

PILOT ACTIVITIES FOR JOBS AND GROWTH AND ADVANCED MANUFACTURING IN EUROPE

Executive Summary and Recommendations

- 1) Good definitions of and differentiation between types of pilot / demonstrator activities are an a priori condition. When discussing “Pillar 2”-related activities, inaccurate use of terms may cause misunderstandings. It is therefore required that the different types of pilot- and demonstrator-related activities are clearly defined. Adequate definitions can be based on technology readiness: “KET pilot lines” covering the TRL 5-8 range, and “KET deployment projects” in TRL 8-9.
- 2) Public procurement initiatives targeting at large scale deployment of TRL 9+ novel products don’t allow favouring EU-based companies while staying within WTO rules. Therefore “smart” leading edge public procurement is recommended. Well chosen technical aspects could be used for differentiating European KET providers from competition. Due to time and expertise limitations, WG4 hasn’t been able to explore this issue in all its aspects ; further elaboration may be beneficial.
- 3) Proposals for KET pilot lines and KET deployment projects will need to be judged against a set of selection criteria. A proposal for such criteria is made in the report.
- 4) A *conditio sine qua non* for the success of KET pilot lines and KET deployment projects is a swift processing of proposals. This requires a predictable and short-interval KET call system, and processing time between call initiation and award decision of no more than 6 months. Although challenging, the testimonies of (mainly SME’s) during the WG4 workshop clearly indicate that anything less ambitious makes no sense for the real economy.
- 5) Although based on a non-representative sample (the industrial companies present at the WG4 workshop), there is strong evidence that most KET pilot lines need to be tailored to the needs of an individual KET company. Sharing potential is restricted by IP considerations, excluding competing companies. Sharing of the infrastructure with R&D partners or with preferential suppliers/customers is frequently an option.
- 6) For an adequate political and financial support of all pillars, a specific funding line for KET pilot activities is recommended.
- 7) The EC definition of R&D should be *extended* to include the R&D typically performed within the context of Pilot Line development and ramp-up of new processes, technologies and products.

- 8) The funding of the selected KET pilot lines should be substantial to reach the intended goal of bridging the gap: SME's should be able to get 50% of their expenditures compensated, for larger companies this should be 40%. For KET deployment projects that generate revenue, compensation can be based on the delta between manufacturing costs for the novel technology vs. the existing technology. The aid intensity on this delta may vary between 30% and 70%. Concerning aid intensities the German Government introduced the idea of matching clauses in the European state aid rules, in order to be able to match better competitive conditions in other countries . This should be considered.
- 9) WG4 recommends to reserve for SME's an adequate part of the financial resources that will be made available for KET pilot lines, as SME's and start-ups have a strong need for pilot lines (cfr WG4 workshop, case studies) and there are very few other MEuro-size financing alternatives available to SME's or start-ups in the pre-revenue generating phase of their existence.
- 10) WG4 pleads for a coordinated KET policy of the EU Commission. This concerns especially Regional Policy. The budgetary mechanisms for structural and regional funds should be made more flexible for co-funding of KETs related projects.

Chapter 1: Introduction and general context

Europe has good prospects regarding the production and marketing of innovative systems and solutions: it is a powerhouse for inventions; it has a skilled labor force; and it has the necessary capital. Europe just has to combine these competencies and encourage risk taking in order to accelerate innovation speed, and generate new markets and production sites.

This initiative will only be successful if the investment risk is balanced with realistic prospects for market growth and job creation. Moreover, this innovation process will only accelerate if the knowledge base for markets and products is sound, and if there is a clear return-on-investment. The entire value chain must interact. The supplier of key enabling technologies has to learn about the market. The market has to learn about leading-edge key enabling technologies. Key Enabling Technologies (KETs) are photonics, micro- and nanoelectronics, nanotechnology, industrial biotechnology, materials and advanced manufacturing.

