Considerations for an 'Innovation Readiness Level' along with the 'Technology and Manufacturing Readiness Level' indicators

...a KIC InnoEnnergy attempt

April 23rd - 24th 2014, IEA Committee on Energy Research and Technology - Modelling and Analyses in R&D Priority-Setting and Innovation, Paris

Celine Jullien
1. Once upon a time KIC InnoEnergy S.E.

2. KIC InnoEnergy Approach: Aligned Process, Methods and Tools at Project, Portfolio, and Thematic Field Levels

3. From Thematic Field to Industry Level: KIC InnoEnergy contribution to the SET Plan Integrated Roadmap
To begin with...

Europe’s handicap
Industrial energy prices, € cents per kWh

Electricity

- EU average
- Germany
- United States

Gas

- Germany
- EU average
- United States

Source: Enerdata/McKinsey

*Estimate
The leading engine for innovation and entrepreneurship in Sustainable Europe

Sustainability by addressing:

- The reduction of the cost in the energy value chain
- The increase of security
- The reduction of CO$_2$ and other greenhouse gas emissions
KIC InnoEnergy Shareholders

Industrial companies
- TOTAL
- EDF
- EnBW
- VATTENFALL
- gasNatural fenosa
- AREVA
- ABB
- eardis

Research centres
- Vito
- IREC
- TNO
- GIG

Universities
- AGH University of Science and Technology
- TU/e
- IFI
- TÉCNICO LISBOA
- Université Stuttgar
- KIT

Business schools
- ESADA
- GRENOBLE
- ESAD EN MENT

Copyright © 2014 KIC InnoEnergy
A strong and complementary network of 149 partners (and increasing) including Industry and Education partners, Research Centers and others, all collaborating at different levels.

Strong presence of Industry partners legitimates the activities and the objectives of KIC InnoEnergy

<table>
<thead>
<tr>
<th></th>
<th>Formal Partners</th>
<th>Associate partners</th>
<th>Project partners</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries</td>
<td>9</td>
<td>11</td>
<td>53</td>
<td>73</td>
</tr>
<tr>
<td>Universities</td>
<td>12</td>
<td>4</td>
<td>11</td>
<td>27</td>
</tr>
<tr>
<td>Research Centers</td>
<td>6</td>
<td>4</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>6</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>25</td>
<td>97</td>
<td>149</td>
</tr>
</tbody>
</table>

Examples

[Images of company logos: IBERDROLA, edp, ERICSSON, Schneider Electric, TAURON, GDF SUEZ, acciona, intel]
KIC InnoEnergy Ways forward

Creating the culture of ROI
Structuring it legally since day 1
(BCS, TS, PA, IP Rules, ROI, ..)

The KT disseminated extensively:
18 EIT awareness days
21 meetings with future KICs
Magrenov (FP7) awarded to guide a KIC like structure in Magreb

Position in the TRL-CRL
EU value chain

Copyright © 2014 KIC InnoEnergy
KIC InnoEnergy Achievements

Innovation Projects
- 16 new products and services
- 30 patents filled-out

Business Creation
- 18 startups created
- 400 business ideas screened since 2011

Education
- 458 Students enrolled in our EIT labelled MS, exec, PhD. school

EUR 400 million business plan

Copyright © 2014 KIC InnoEnergy

Game changers
Google of Energy, future ABB
Disruptive product & services
Sustainability (financial, operations)
High performance ecosystem & KT
Synergies with EU
1. Once upon a time KIC InnoEnergy S.E.

2. KIC InnoEnergy Approach: Aligned Process, Methods and Tools at Project, Portfolio, and Thematic Field Levels

3. From Thematic Field to Industry Level: KIC InnoEnergy contribution to the SET Plan Integrated Roadmap
KIC InnoEnergy Approach

- @ Thematic field level
- @ Portfolio Management level
- @ Project level

- Competence mapping for Intra and Extra KIC Partners per thematic field 2000-2012
- Strategy and Roadmap per thematic field 2013-2017

Assessment Process

Portfolio Management Criteria

Impact

KIC InnoEnergy IRL tool®

Innovation Project Monitoring and Support

Copyright © 2014 KIC InnoEnergy
110 Priority Technologies

- Shortest Time to market (for the technology involved)
- Highest impact in: Energy cost decrease, Increase of operability, decrease of GHG effects
- Leadership and competence of KIC partners in the said topic and technology
- Declared KIC industry interest and commitment
- Foreseeable regulatory impact
- Required investment to develop the innovations
- Cross impact in several applications
- IRL
## WIND ENERGY

