

Innovation in FMEs



FME Innovation task force
November 2018



Summary of the report's recommendations

This report is the result of work completed by the "FME Innovation Task Force" – an expert group assembled by SINTEF and NTNU Energy in the spring of 2018 with the aim of providing recommendations relevant to innovation-related work being carried out at the Norwegian Centres for Environment-friendly Energy Research (FME). The report is presented in the form of five recommendations focusing on how the FMEs can create an innovation culture and develop know-how and tools that enable greater levels of innovation. Each of the recommendations is accompanied by a justification and a set of suggestions for further work. The five recommendations for greater levels of FME innovation are as follows:

1. A high level of management commitment is essential, and all FME Managers must assume the role of a committed promoter of innovation.
2. It is essential to have a plan in place at each FME for the development of an innovation culture, adapted to the particular circumstances of the FME in question.
3. It will be sensible to assign a dedicated person (Innovation Manager) to follow up this plan. He or she shall supervise all aspects of innovation within the FME and maintain contact with the other FMEs, perhaps by means of an innovation forum.
4. The task force recommends the use of tools to facilitate the systemisation and valuation of concepts and technical innovations. Some of these tools will be generic, although the FMEs may also gain benefit from a variety of other tools reflecting the research fields in which they are engaged. This report does not name specific tools, but recommends that work be started to identify and adopt tools that can be utilised by all FMEs.
5. In order to demonstrate the societal benefits of technical innovations, and to ensure that these and any new knowledge are applied, it is recommended that a systematic project be conducted to highlight the technical innovations generated by the FMEs. This project should be linked to the FMEs' ongoing dissemination work.

The majority of FMEs are already under way with some of the five activities. The different FMEs have their own structures, procedures and ways of doing things. It would be useful for the FMEs to share a unified understanding of the term innovation, and of the measures required to become good innovators and to learn from each other going forward. The proposals for actions presented in this report help to pave the way for such developments in the future.

The work described in the report has been prepared jointly by SINTEF and NTNU. The results and tools presented consist of recommendations to the FMEs, in close collaboration with researchers and industry partners participating at the centres.

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Introduction

The concept of “saving the world” has become part of our everyday challenge. We are continually reminded by scenarios and reports on climate change, and the urgency of making changes. With all this going on, it is easy to become impatient – and a little anxious.

The research teams at NTNU and SINTEF are used to working with the challenges facing society – in collaboration with industry and the public authorities. What makes us less anxious, but perhaps more impatient, is the knowledge that we are working every day to find and develop solutions.

NTNU and SINTEF are both deeply involved in the FMEs (centres for research into environmentally-friendly energy). The FMEs represent both key instruments for society as a whole, and a major investment. This is because the FMEs are the cradles of exactly those solutions that will “save the world”. They are the natural places to begin because it is here that the three climate change “musketeers” – know-how, industry and the public authorities – come together to carry out long-term research with the aim of developing skills and innovation related to environmentally-friendly energy and carbon management.

We believe that it is possible for the FMEs to make an even greater impact by adopting an even sharper focus on innovation. Our experience from the now concluded FMEs such as NOWITECH, CEDREN and BIGCCS demonstrates that management commitment, systematic work and knowledge development, cultural development, innovation categorisation and counting, as well as effective dissemination, combine to create support for innovation-related work and help to highlight the impact of, and the potential inherent in, the FMEs.

Partners working at the FMEs are not alone. The FMEs can be regarded as “Norwegian national teams” in their fields, providing a joint boost to both industry and the research institutions and large centres in which they are rooted. Together, we have the ability to identify solutions to some of the major challenges that society faces, and by doing so contribute to the creation of jobs and wealth.

With this in mind, managers from SINTEF Energy Research, NTNU Energy, the various FMEs headed jointly by SINTEF and NTNU, as well as the Technology Transfer Offices (TTO), legal departments, innovation managers and communicators, have all come together with the aim of giving a joint boost to innovation activities.