Pilot activities (pilot lines or deployment projects) are the best means to generate the knowledge base and the visibility. This is especially true for key enabling technologies. The sooner a system provider like an automotive OEM is enabled by pilot components, materials or equipment, the sooner innovative systems such as electrical cars can be delivered to the market. On the other hand, deployment projects can support the marketing process and generate early feedback to the system provider and its suppliers of the KET industry

KET pilot activities are the most efficient catalysts for innovation, opening up the bottleneck, enabling crossing of the valley of death between invention and market. KET pilot actions create win-win situations: for the European industrial value chain and for the public.

In its Europe 2020 strategy, the EU Commission outlined that Europe's real economy has to be strengthened. In line with the statements given above, public policy support for KET pilot activities (pilot lines and deployment projects) can be a highly effective lever for this strategy. Consequently,

this report describes how public policymakers can support KET pilot actions within the limits of trade regulation and competition law.

The report proposes a definition for pilot activities. KET pilot activities have to be distinguished from both technological research (pillar 1) and Competitive Production (pillar 3). KET pilot actions should be triggered by different means than R&D or Production.

The report describes qualitative and quantitative criteria for selecting pilot activities which should be supported by public means.

Moreover, the report offers case studies indicating the economical and societal impacts of pilot activities and the financial challenges to be tackled in regards to them.

The report gives a brief introduction to WTO rules and describes limitations to be observed. This chapter is not exhaustive but it makes evident, that policy makers support innovation, jobs and growth with higher intensity.

In its final chapter, the report offers recommendations for improved framework conditions to make KET pilot activities happen. This concerns regulation, funding and legislation.

The first Rationale for KET pilot activities

Europe has a good tradition in pilot activities. Especially in telecom networks and in electric power generation and distribution, test beds and pilot projects are common to save time and money, to reduce risk and to accelerate innovation. Consequently, European providers for these infrastructures are world class. It should be noted, that the respective test beds and pilot projects have been publicly co-funded. This was a good deal for governments. The return on investment was strong in additional taxes, jobs and technology.

KETs are a precondition for the above mentioned infrastructures. Moreover they are needed to enable solutions in IT, Mobility, Security, Energy, Health and other applications which are of paramount importance for a modern industrial society. The successful deployment of KETs is a key precondition for achieving the objectives of EU 2020.

For this reason, KETs pilot activities should be supported with public funding. This funding differs at least partly from support for basic technological research or from investment grants for production sites. A clear definition of the term 'KET pilot activity' is essential in designing adequate and differentiated support measures. This definition has to describe the two kinds of pilot activities: KET Pilot Lines and KET Deployment Projects. This definition relies on the use of Technology Readiness Levels, which may be used to assist in the decision making process.

Technology Readiness Levels (TRL) of KET Pilot Activities

Pilot activities have to be based on a minimum technology readiness level. Otherwise the probability for failure is too high. With respect to the table below, a technology readiness level between 5 and 8

is required for pilot line activities.

In KET deployment projects, (pre-) qualified KET-based products, materials or pieces of equipment are early introduced into a real market environment. In order to do so the resulting technologies will have reached at least level 8.

This statement does not imply that every pilot line is linked to a deployment project or vice versa. Moreover it does not imply that the one is generally better than the other. That depends on the circumstances of technologies, markets and products.

The Technology Readiness table as used by the Danish Technological Institute, and presented at the KET Sherpa meeting March 4, 2011 is outlined below:

- 9 = Actual technology system qualified through successful mission operations
- 8 = Actual technology system completed and qualified through test and demonstration
- 7 = Technology prototype demonstration in an operational environment
- 6 = Technology demonstration in a relevant environment
- 5 = Technology validation in a relevant environment
- 4 = Technology validation in a laboratory environment
- 3 = Analytical and experimental critical function and/or characteristic proof-of-concept
- 2 = Technology concept and/or application formulated
- 1 = Basic principles observed and reported

