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Invitation to KME-programme board meeting no 1/18

To:	Erik Skog (chairperson)	Erik Skog AB
	Sebastian Kaiser	Andritz
	Christoph Gruber	Andritz
	Thomas Norman	Babcock & Wilcox Vølund
	Lars Mikkelsen	Babcock & Wilcox Vølund
	Søren Aakjær Jensen	Ørsted (Dong Energy)
	Anna Jonasson	E.ON Energilösningar
	Eva-Katrin Lindman	Stockholm Exergi (fd Fortum värme)
	Erik Dahlgren	Stockholm Exergi (fd Fortum värme)
	Jukka Meskanen	Fortum
	Edgardo Coda	Sumitomo SHI FW
	Vesna Barišić	Sumitomo SHI FW
	Andreas Borg	GKN Aerospace
	Matti Huhtakangas	MH Engineering
	Bo Jönsson	Kanthal Sandvik
	Dilip Chandrasekaran	Kanthal Sandvik
	Jesper Ederth	Sandvik Materials Technology
	Marie-Aude Porter	Siemens IT
	Pamela Henderson	Vattenfall

New stakeholders:

Hanna Kinnunen	Valmet
Thomas Höjer	Calderys
Conny Nilsson	Calderys
Owe Mårs	Höganäs
Sven Bengtsson	Höganäs

Adj members

Annika Stålenheim	Vattenfall
Johan Moverare	Linköpings universitet
Rikard Norling	Swerea KIMAB
Oliver Rod	Swerea KIMAB
Jan-Erik Svensson	Chalmers
Bertil Wahlund (secr)	Energiforsk

Date and time: March 2, 13.00-15.00 (Swedish time).

Place: Telephone, +46 8-677 25 60, code 19096#

Please e-mail to bertil.wahlund@energiforsk.se if you are prevented from attending the meeting.

Agenda proposal board meeting no 1/18

Annex

1 Agenda

2 Elections of person to approve minutes

3 Minutes from board meeting 4/17

Also on web site.

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4 Notifications

4.1 Coming dissertations

4.2 Coming conferences

5 Budget

Report on budget follow up of funds used, requested cash and reported in-kind. The final economic reporting is soon due, and the companies should go through the respective commitments.

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6 Follow up of projects

Final project reports will be evaluated and approved in coming meetings.

7 Next KME programme 2018-2021

Report from KME future group meeting:

The KME future group concluded that the KME consortium should to be maintained, and the industry is recommended to form a KME consortium for the coming period.

The KME Consortium is as an important forum for networking and collaboration that includes well-established routines for IPR, information exchange, results dissemination (incl the KME/HTC conference). The network of companies and researchers is a key factor for creation of relevant research projects. KME/Energiforsk will besides provide for dialogue and give input to SEA regarding industry relevant research

The industry participates as in previous periods, with cash for running the consortium and with in-kind in projects, via a consortium agreement and specific project agreements.

Due to new prerequisites and information, the strategy and way forward for submission of projects in the SEA call for proposals *Biopower* should be altered. Large consortium application is no longer judged as the best strategy. Instead, separate KME project applications should be elaborate and submitted in the call.

The respective project leader is responsible to submit the project to SEA and the applications should include:

- a) a common KME texts showing that the resp. project is a part of KME.
- b) a budget for KME/Energiforsk to coordinate and manage the programme including the industry cash to be matched by the SEA.

Projects approved by the SEA, and other financing bodies later on, will be coordinated by KME and make up the KME-project portfolio.

7.1 Project proposals to programme

Discussion on KME projects under development. Status.

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- 8 Programme conference HTC/KME 2018** 4
The 2018 conference will be held in Stockholm, March 20-21, at
Spårvagnshallarna. (later)
- 9 Others**
- 10 Next meetings**
Suggested meeting agenda for 2018 to be decided:
- April 5, 9.30-11.30, telephone, KME meeting to conclude the current period, first round to revise and approve final project reports
 - April/May/June, physical meeting, Stockholm, start-up meeting of new period (tentatively be held same day as HTC board)
 - KME/HTC programme conference, March 20-21, 2018, Stockholm

Stockholm as above
Bertil Wahlund

Consortium Materials technology for thermal energy processes – minutes board meeting no 4/17