Know-how and experience have been shared, needs analysed, and a joint understanding of, and agreement on, the benefits of collaboration across the FMEs affirmed. Agreement has been reached to pool our ideas, experience, tools and methodologies – enabling all those involved to learn from each other and raise their work to a higher level. In order to take this work forward, a group called the “FME Innovation Task Force” was assembled.

This report is the result of the work carried out within the group, summarised in the form of five principal recommendations accompanied by a set of proposed actions and suggestions for further work.

A handwritten signature in blue ink, reading "Sigmund Ø. Størset". The signature is written in a cursive style with a large, stylized 'S' at the beginning.

Sigmund Ø. Størset
Chair of the FME Innovation Task Force

Mandate

The mandate of the Innovation Task Force consists of a summary of a set of wishes presented at the start-up meeting on 9 January 2018, and is as follows:

to assemble and systematise experience, knowledge and methodologies linked to innovation within the FMEs with the aim of enabling them to learn from each other.

to recommend tools and methodologies designed to establish value, technology readiness levels (TRL) and other desirable “innovation counting” methods in order to empower the FMEs to apply these using a standardised approach.

The Innovation Task Force Working Group

Sigmund Ø. Størset, SINTEF Energy Research, FME NCCS

Ann Kristin Kvellheim, SINTEF Building and Infrastructure, FME ZEN

Per Arne Wilson, NTNU, Rector’s Staff Group

Camilla J. Larsen, NTNU TTO

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1. The Centre Manager must assume the role of a committed promoter of innovation

Each FME is a unique cradle for innovation because it represents a broad partnership involving both research and industrial participants. It can be regarded as a “Norwegian national team” for research and development within its own fields, and as an important forum for its participants. It is essential that the Centre Manager reaps the benefits of this and recognises that the FME’s industry partners are also part of the organisation. In building an innovation culture at an FME, it is important to have industrial partners on the team so that an awareness of innovation and the appropriate mindset are established among all participants. This will affirm the relevance of the research and innovation produced by the centre. Discuss expectations with all participants and always be asking – what is good innovation from a research point of view, and what are the expectations of the industry partners?

The promotion of innovation at an FME demands that it is assigned as a central pillar. Innovation must permeate all levels of the centre throughout the lifetime of the FME. This is a management responsibility that devolves to the Centre Manager, and which he or she must acknowledge and adhere to. All members of the organisation must feel that the FME and its management which is expected taking innovation seriously and that this is crucial if the centre is to achieve the societal impact it has set for the FMEs.

Putting innovation on the agenda

The Centre Manager needs to put innovation on the agenda of the FME. Talk to the various participants at the FME about their expectations and what innovation means to them. It is also important to acknowledge that in order to succeed it is essential to instil the concept of innovation with meaningful content – something that makes it more than just another buzzword. This content may vary from centre to centre. Outstanding research is not necessarily sufficient to generate innovation. Ultimately, successful innovation may be the product of idea generation, problem solving, team culture and interaction, also in some cases, countless iterations. It is important to discuss what the FME and the people working there *actually* have to do in order to achieve success in innovation.

Effective innovation management is also about effective communication. In order to stimulate continued efforts in the field of innovation-focused research, it is important that success stories are communicated fast and effectively. At the same time, we have to become skilled at communicating our innovations so that our industry partners and other stakeholders are well aware of our most important industry-related results. If the industry is to experience the impact we are looking for, our research must come out of hiding and be communicated to the partners.

Building the team

If an innovative Centre Manager is to succeed with his or her strategies, it is also essential that the entire centre management team, together with the industry partners, are agreed on the same aims and singing from the same hymn sheet. A dedicated Centre Manager and management team that fails, or does not want, to acknowledge the importance of innovation has no chance of motivating the entire organisation. Management at the FME must share the same goals and, ultimately, act as a watchdog – continually directing focus on innovation at all levels of the organisation.

Recommended actions

- Innovation at each FME should be evaluated annually (Responsible: the FME Board)
- The Research Council of Norway shall maintain innovation as a component of each FME's self-assessment criteria (Responsible: the Research Council)

Many FMEs are set up to be assessed for innovation, and we recommend that the respective Boards require this specifically. Furthermore, the Research Council operates with innovation as a criterion for FME self-assessment, and we believe it is important that this is maintained.