- Reduction of the LEC by improving reliability, lifetime and inspection costs and risks.
- Better accuracy of the energy prediction
- Reduction of the installation costs, especially in Offshore
- Innovative concepts and materials of the components for Onshore and Offshore Wind Turbines, including design tools
- Improving the power transmission and grid integration for increasing the wind farms deployment, including energy storage

### 2020 Challenges

<table>
<thead>
<tr>
<th>Products &amp; Services</th>
<th>2012</th>
<th>2014</th>
<th>2016</th>
<th>2018</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind Farm and O&amp;M Improvements</strong></td>
<td>Monitoring systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wind &amp; weather forecast. Energy accurate prediction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Installation and deployment. Logistics (offshore)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wind Turbine design – Including substructures (priority offshore)</strong></td>
<td>Design tools for wind turbine components</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>New conceptual designs. Scaled prototypes (wind turbines and substructures)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improvement for existing turbines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Innovative materials and manufacturing processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wind Turbine and Wind Farm control</strong></td>
<td>Advanced sensors to control, to reduce loads and environmental risks, and to improve efficiency. Smart blades.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power transmission and integration</strong></td>
<td>Power transmission systems: electrical infrastructure and floating substations (offshore)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 2012 - 2020

- CAPEX & OPEX reduction. Life time increase. Monitoring brings up reliability which reduces costs and increases clean energy production.
- Estimated Wind Farm LEC reduction: 2-3%. Environmental monitoring brings higher social acceptance for wind energy.
- Improvement of tool accuracy or CAPEX reduction.
- Reduction LEC from new concepts expected at least 10%. For disruptive component concepts up to 5%.
- For innovative materials: estimated Wind Farm LEC -2%.
- Improved environmental aspects.
- Estimated Wind Farm LEC -3%.
- Expected LEC reduction (including OPEX and CAPEX) -2%. C: Better electricity selling strategy = higher revenue. Overall efficiency of storage system expected >70%
Top 10 ww Industry and Academic Players in KIC 110 Priority Technologies

Volume of Data analysed
~150 000 patents
~180 000 publications

Desk research
Focused on ~800 worldwide players & 100 KIC partners
1890 identified collaborations
340 identified acquisitions / spin-off
1210 identified products / services
17 identified licenses
Thematic field and KIC level Assessment Process

Thematic Field level assessment

KIC level assessment

STEP 1
KLAC assessment review
27/12 to 15/01

STEP 2
KLAC 1st Ranking Meeting
17/01

STEP 3
KLAC Hearing Meeting
23&24/01

STEP 4
KLAC Final Ranking Meeting
24/01

46 projects

18 projects
### Assessment criteria (transparent, formalized, communicated, known)

<table>
<thead>
<tr>
<th>A1</th>
<th>BUSINESS DEVELOPMENT</th>
<th>6,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1.1</td>
<td>Preliminary product or service definition (problem statement, solution benchmark, …)</td>
<td>2,0</td>
</tr>
<tr>
<td>A1.2</td>
<td>Business opportunity assessment (market analysis, competitive analysis, value proposition for customers, …)</td>
<td>3,0</td>
</tr>
<tr>
<td>A1.3</td>
<td>Soundness of IP analysis (background, freedom to operate, protections, etc.)</td>
<td>1,0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A2</th>
<th>RISK ANALYSIS</th>
<th>5,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2.1</td>
<td>Availability of required knowledge in the consortium</td>
<td>2,0</td>
</tr>
<tr>
<td>A2.2</td>
<td>Technical barriers identified and mitigation plan</td>
<td>1,5</td>
</tr>
<tr>
<td>A2.3</td>
<td>Evaluation of other risks (financial, societal, law, resources, team, …) and mitigation plan</td>
<td>1,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A3</th>
<th>FINANCIAL VIABILITY</th>
<th>3,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3.1</td>
<td>Project budget vs. market potential and scope of the project</td>
<td>1,0</td>
</tr>
<tr>
<td>A3.2</td>
<td>Justification of requested KIC investment</td>
<td>1,0</td>
</tr>
<tr>
<td>A3.3</td>
<td>Assessment of plan for KIC investment return</td>
<td>1,0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A4</th>
<th>OPERATIONAL VIABILITY</th>
<th>4,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4.1</td>
<td>Soundness of project plan (milestones, deliverables, availability of resources, etc.)</td>
<td>2,0</td>
</tr>
<tr>
<td>A4.2</td>
<td>Soundness of consortium vs. value chain</td>
<td>1,0</td>
</tr>
<tr>
<td>A4.3</td>
<td>Quality of project management</td>
<td>1,0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A5</th>
<th>COMPLIANCE WITH KIC REQUIREMENTS</th>
<th>4,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5.1</td>
<td>Integration of students, academics, education organisations</td>
<td>0,5</td>
</tr>
<tr>
<td>A5.2</td>
<td>Potential to create business (start-ups, spin-offs, …)</td>
<td>1,0</td>
</tr>
<tr>
<td>A5.3</td>
<td>Compliance with KIC InnoEnergy roadmap</td>
<td>2,0</td>
</tr>
<tr>
<td>A5.4</td>
<td>Participation of SMEs</td>
<td>0,5</td>
</tr>
</tbody>
</table>
**Portfolio Management Criteria**