Definition of KET Pilot Activity: “KET Pilot Line” and “KET Deployment Project”

KET Pilot Line (KPL)

A KET Pilot Line develops and fine-tunes manufacturing technology, and delivers KET-based pilot prototype products, materials, or manufacturing equipment to lead customers such that they can be sampled and subsequently introduced successfully into the customers’ production lines. Said pilot prototype products, materials or equipment enable new product innovation for the downstream industry earlier than with existing capabilities. This will greatly enhance the industry’s ability to quickly turn R&D into innovative products and in so doing gain market share or enable new markets. Moreover, the experiences achieved in a pilot line may reduce production costs in the subsequent high volume manufacturing.

In technological terms, a pilot line follows on R&D where the proof-of-concept of the product, material or equipment in a laboratory environment already has happened. In a pilot line, the basics of the production process and all details of the final product, material or piece of equipment are demonstrated in low volume prototype product production with the appropriate cost and production

yield. The final product can be completed and qualified through test and demonstration. The product has to meet predefined qualification criteria. The success of the pilot will be measured in the degree of readiness of the product, material or equipment for introduction into a high volume manufacturing environment.

In general, there are two types of pilot lines.

- A stand alone KET pilot line is constructed only for the purpose to mature, qualify and produce pilot products in order to allow downstream users the fast implementation of the pilot product in their system. After the achievement of this milestone, the Pilot line may be closed or reconstructed for other missions.
- An embedded pilot line is the first part of a following mass production (the seed of a production line). It may even share some line equipment with already existing lines in order to save money and time.

The purpose of the pilot line is to deliver early-stage prototype products through production in low volumes. If the pilot line is co-funded with public money, these volumes should be sufficiently low, as to avoid market distortion.

Pilot lines will be industry led and owned. Due to the requirement to strongly connect the pilot line with future high volume manufacturing, the pilot will likely be dedicated to a single industry owner. However it is also expected that some technologies may lend themselves to shared facilities where a certain amount of commonality exists in technology roadmaps and/or the cost of executing the pilot is beyond the means of a single industry.

KET Deployment Project (KDP)

'KET Deployment Projects' enable the experimental and early deployment of innovative products and systems issued from one or several KET, ahead of its large-scale commercialization, in order to develop and assess the value creation along the value chain downstream (both in terms of products and services) in real setting and environments. They thus allow both to reduce commercialization risk as well as to maximize the economic impact and benefit of the introduction of an enabling technology, for a large eco-system.

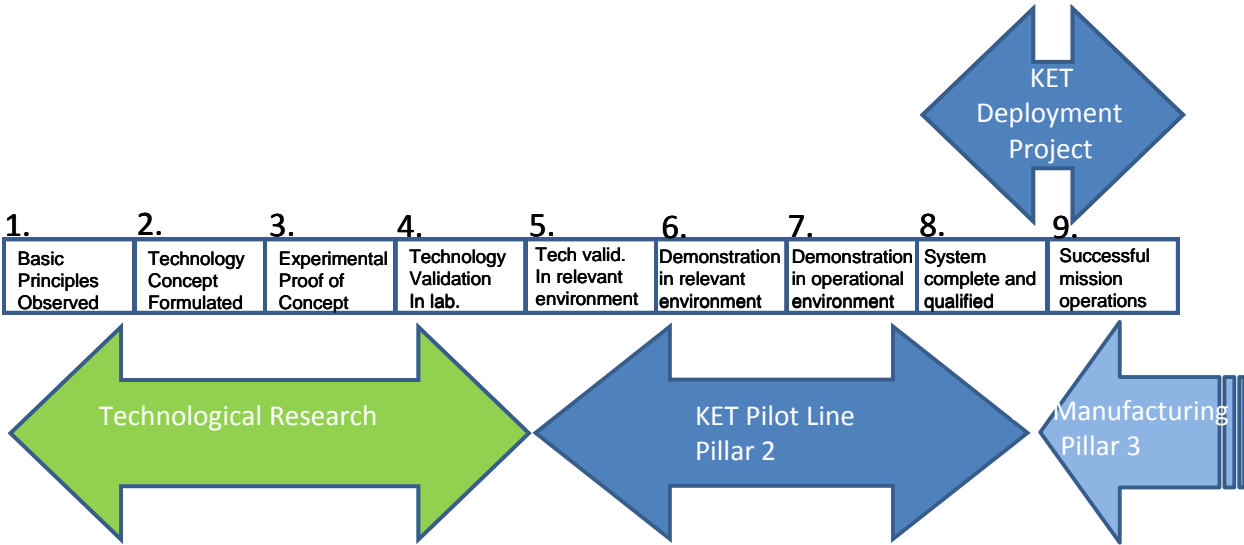
In order to accelerate the market pull for KET related solutions, that are in line with the Europe 2020 Agenda, Deployment Projects (KDP) can be useful tools. They can be instrumental in addressing societal challenges like energy saving, medical care or other 2020 objectives.