2. All FMEs must appoint a dedicated Innovation Manager

In order for an FME to succeed in its innovation-related work, it is important to assign personnel to work continuously with innovation throughout the lifetime of the centre. Management at the FME must determine a plan and establish expectations and a principal focus. Then the work can get under way. Our recommendation is to appoint a single person with dedicated responsibility for innovation management at each FME.

The Innovation Manager as a nerve centre

The responsibilities of the Innovation Manager at an FME will include the practical follow-up of innovation topics linked to both research-related innovation processes and communication with industry partners. In this role, the Innovation Manager will function as a permanent point of contact for the industry partners in matters concerning innovation, IPR and technology transfer. The Innovation Manager will enable the FME management team to ensure that the potential inherent in management focus and initiative linked to innovation processes is actually put into practice. In this way, the Innovation Manager can assist the Centre Manager in maintaining an effective focus on innovation. The Innovation Manager should also act as a key and visible resource person for the industry partners at the FME in matters such as the nature of partner involvement, and the process of gleaning as much as possible from research work and innovation activity.

The Innovation Manager should also play a key role in identifying not only innovations produced at the centre, but also research activities that exhibit innovative potential. In this way, the Innovation Manager will be able to contribute towards boosting innovation focus and potential resulting from research activities.

Recommended actions

- Each FME should appoint an Innovation Manager or equivalent (Responsible: individual FMEs)
- The establishment of an FME innovation management forum to promote the exchange of skills and experience between the various FMEs (Responsible for start-up: the FME Innovation Task Force)

All the FMEs currently headed by SINTEF and NTNU either have an Innovation Manager in place, or are in the process of establishing the post. The FME Innovation Task Force will organise the first meeting of the innovation management forum and will make suggestions regarding the forum's future tasks.

3. Each FME must prepare a plan for developing innovation competence

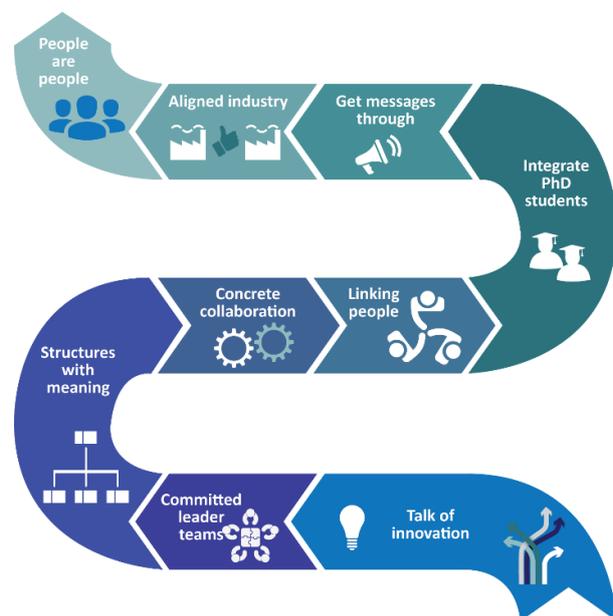
As well as management commitment and the provision of dedicated personnel, it is important that all FMEs promote high levels of innovation skills among their participants (research scientists, doctoral and other students, as well as industry partners). This will entail offering the means of acquiring know-how, as well as an arena to exercise and develop the acquired skills. Innovation competence contributes towards building an innovation culture, which is a criterion for innovation success.

First make a plan

A first step is to prepare a plan for the development of innovation competence. This plan can be included as a component of a more wide-ranging innovation plan and/or as part of the FME's overall research plans. When the plan is in place, the FME's management team must ensure that it is effectively communicated to its participants. The plan should set out ambitions regarding how the centre intends to develop innovation competence among its industry and user partners, and how it intends to promote interaction between research and industry.

