



Table of Contents

| | | |
|------------|---|--------------|
| Ia | Vorwort | XI |
| Ib | Preface | XII |
| IIa | Zusammenfassung | XIII |
| IIb | Summary | XVIII |
| III | Innovation Capacities Analyses ENSEA | 1 |
| | Executive Summary | 7 |
| | Introduction | 8 |
| | Main findings and conclusions | 11 |
| | General Introduction, Scope and Methodology | 17 |
| | III 1 Introduction | 18 |
| | III 2 Overview of ENSEA project | 21 |
| | III 3 Methodology | 25 |
| | Regional Report of the Scottish Region | 27 |
| | List of Figures | 28 |
| | List of Tables | 28 |
| | 1 General Overview of Scottish Region | 30 |
| | 1.1 Geography | 30 |
| | 1.2 Governance structures | 30 |
| | 1.3 Economy | 30 |
| | 1.4 Employment | 31 |
| | 1.5 Scottish Academic Research in Energy | 32 |
| | 2 Description of the Regional Energy System | 36 |
| | 2.1 Overview | 36 |
| | 2.2 Regional energy system | 36 |
| | 2.3 Investment in Energy in Scotland | 36 |
| | 2.4 Scottish Demand for Energy | 36 |
| | 2.5 The Gas Supply Industry | 38 |
| | 2.6 Electricity Supply Industry | 38 |
| | 2.7 Heat Supply Industry | 43 |
| | 3 Overview of Innovation and Collaboration | 45 |
| | 3.1 The Scottish Innovation System | 46 |
| | 3.2 EU Policy & Objectives | 48 |
| | 3.3 EU Policy Support & Operations | 50 |
| | 3.4 Use of EU Funding Programs | 52 |
| | 3.5 Support for EU Collaboration in Scotland | 53 |
| | 3.6 UK Policy Development & Implementation | 54 |
| | 3.7 UK Renewable revenue support framework | 56 |
| | 3.8 Scottish Formulation and Advocacy of Policy | 57 |
| | 3.9 Facilitation and Direction of R&D | 63 |
| | 3.10 Knowledge Creation and Development | 69 |
| | 3.11 Knowledge Diffusion and Exchange | 72 |



| | |
|--|------------|
| 3.12 Research and Innovation Support | 76 |
| 4 SWOT Analysis | 81 |
| 4.1 SWOT Summary – Scottish Innovation | 81 |
| 4.2 SWOT Summary – Scottish Region in General..... | 86 |
| 4.3 SWOT Summary – Scottish Energy System..... | 95 |
| 5 Summary and Conclusions | 126 |
| 5.1 Next Steps..... | 133 |
| 6 References | 134 |
| Regional Report of the Energy Valley Region | 135 |
| List of figures | 136 |
| List of tables..... | 136 |
| 1 General overview of the Energy Valley region..... | 137 |
| 1.1 Geography | 137 |
| 1.2 Economy | 138 |
| 1.3 Education / research..... | 141 |
| 1.4 Important regional plans covering for example energy, climate change and economic development | 141 |
| 2 Description of the regional energy system | 145 |
| 2.1 Consumption, production, storage and transport of energy | 145 |
| 3 Description of Innovation and Collaboration | 154 |
| 3.1 Smart Specialization and Cluster Strategies | 154 |
| 3.2 Some detailed data on energy companies | 155 |
| 3.3 Knowledge generation..... | 156 |
| 4 SWOT analysis..... | 163 |
| 4.1 Triple-helix Matrix..... | 166 |
| 5 Summary and conclusions | 168 |
| Regional Report of Wachstumsregion Ems-Achse e.V. | 169 |
| List of figures | 170 |
| 1 Wachstumsregion Ems-Achse e.V. at a glance..... | 171 |
| 1.1 Geography | 172 |
| 1.2 Economy | 174 |
| 1.3 Education/Research..... | 175 |
| 2 Description of the regional energy system | 182 |
| 2.1 Summary of the national and regional energy system | 182 |
| 2.2 The Lower Saxony energy system | 188 |
| 2.3 Energy generation in the Wachstumsregion Ems-Achse | 197 |
| 3 Policies for research and technological development (RTD) | 199 |
| 3.1 Cluster strategy | 199 |
| 3.2 Smart Specialization | 199 |
| 3.3 Internationalization | 200 |
| 3.4 Actors facilitating research and technological development..... | 201 |
| 3.5 Relevant policies at national and regional level | 202 |
| 4 Description of the methodology | 207 |
| 5 SWOT Analysis | 210 |
| 5.1 Ems-Achse overall..... | 210 |
| 5.2 Wind Energy..... | 212 |
| 5.3 Bio Energy | 214 |
| 5.4 Solar Energy | 215 |