KDPs have to integrate stakeholders along the value chain, including end users, but should clearly be industry / product focused. Only an integrated and coordinated approach allows a streamlined planning, funding, execution and evaluation of the projects.

In technical terms, a KDP works with KET enabled products, although the standards and norms setting process may not be finalized. In any case, a KDP aims at achieving high technological and environmental standards, which can be met by leading edge KETs related solutions only.

Deployment projects are no substitutes for a mass market, but should rather generate a “first mover advantage” for the European industry. KDPs by no means are intended to generate market distortion. On the other hand, their magnitude and number must be sufficient to demonstrate a significant impact (value for money: competitive advantages and technology leadership that are translated into economic growth, job creation and societal challenges met) and allow a precise evaluation of the tested solution. Therefore, a significant size of the individual KDPs must be assured to have the envisaged effect. To this end KDPs enable KET industry to get early customers' feedback thus helping testing and fine tuning early KET products and systems to identify problems that need to be overcome for their broader market introduction (facilitating user acceptance, proving user benefits, standards creation, etc.).

A graphical representation of the interlinking character of the different types of technology development, leading to manufacturing, is provided below.



Chapter 2: Case studies

One of the main objectives of working group consists in gathering a sufficiently broad sample of potential pilot line and deployment projects in Europe. The April 7th WG4 workshop provided an excellent forum for this sampling exercise. In the days leading up to the workshop all industrial experts were invited to fill out a 2-slide template (see attachment(1)): a general description of the case on slide 1, and a predefined table with some data on slide 2. The case study invitation received a positive response from the industry invitees: 13 case studies were received. During the workshop the 1st general slide of each case was presented and discussed (see attachment(2)) ; the information in the 2nd slide, containing data that are not open to the general public, has been condensed into the table below :

KET	Capex				Sharing with			Societal impact	KPL	KDP
	25M or less	25M< <100M	100M< <250M	250M or more	academia	value chain	competition			
adv mtl	X					X		En Eff	X	
nanoelec				X				Jobs	X	X
photonics	X				X	X		En Gen	X	
photonics			X		X	X	X	Jobs		X
nanoelec		X			X	X		Jobs	X	
nanoelec				X		X		Jobs	X	
photonics		X			X	X	X	En Eff		X
adv manuf	X							En Gen	X	
photonics		X			X	X	X	Jobs		X
adv mtl								En Eff	X	
nanoelec		X			X	X		En Eff	X	
biotech	X				X			En Gen	X	
adv mtl	X				X	X		En Eff	X	

The sample of pilot plants / deployment projects covers all KETs but it has to be admitted that biotechnology is underrepresented. We have received additional information from one of the Sherpa's on another type of biotech pilot for biological enzymatic conversion of agricultural residue, hard wood and energy crops based. The example refers to a consultancy company as the source. The capex would be approx. € 25-50 million per bio-refinery. Advanced Manufacturing Systems is also not very visible but present as supporting competency in many of the case studies (all nano-electronics cases, some advanced materials cases).