The contents of the plan can be adapted according to the needs of the individual FMEs. The following are some examples of measures that may be included:

1. In collaboration with communications personnel, establish a low threshold channel to enable communication between researchers and user partners.
2. Organise innovation-related workshops/meetings on a regular basis.
3. Organise innovation-related seminars involving doctoral, post-doctoral and other students and tutors.
4. Identify developmental and innovation-related tasks suited to work in teams.
5. Organise regular "innovation lunch" events or brief meetings with a technical training focus. The following is a list of subjects that may be suitable:
 - a. This is how we work with innovation – with examples provided by entrepreneurs/partners
 - b. IP strategy and management.
 - c. How can the TTOs assist us?
 - d. How do we develop and bring an idea to fruition?



The diagram illustrates how a plan for innovation skills development can be structured for a typical FME.

Generic topics such as IP strategy and management, how to apply for patents, etc., should be subcontracted to a shared provider so that individual FMEs do not have to develop their own programmes. This can be marketed as an “FME School of Innovation”. We recommend that responsibility for such an initiative be devolved to a central division at NTNU (by-passing the FMEs) with responsibility for innovation or teaching. A so-called Ocean School of Innovation previously existed at NTNU and experience from this can be applied in the new initiative.

Recommended actions

- Each FME shall prepare a plan for innovation skills development (Responsible: the FME's Innovation Manager)
- Establish an “FME School of Innovation” (Responsible: SFU Engage, in collaboration with the FMEs)

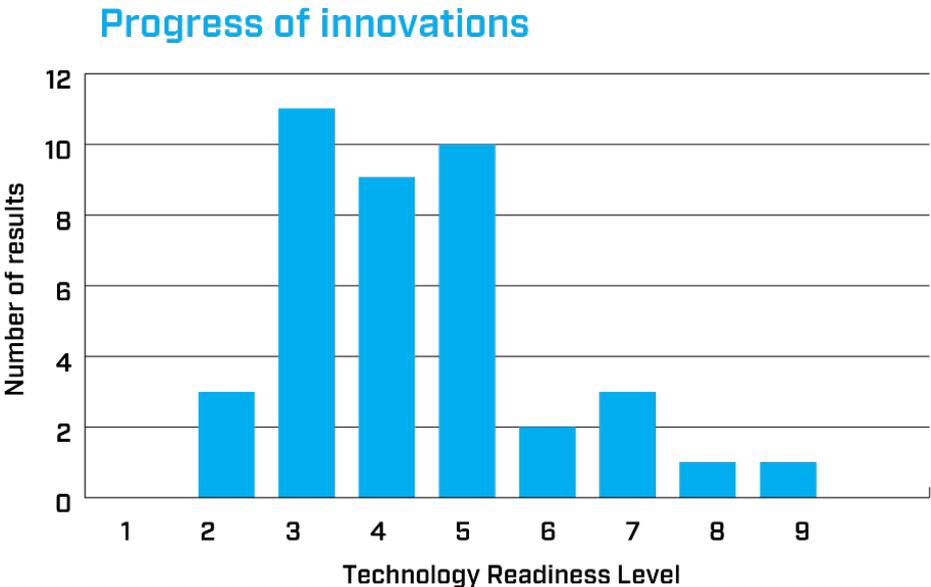
Many groups at NTNU and SINTEF require, and want to contribute to, a school of innovation. We recommend the establishment of an “FME School of Innovation”. If this recommendation is accepted, we propose that SFU Engage be delegated overall responsibility, in close collaboration with the FMEs, and that the initiative be launched in the spring of 2019.

4. Each FME must adopt a methodology for systematic mapping of innovation

A precondition for delivering on innovation is to succeed in determining a robust list of topics that the FME intends to focus on, and to identify potential innovations within these fields that are appropriate to the centre’s goals. The various projects are followed up and evaluated according to their level of maturity. The desired outcome is that as many projects as possible shall continue upwards on the ladder of maturity, while those that fail to do so are discontinued. Such a system could constitute a management and prioritisation tool and can also be used in communication.

The categorisation of projects, results and innovations

The categorisation of projects based on the nature of their anticipated outcomes will most probably work well for many of the FMEs. Such categories include “Product/Service”, “Process/Method” or “New Knowledge”. Projects may also be categorised according to the nature of the value they generate, whether in terms of lower costs, increased profitability, reduced risk, reduced negative impact on the environment, etc. Individual projects can then be inserted into a table or matrix based on the level of maturity of the technology in question. At the NOWITECH FME, innovations were counted and categorised according to their level of maturity. This was also used as an effective and appropriate means for NOWITECH to disseminate information linked to the innovations it produced. The figure below illustrates the categorisation of the innovations developed by NOWITECH.