| | |
|--|------------|
| 5.5 Geothermal Energy | 216 |
| 5.6 Marine Power | 217 |
| 5.7 Hydro Power | 217 |
| 5.8 Fossil Energy | 218 |
| 5.9 Energy Storage | 219 |
| 5.10 Energy Supply/Infrastructure | 220 |
| 5.11 Triple-Helix Matrix | 221 |
| 6 Summary & Conclusion | 224 |
| 7 Bibliography..... | 225 |
| Regional Report of Rogaland | 227 |
| List of figures | 228 |
| List of tables..... | 228 |
| 1 Introduction..... | 229 |
| 2 Objectives | 231 |
| 3 Rogaland region in a glance..... | 232 |
| 3.1 Geography and Demography..... | 232 |
| 3.2 Higher Education and Research..... | 232 |
| 3.3 Conditions for sustainable economic growth..... | 233 |
| 4 Policy and support mechanisms..... | 234 |
| 4.1 Policy..... | 234 |
| 4.2 Support mechanisms – R&D and innovation programs | 236 |
| 4.3 Commercialisation | 239 |
| 5 Regional energy sector | 240 |
| 5.1 Energy system from the national perspective..... | 240 |
| 5.2 Electricity Production..... | 240 |
| 5.3 Transmission infrastructure and system | 246 |
| 5.4 Electricity consumption in various sectors | 251 |
| 6 International cooperation | 254 |
| 6.1 Energy Networks..... | 254 |
| 6.2 Projects | 258 |
| 7 ENSEA collaboration – expectations | 261 |
| 7.1 Knowledge exchange and best practice | 261 |
| 7.2 SWOT analysis in Rogaland region | 261 |
| 7.3 Information and coordination | 266 |
| 8 Summary and conclusions..... | 267 |
| 8.1 Benefiting from regional SWOT analysis | 267 |
| 8.2 Identification of demand driven research projects..... | 271 |
| 9 References | 272 |
| Appendices | 274 |
| 1 General appendices | 275 |
| 2 Appendices Scottish Regional Report..... | 290 |
| IV ENSEA ‘Joint Action Plan’ | 295 |
| IV 1. Introduction..... | 298 |
| IV 2. Vision of the European North Sea Energy Alliance | 298 |
| IV 3. Establishment of a North Sea Research Association..... | 301 |
| IV 4. Establishment of strategic partnerships in the North Sea area..... | 302 |



| | |
|---|------------|
| IV 5. Establishment of a quadruple-helix cluster structure as operational level in the North Sea area..... | 302 |
| IV 6. Strategic objectives of the ENSEA cluster and elaboration of a JAP | 306 |
| IV 7. JAP methodology..... | 306 |
| IV 8. JAP results..... | 308 |
| IV 9. ENSEA Lighthouse Projects..... | 312 |
| IV 9.1 Educational North Sea Networks | 313 |
| IV 9.2 SME Networks around the North Sea | 314 |
| IV 9.3 Hydro Power – balancing and storage for the North Sea region | 315 |
| IV 9.4 North Sea Power Ring System | 315 |
| IV 9.5 Sustainable communities around the North Sea | 315 |
| IV 9.6 Green decommissioning: Exploring the potential for optimal (re-)use of existing Oil & Gas infrastructure in the North Sea | 316 |
| IV 9.7 Energy System Integration Doctoral Training Network | 316 |
| IV 10. Conclusion | 317 |
| Annex..... | 318 |
| V Measures Towards Implementation of the Joint Action Plan | 331 |
| V-ABBREVIATIONS | 337 |
| V EXECUTIVE SUMMARY | 339 |
| V 1. INTRODUCTION | 340 |
| V 1.1. Formalize ENSEA collaboration | 340 |
| V 1.2. Initiate internationalization strategy..... | 341 |
| V 1.3. Identification & definition of projects..... | 341 |
| V 1.4. Set up joint demand driven research program on system integration | 342 |
| V 2. INTRODUCTION TO WG REPORTING | 343 |
| V 3. THE WORKING GROUP ESTABLISHMENT | 344 |
| V 4. REPORT OF THE WORKING GROUPS | 345 |
| V 4.1. Governance & Modelling..... | 345 |
| V 4.2. North Sea Power Ring..... | 348 |
| V 4.3. Green Decommissioning | 350 |
| V 4.4. Energy Efficiency & Sustainable Communities..... | 353 |
| V 4.5. Educational Collaboration & Training | 358 |
| V 4.6. Innovation and SMEs | 367 |
| V 4.7. ENSEA Cluster (formalization) | 370 |
| V 4.8. Large-Scale Storage | 373 |
| V 4.9. Heat & Biomass | 376 |
| VI Energy Systems Integration: The Agenda for the Future – Policy Brief | 397 |