Although the sample is too small to draw any firm conclusions, there seems to be some evidence for the following statements:

- none of the pilot lines (KPL's) can be shared with competitors
- most of the KPL's are in the range of up to 25MEuro (where we find all SME's), or between 25 MEuro and 100MEuro
- the deployment projects (KDP's) are in the ranges 25-100 MEuro and 100-250 MEuro
- the range above 250 MEuro contains only More-Moore-pilots in nanoelectronics

Each of the four (somewhat arbitrarily chosen) ranges has its own issues when it comes to finding financing for its pilot lines. During the workshop, the SME's in the low capex class stated that they have relied on regional or national technology development support as the administration required for European projects is too heavy for them. In most European countries, especially in the smaller ones, the investments related to even <25 MEuro pilot plants are too large to accommodate. Only very few European venture funds are willing to share the high risk of start-ups. Therefore there is an acute shortage of financial resources for such SME KPL's, certainly contributing to the valley of death. On the other side of the spectrum the sheer magnitude of the investments required for KPL's in the cutting edge of nanoelectronics may create a problem to be solved with bundled financial resources of Europe only.

Chapter 3: Criteria for success and selection

The impact to be achieved, impact assessment

The distinguishing feature of KETs is their enabling effect. New KETs products, materials or equipment drive innovation in the downstream industry. Government-supported pilot activities can speed up this process but political support is not a substitute for entrepreneurship. In line with the subsidiarity principle, public support should only be granted to activities which would not happen in the EU without support and which are essential for achieving the EU 2020 objectives. For this reason the report proposes a set of selection criteria which would be helpful in developing an impact assessment of the potential of the pilot line to produce a good return on investment for the public money granted.

With reference to the EU 2020 agenda and to the structure of Europe's industry, proposals for pilot activities have to be assessed and funding decisions have to be taken. An assessment should be facilitated by a list of criteria to be published and taken into account by all proposers.

List of Criteria for KET pilot lines

- Status of industrial asking for public support
The company should be a manufacturing enterprise with at least one significant production site in the EU. Criterion has to be fulfilled.
- Check of market distortion of the KET pilot line
Volume of expected output of the KET pilot line in the next three years. If already a market exists, the market share should be small in comparison to world market.
Criterion has to be fulfilled unless the market is in a small early stage condition
- Technology leadership
Existing R&D results should be leading edge compared to competition. Description should give evidence about competitive technological advantage as a consequence of the pilot plant.
Criterion has to be assessed case by case.
- Impact on societal challenges
Typical examples are benefit to the environment like energy saving or waste recycling, benefit for aging populations like easier production processes, healthier

- working conditions.
- Rationale for support by EU
 - Benefit for other EU member states outside the location of pilot line: suppliers?, customers? RTOs? Convergence or phasing-out region? Environmental project?
 - At least one criterion has to be met.
- Potential for creating manufacturing jobs in Europe
 - Direct sustainable jobs to be generated or safeguarded.
- Commitment from industry
 - First exploitation of generated IP and technology in Europe.
 - Criterion has to be fulfilled.
 - If not: Public funding should be paid back.
- Involvement of industry partners along the value chain
 - For projects with larger public funding (e.g.> € 10 mil), company receiving public funding should involve lead customers and/or suppliers (preferentially SMEs)
 - Criterion should be fulfilled.
- Criteria for success
 - Description of critical success factors and objectives to be achieved.