NOWITECH recorded innovations on a continuous basis, and updated their levels of maturity annually. The graph is taken from the final report.

For some FMEs, it may be useful to implement a system that assesses innovation maturity in a similar way to that applied by NOWITECH. The parameter Technology Readiness Level (TRL) may provide a relevant indicator. Using a project assessment approach of this type, researchers are encouraged to think about their work in a way they seldom do, and this in itself may be a valuable exercise.

After categorising projects according to type, combined with an assessment of the technology's level of maturity, we obtain an effective platform and a tool that can be applied to actively stimulate further development and innovation, and to monitor progress from an innovation perspective. An approach to assessment as described above will also constitute an effective platform for the highlighting, counting and reporting of innovative research and results to all stakeholders. In particular, this type of tool will become an effective means of communicating innovations and results to the FME's industry partners. By developing such methodologies in collaboration with the FME's industry partners, each centre will be able to adopt tools and approaches that work most effectively for them. Tools of this type are commonly better known among industry than among researchers, and collaborative efforts to develop such methodologies have the potential to be of great benefit.

Recommended actions

- Start development of the recommended approach to innovation assessment (Responsible: The FME Innovation Management Forum)
- Establish and maintain a list of innovations and potential innovations (Responsible: the Innovation Manager at each FME)

The FME Innovation Task Force's mandate regarding this topic involved proposing a specific approach to measuring innovation. However, we have opted not to propose a specific method, but rather to point out that the Innovation Management Forum would be best suited for this task. We have two reasons for this. Firstly, all FMEs that wish to apply the tool should be given the opportunity to contribute towards its development. However, only two of the FMEs were directly represented on the Task Force. Secondly, many of the FMEs have already developed and implemented their own methods and tools, and a joint understanding or approach should be viewed with this in mind. We believe that this can best be achieved in a joint forum in which all SINTEF and NTNU FMEs are represented.

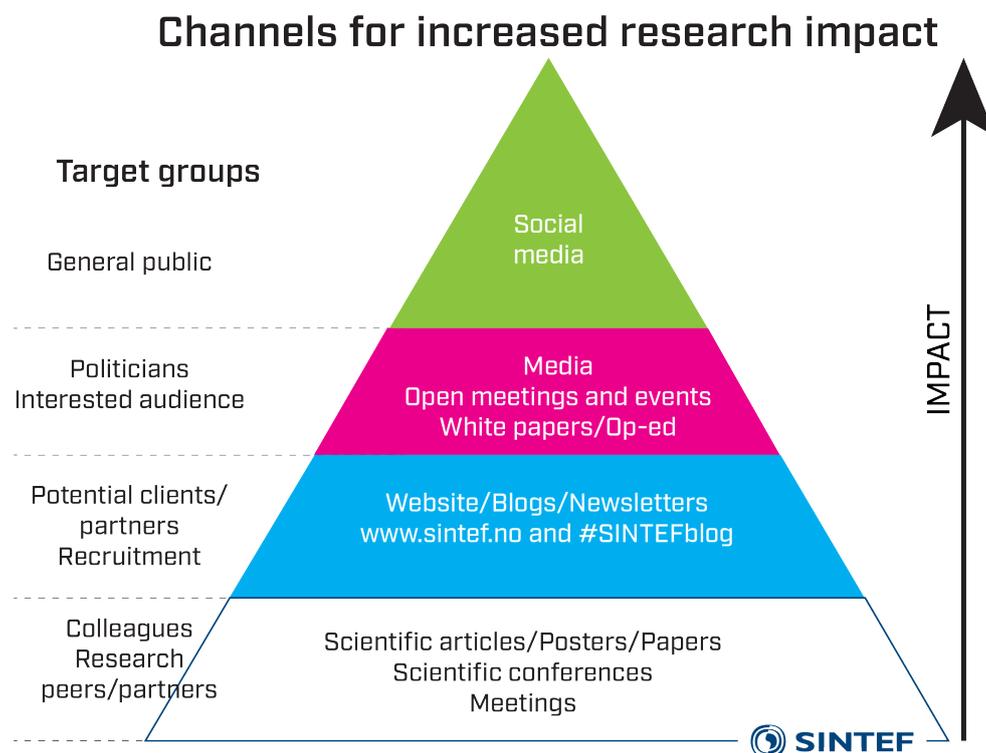
5. FMEs should show off the impact of their innovations