**Thematic field and KIC level Assessment Process**

**Portfolio Management Criteria**

**TRL/MRL/TAM/”Year of market ready”**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>![Green Circle]</td>
<td>![Gray Circle]</td>
<td>![Blue Circle]</td>
</tr>
</tbody>
</table>

1. Biometha
2. Accor
3. Effic
4. Eye Us
5. Flowbox
6. AME OX200
7. Torsion Drive
8. Value Flex
9. Saga
10. Beest
11. Inevitad
12. Flex²
13. SmallFT
14. Refills
15. Deal
16. GasQ
17. BioORC
18. Fascom
19. CarbonOro
20. CySeMol
21. Sun-Rise
## WPO at project level

<table>
<thead>
<tr>
<th>Topic (headline)</th>
<th>Deliverable from WP0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Product/service definition:</td>
<td></td>
</tr>
<tr>
<td>a. Product/service definition/specification</td>
<td>List of expected products and/or services</td>
</tr>
<tr>
<td>b. Technical assessment</td>
<td>Assessment of technical aspects</td>
</tr>
<tr>
<td>c. Problem statement</td>
<td>Description of what needs to be done technically</td>
</tr>
<tr>
<td>d. Innovativeness</td>
<td>Comparison and differentiation of the expected products and/or services with the state of the art</td>
</tr>
<tr>
<td>e. Technical benchmark, alternative without</td>
<td>Positioning of the function/performance of the expected products and/or services versus state of the art</td>
</tr>
<tr>
<td>2. Market analysis</td>
<td></td>
</tr>
<tr>
<td>a. Market benchmark (3-5 years)</td>
<td>Target market segments and their sizes in Mio €</td>
</tr>
<tr>
<td>b. Product Market Combination’s, unique selling points</td>
<td>List of major competitors and unique selling points of the new products</td>
</tr>
<tr>
<td>c. Customer business case (why would the customer buy?)</td>
<td>Rentability analysis draft (profit and loss calculation) from viewpoint of the customer</td>
</tr>
<tr>
<td>d. Business case, (how to make profit?)</td>
<td>Rentability analysis draft of the project’s product (profit and loss calculation) from viewpoint of the supplier/manufacturer of the product and/or service</td>
</tr>
<tr>
<td>e. Marketing 3P’s (place, price, promotion)</td>
<td>Draft of the marketing plan</td>
</tr>
<tr>
<td>f. Required investment to overcome the valley of death?</td>
<td>Draft of the investment plan</td>
</tr>
<tr>
<td>3. Competitive analysis:</td>
<td></td>
</tr>
<tr>
<td>a. Market price at market entrance (because of design to cost)</td>
<td>Target cost and price of the new products and/or services</td>
</tr>
<tr>
<td>b. Competitors and the difference with the proposed proposition</td>
<td>List of competitors and the value proposition of their competing products/services. Differentiation of the expected products/services from competing products/services</td>
</tr>
<tr>
<td>c. Value chain available and connected?</td>
<td>Description of all steps that need to be covered to make the new product/service available and who performs them</td>
</tr>
<tr>
<td>d. Industrial partners committed? (project consortium)</td>
<td>Major parts of the value chain are covered by partners to the consortium. These partners contribute adequate own resources and receive adequate KIC funding. Preferred form of the deliverable: Signed commitment from industrial partners (Project Agreement or LoI)</td>
</tr>
<tr>
<td>4. Freedom to operate:</td>
<td></td>
</tr>
<tr>
<td>a. Intellectual Property: own</td>
<td>IP Agreement which lists identified Background in the consortium and makes it available to the consortium and partners in the value chain</td>
</tr>
<tr>
<td>b. Intellectual Property: hostile</td>
<td>External IP identified and analyzed with the result that development and production of the new products/services is not restricted by external IP</td>
</tr>
<tr>
<td>c. Intellectual property: foreground and licensing</td>
<td>List of areas where new IP is expected, and to whom this new IP shall be licensed</td>
</tr>
<tr>
<td>5. Detailed project plan/WBS</td>
<td></td>
</tr>
<tr>
<td>a. What, when, who, where to reach the goal.</td>
<td>Sound project plan</td>
</tr>
<tr>
<td>b. What are the deliverables in scheme</td>
<td>Milestones and output-oriented deliverables defined</td>
</tr>
<tr>
<td>c. Risk’s and mitigation</td>
<td>Risk analysis and mitigation plan available: Risks identified and sound mitigation actions established</td>
</tr>
</tbody>
</table>
The KIC InnoEnergy IRL tool® allows you to assess the innovation potential of a given project considering the maturity of 5 dimensions:

- **TRL (Technology Readiness Level)** measures the maturity of a given technology.
- **IPRL (IP Readiness Level)** measures the "freedom to operate" of a given product/service.
- **MRL (Market Readiness Level)** measures the maturity of a given need in the market.
- **CRL (Consumer Readiness Level)** identifies the level of knowledge about the consumer and to what extent affects the product/service to this consumer.
- **SRL (Society Readiness Level)** identifies the level of knowledge about the stakeholders' interests and concerns and to what extent affects the product/service to the society.

KIC InnoEnergy Innovation Readiness Level (IRL tool®)
Each dimension has different 
**maturity levels**

- **TRL**
  - Technology
  - Level 1. Unsatisfied needs have been identified
  - Level 2. Identification of the potential business opportunities performed
  - Level 3. System analysis and general environment analyzed
  - Level 4. Market research performed
  - Level 5. Target defined
  - Level 6. Industry analysis performed
  - Level 7. Competitors analysis and positioning performed
  - Level 8. Value proposition defined
  - Level 9. Product/service defined
  - Level 10. Business model defined coherently

- **IPRL**
  - Freedom to operate

- **MRL**
  - Market
  - Level 4: Market research performed

- **CRL**
  - Consumer behaviour

- **SRL**
  - Society acceptance

Each level has different questions to substantiate each maturity level

**LEVEL 4: MARKET RESEARCH**

1. Market size (in M€) of the specific market (e.g. thin films). Also market size by geography
2. Market structure and segmentation (in M€) of the specific submarkets (e.g. OPV, CIGS, etc.) and % of market share
3. Market trends (5 years period) in M€ and % of growth (by technology and geography)
4. TAM quantification (in M€), which is the upper limit for your market given 100% saturation of your product/service
The Project Manager of a given R&D project fills the information. The Committee evaluating the projects evaluates the quality of the answers and assigns a level for each dimension.

The results obtained support the decision making.
Results from a given project

Dimension analysis

Analysis

Aggregated analysis

Coherence in the evolution of the different dimensions. Evaluation of the project as a whole.

Further uses

Project Management

Evolution of a project over time.

Ratio of accepted/rejected projects

Analysis of the portfolio of projects

Medium risk portfolio

High risk portfolio

FIGU
1. Once upon a time KIC InnoEnergy S.E.

2. KIC InnoEnergy Approach: Aligned Process, Methods and Tools at Project, Portfolio, and Thematic Field Levels

3. From Thematic Field to Industry Level: KIC InnoEnergy contribution to the SET Plan Integrated Roadmap
KIC InnoEnergy Contribution to the SET Plan

@ Sectoral level

@ Thematic field level

@ Portfolio Management level

@ Project level

Value Chain Ready transformation

SET Plan Integrated Roadmap

Competition mapping for intra and Extra KIC Partners per thematic field 2000-2012


Strategy and Roadmap per thematic field 2013-2017

Assessment Process

Portfolio Management Criteria

KIC InnoEnergy IRL tool®

Impact

Copyright © 2014 KIC InnoEnergy
KIC InnoEnergy Approach to integration

1. **Integration** by incorporation of **Societal Appropriation** Concerns and **Market Value Chain** Perspectives to the **Technological Dimensions** of energy challenges.

2. **Integration** by **experimentation** in generalized **Research and Innovation Action Hall**, to test, implement, learn, reinvent, measure transformation throughout the whole innovation chain.

3. **Integration** by **combination** of industry dynamics - **Value Chain Ready Transformation** - and project **Innovation Readiness Level**.

=> Measure Integration: impact in job creation, in growth leverage, competitiveness increase…