List of Criteria for KET deployment projects

- Status of KET contributors
 - The KET contributors should have significant production for their contribution in Europe.
 - Criterion has to be fulfilled.
- Technology leadership
 - The competitiveness of the deployment project should be benchmarked on a global scale.
 - Criterion has to be assessed case by case.
- Impact on societal challenges
 - Examples are benefit to the environment like energy saving or waste recycling, safety or security, benefit for aging populations like easier production processes, healthier working conditions.
 - At least one benefit has to be achieved.
- Rationale for EU support
 - Benefit for EU member states outside the location of deployment project: suppliers from EU member states outside the project location? Cooperation with RTOs? Project in convergence or phasing-out region? Environmental project?
 - At least one criterion has to be met.
- Potential on creating (manufacturing) jobs in Europe
 - Direct sustainable jobs to be generated or safeguarded.
- Commitment from industry
 - First exploitation of generated know-how and technology in Europe.
 - Criterion has to be fulfilled.
 - If not: Public funding has to be paid back.
- Criteria for success
 - Description of critical success factors and quantitative objectives to be achieved.

Chapter 4: An outline for a European Pillar 2 support framework

WTO regulation does not prevent support to pilot activities

WTO rules describe in article 8 of the Marrakesh agreement non-actionable subsidies. That article is attached to this report (attachment (3))

Article 8 a) regulates the intensity of state aid for R&D. 8 b) concerns subsidies in less developed regions. 8 c) covers subsidies for investments related to environmental legislation. Details can be found attached.

It is noteworthy that

- articles 8 b) and c) offer political flexibility, which is used in Europe only to a limited extent. Concerning 8 b) the ERDF fund and the ESF fund are frequently used for infrastructures but could be used more frequently for innovation projects. Concerning 8 c), public support for environmental measures in industry is not intensive, although the measures are in line with Europe 2020.
- measures under article 8 are allowed (non-actionable), even if they might distort trade.
- the EU R&D&I framework does not completely exploit the possibilities of the WTO regulation. The public support for industrial R&D&I could be more intensive than it is today in the EU. In this concern it should be added that several member states do not even exploit the R&D&I framework of the EU at all.
- public support for KET pilot activities with TRL 5-9 is clearly within the scope of WTO.

The smart approach to make it happen: the framework on public support for KETs pilot action.

The EU is not the only region caring for innovative value chains. Many global regions are striving for jobs and growth and advanced manufacturing. Recent pilot activities in China (e.g. USD 3 bn for LED lighting in 21 cities) or USA (USD 2.4 bn for full electric vehicles) demonstrate the intensity which is needed in Europe, if leading positions in the global innovation competition will stay a realistic objective. Europe has to concentrate its efforts on innovation. Moreover it has to coordinate its efforts without losing time. Europe has to formulate and push through its political will.

Smart aid intensity for KET pilot activities

The eligible costs are the same as in the FP7; the CAPEX depreciation should be allowed to happen within the project time. SMEs should receive higher public funds in order to balance their weaker position to gain private funds. Based on these principles, aid intensities for pilot lines should be between 40% and 50%, as indicated below.

Proposed aid intensity for KET pilot lines:

	Pilot line, TRL 5-8	Additional aid intensity for SMEs
Aid intensity	40%	+10%

Referring to a proposal of the German Government, matching clauses could be considered to generate a global level playing field.

For privately funded KET deployment projects a framework like Commission guideline 2008/C82/01 is proposed. Eligible costs are the difference between the innovative KETs deployment project and a state of the art project without innovation. Projects in less developed regions and/or investments of SMEs should be supported with higher intensity. This would allow aid intensities between 30% and 70% for the difference costs related to KET innovation.

Proposed aid intensity for KET deployment projects:

	aid intensity	If SME is the investor of KDP: add. aid intensity	If KDP is located in convergence or phasing out region add. aid intensity
Like in 2008/C82/01, aid is attributed to difference costs	30%	+20%	+20%

In analogy to KET pilot lines, matching clauses for the aid intensity of KDP could be considered.

The other option to consider for deployment projects is public procurement.