The FMEs represent an initiative launched following the Norwegian cross-party Climate Change Policy Consensus. The FMEs are expected to communicate the impact of the work carried out at the centres, both to society as a whole and politicians in particular. This is important as a means of legitimising political decisions to invest public funds in environmentally-friendly energy research.

The FMEs should communicate the following:

- the significance of the results and technological innovations produced by research carried out at the FMEs.
- the value that this research offers – to society as a whole (socioeconomics/continuity of supply), to the industry partners (business economics) and to climate change mitigation (emissions reductions/environmental impact).

By disseminating information about innovations produced at the FMEs, we demonstrate the impact of our research on society as a whole, and at the same time *boost* this impact because communication helps to promote the wider application of the technologies in question. In order to be applied, new knowledge must be disseminated and understood. For this reason the FMEs have a responsibility to communicate information far beyond the participants at the centres.



The diagram illustrates how project results, such as innovations, can be disseminated using a variety of channels, linked to affiliated target groups. The more wide-ranging our communication, the more likely it is that a project or innovation will first achieve, and thereby boost, its impact.

Dissemination is a management responsibility, and in order to succeed, all FME management teams should adopt a communications plan and strategy. Dissemination should be conducted on the target group's terms, using appropriate channels. This means that appropriate material should be prepared for target groups outside the FMEs. For example, it may be possible to use the results of systematic innovation assessments to demonstrate development and (anticipated) value.

In order to become good communicators, FME personnel require training and guidance. Organised communications training is essential. It is also important to ensure that communication is facilitated by meetings organised at different events, such as the annual Arendal Political and Business Forum (*Arendalsuka*), or the participation by FME representatives in public media debates. As well as established fora, the FMEs can create their own arenas in the form of tailored meetings between industry representatives and researchers, technical seminars (at which the aim will be for researchers to inform politicians), and workshops designed to generate broad levels of awareness and raise levels of knowledge.

Recommended actions

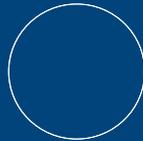
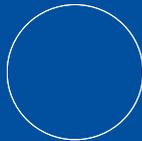
- The FMEs must each prepare a communications strategy and a plan for implementation, draw up a budget and allocate personnel (Responsible: individual FMEs)
- Communications materials must be prepared for internal and external target groups (Responsible: individual FMEs and their host institutions)
- Organise an FME Innovation Conference (Responsible: the FME Innovation Management Forum in collaboration with SINTEF TTO and NTNU TTO)

We recommend that the FMEs, in collaboration with the Research Council of Norway, establish a permanent FME Innovation Conference with the aim of presenting the research results produced by the FMEs and the value of these to society. The FME Innovation Forum, in collaboration with SINTEF TTO and NTNU TTO, shall continue with this work with the aim of arranging the inaugural conference in autumn 2019.

Apply the recommendations in this report

This report was presented to NTNU Energy, SINTEF, the FMEs, and the Research Council of Norway on 28 November 2018, and marks the conclusion of the work carried out by the FME Innovation Task Force. The work has culminated in a total of five recommendations for the FMEs, each with a set of recommended actions. The proposed actions are rooted in the FMEs and research groups at NTNU and SINTEF, and we hope that they will be actively followed up in the wake of the work involved in preparing this report. Our hope is that the actions recommended here, and their implementation, will consolidate the innovation-related work being carried out at the FMEs, and help to provide a boost to all the research groups. The Innovation Task Force wishes everyone success in their innovation work!

 SINTEF



 NTNU