be key in	
ensuring global supplies	183
Uncertainties. The case of Iraq as an example	184
The reorganization of the global trade in oil between 2012 and 2035. Its implications for the security of global supply	185
The new geography of demand. Decline in the OECD, growth in	103
Asia and the Middle East	185
The balance between production and demand. Imports move from	103
the OECD to Asia. Unconventional fuels make North America a	
net exporter	187
The overall flow of oil veers from the Atlantic basin, with the ex-	107
ception of Europe, towards the east of Suez, particularly to	
China and India	189
Security implications of the global oil supply	190
Unconventional gas	191
Preliminary technical considerations	191 191
Main types of unconventional gas	191
Estimation of resources and production costs (without internaliz- ing the CO ₂ .costs)	193
Geographical distribution of resources. The unconventional gas as a	173
counterweight to the Middle East and Russia	196
The case of shale gas	197
Production of natural gas between 2012 and 2035. The unconventional	177
gas revolution expands beyond the U.S. and Canada	201
In just over two decades unconventional gas could represent	201
more than a quarter of the global production of natural gas	201
U.S. production and Canadian production continues to grow in the	20.
next decade and it is then stabilised. Mexico comes onto the	
scene	203
China and Australia burst onto the world stage in the production	
of unconventional gas	204
The potential of Argentina	205
The incognita of Europe	206
The reorganization of the global trade in natural gas between 2011 and	
2035. New pipelines and new players in the market of LNG	207
The new geography of demand. China and the Middle East are	
growing rapidly, although the U.S. will remain the largest market	207
Balance between production and demand. Unconventional gas	207
makes Australia and the USA and Canada net exporters. Im-	
ports are moving from the Atlantic basin (except Europe) to-	
wards the Asia-Pacific	209
Europe increases its dependence on imports	210
The increased production in China and India is not enough to off-	
set the increased demand	211

	Página
Transport by pipeline from Russia to Europe stagnates and it is to be redirected toward China. Azerbaijan and Turkmenistan	24.0
take centre stage The trade in liquefied natural gas (LNG) is reorganized due to the increasing domestic consumption in the Middle East and the emergence of new sources of supply from Australia, U.S. and	212
Canada	213
Conclusions	214
Key conclusions regarding unconventional oil	214
Key conclusions relating to unconventional gas A final thought. Unconventional hydrocarbons and energy dependence:	216
The divergent paths of the U.S. and Europe	218
Bibliography	219
Chapter V	
The rise of china and its energy supply	221
The rise of china and its energy supply	223
Introduction	223 227
China's energy voracity. Asia: the market of the future	231
China, a key geopolitical factor in the energy panorama. The geo-strate- gy of the future	234
The change of energy paradigm. From the supply to the demand ap-	234
proach	238
The strategic triangle of energy supply security	240
The geographical scenario. The Chinese model of relations	242
The rationalization of the means of supply. The political commitment	244
Coal	245
OilNatural gas	246 250
The diversification of energy sources. A promising future	254
The challenges to security of supply	259
Fossil fuels. Difficult political decisions	260
The irresistible access to the golden age of unconventional gas. A revo-	
lution yet to arrive	265
zon	270
The technological revolution. A dream at a distance	273
The challenge of nuclear security after Fukushima	276
Conclusions. A SWOT analysis	279
Strengths	280 280
Opportunities	281
Threats	281
Abbreviations and Acronyms	282
Bibliography	283
Books	283
Documents, articles	284
Web pages	287
Composition of the working group	289
Strategic Dossier	291