A leading edge public procurement is key for the improvement of public services. In order to reflect the constraints of the WTO Governmental Procurement Agreement (GPA) and the need for European based innovation, the Commission outlined in 2007 how public procurement could cover the pre-commercial sector (COM (2007) 799 final, Pre-commercial Procurement: DRIVING INNOVATION TO ENSURE HIGH QUALITY PUBLIC SERVICES IN EUROPE).

Neither pre-commercial procurement nor public procurement within the GPA limitations covers the

need for large scale European KET demonstration projects (reserved for European companies) to be rolled out for public infrastructures like lighting or transport. For that reason, “smart” leading edge public procurement is recommended. Well chosen technical aspects could be used for differentiating European KET providers from competition.

It should be noted, that public procurement of this kind is mostly within the responsibility of member states and regions.

Smart Exploitation of IP and Technology

It is likely that pilot initiatives will generate patents and technology. The project partners should initially exploit these patents and technology in Europe in addition to later moving to the global market place. For this reason the partners of pilot actions should file an exploitation plan within their proposals. The exploitation plan may be amended in line with the progress of the project. After the finalization of the project the partners have to demonstrate the exploitation according to the plan.

There may be good reasons for the partners to withdraw from the plan. The project may have been less successful than expected; the market may have changed, partners may have changed their business strategy. If these partners fail to demonstrate any exploitation of the IP or technology generated in the project, they should be forced to offer this IP or technology to the public in the EU. A Blue Print for a legislation ensuring this kind of exploitation may be the US Bayh-Dole Act.

Smart Regional Policy

It is noteworthy that the biggest share of the EU budget is dedicated to regional policy. Regional innovation policy and KET innovation policy should be linked. Cooperation of DG Regio with other KET related DGs should be improved. Joint financing of KETs pilot actions which are in line with the regional policy of the EU should be fostered. The European Regional Development Fund (ERDF) could be a strong motor for regional clusters and innovation based on KET. Until now, ERDF budgetary rules hinder the recommended coordinated policy. The Joint financing is possible only if the ERDF regulation will be amended.

Proposal:

ERDF regulation (1083/2006), §54 (5) should be eliminated completely or amended to allow at least co-financing of KET related Community programs.

Details about this topic can be found in the attachment (4).

Smarter and Faster Project Decisions

Time is money. Since the innovation cycles in KET industries are short, time is much money. This fact has to be reflected and respected in concern with the decision processes for EU technology

programs.

The first decision process is about the programming. A less detailed top down programming and more bottom-up approach could speed up this process significantly.

The disadvantage could be calls for proposals with a broader scope. This would attract more proposals and could delay the decision process for funding.

It is recommended to split this process into two steps: (to be discussed, a high quality decision process may be slow)

- First fast step sorting out all proposals with clearly negative prospect (two months)
- Second step with adequate assessment of top proposals (four months)

The adequate assessment of the remaining good proposals can and should be executed by a group of executive experts from the relevant downstream industry, EIB and experts from KET industries. The funding decision has to be taken by funding authorities within six months. The Commission has to take care for adequate capacities.

Every six months a new KET proposal call is recommended.

Adequate Funding of SMEs

In order to prevent monopolization of the necessarily limited resources available for pilot lines and deployment projects by the more experienced and better organized entities, it seems useful to offer a separate basket only available for SMEs or/and for smaller projects. This basket should be available with lower administrative hurdles; the criteria list should be shorter.

Adequate Funding of Pilot Activities

The aid intensity for pilot activities in Europe is hampered by the constraints of the R&D&I framework. The EC definition of R&D is to be extended to include the R&D typically performed within the context of KET Pilot Line development and ramp-up of new processes, technologies and products.

Adequate Installation of Funding Lines

Whilst Technological research activities (Pillar 1) are covered in the existing framework programme, any funding for pillar 2 activities might get a challenge. For that reason it is recommended that the Commission establishes a specific funding line for Pilot Line activities within the forthcoming CSF.