Date	November 28, meeting time 13.00-15.00	
Place	Chalmers, Gothenburg	
Participants	Erik Skog (chair) Anna Jonasson Dilip Chandrasekaran Bo Jönsson Marie-Aude Porter Erik Dahlén Vesna Barišić Lars Mikkelsen Søren Aakjær Jensen Matti Huhtakangas Annika Stålenheim Sonja Enestam Hanna Kinnunen Mikko Uusitalo Rikard Norling Oliver Rod Pamela Henderson Jan-Erik Svensson Jesper Liske Bertil Wahlund (secre.)	Erik Skog AB E.ON Värme Sverige Kanthal/Sandvik Heating Technology Kanthal/Sandvik Heating Technology Siemens Fortum värme Sumitomo SHI FW (SFW) B&W Vølund Ørsted (Dong Energy) MH Engineering Vattenfall (telephone) Valmet (new stakeholder) Valmet (new stakeholder, telephone) Valmet (new stakeholder, telephone) Swerea KIMAB Swerea KIMAB (co-opted) Vattenfall (telephone) Chalmers Chalmers (co-opted) Energiforsk
Prevented	Eva-Katrin Lindman Jukka Meskanen Thomas Norman Jesper Ederth Andreas Borg Christoph Gruber Sebastian Kaiser Johan Moverare Edgardo Coda Thomas Hojer Conny Nilsson	Fortum värme Fortum B&W Vølund Sandvik Materials Technology GKN Aerospace Andritz Andritz Linköpings universitet Sumitomo FW Calderys (new stakeholder) Calderys (new stakeholder)

Distribution	participants, prevented and	
	Sven Andersson	B&W Vølund/Götaverken
	Per Kallner	Vattenfall
	Andreas Sundlöf	Söderenergi
	Erik Westman	Söderenergi
	Heike Martinsson	Söderenergi
	Henrik Lindståhl	Tekniska verken i Linköping AB
	Mikael Fransson	Tekniska verken i Linköping AB
	Ulf Hagman	Göteborg Energi AB
	Erika Antonsson	Göteborg Energi AB
	Toni Holkko	Gävle Energi
	Lucas Enström	Gävle Energi
	Ulf Lindqvist	Jämtkraft AB
	Dag Wiklund	Jämtkraft AB
	Jesper Baaring	Öresundskraft
	Johan Thelander	Karlstads Energi AB
	Magnus Eriksson	Mälarenergi AB
	Per Tunberg	Mälarenergi AB
	Patrik Schneider	Kraftringen
	Jasmin Aspen	Kraftringen
	Lars Hammar	Kraftringen
	Erik Thornström	Swedenergy

1 **Agenda**

The distributed agenda was approved.

2 **Person to approve minutes**

VB, SFW, was elected to approve minutes (next present person/company on participants list).

3 **Minutes from board meeting 3/17**

The minutes from board meeting 3/17 was approved without comments.

- A reminder, the report *High temperature corrosion in used-wood fired boilers*, KME-708, can be downloaded from KME member pages, where the coming reports will be published

4 **Notifications**

4.1 **Coming dissertations**

Upcoming dissertations

Nooshin Mortazavi, Title of PhD thesis: *Novel Insights into the Oxidation of High Temperature Alloys - The Role of Environment, Microstructure and Reactive Elements*, December 21, Chalmers.

Recently defended dissertations

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4.2 Coming conferences and workshops

KME/HTC programme conference 2018, March 20-21, Stockholm

Boiler days (Panndagarna, Värme- och Kraftföreningen), April 17-18, Örebro

The 27th International Conference on the Impact of Fuel Quality on Power Production and the Environment, September 24–28th, 2018, Lake Louise, Canada. <http://blogs2.abo.fi/fuelqualityimpact/>

5 Budget

BW showed the updated budget follow. Follow up is made of funds used, requested cash and reported in-kind. The reporting follows the plan in most cases and two projects reports in-kind contribution over 100 %. Updated budet in annex 1.

In the following projects deviations from plans are identified:

- KME-707, *Improved Steam Turbine Design for Optimum Efficiency and Reduced Cost of Owership* is nearly finalised and will not use all SEA funds, and the outstanding balance will be re-disbursed to SEA.
- KME-703, *Durable MCrAlX Coatings for demanding applications in gasturbines*, low industry in-kind contribution. New report of in-kind contribution from Siemens, shows that the project is on track.
- KME-717, *Boiler corrosion at lower temperatures – influence of lead, zink and chlorides*, low industry in-kind contribution. Project leader RN check the status at the industries.
- KME-720, *The effect of increased fractions of waste wood on water wall- and superheater corrosion*, low industry in-kind contribution, se item 6 below for discussion.

A reminder about the reporting dates for industry in-kind:

- March 31 the following year for the period July-December
- September 30 for the period January-June.

6 Follow up of project

Several of the project status reports are delayed. Within short the reports will be published at the KME web pages.

Project KME-720 has encountered new problems with the water wall probe. During installation of the probe, there was a leakage of glowing sand. The installation was thus stopped, due to risk and safety reasons, and project will not be able to make water wall tests. This will give implications of project and some of the goals will not be fulfilled, and the industry in-kind contribution will be lower than agreed. It is important that costs at Chalmers are adjusted accordingly. The situation including a revised plan and goals should be presented in the status report.

7 Next KME programme 2018-2021

BW updated the status of the planning for the new programme.

As informed at previous meetings, there are two parallel processes, one for respective Energy Agency programme from which KME will apply research grants with consortium applications; *Steam based processes*, from now called *Biopower*, and *Turbines for future technologies*.

Turbines for future technologies

The programme *Turbines for future technologies* is already ongoing and KME continues to discuss with SEA on how and when materials technology research could be included in the programme. For the ongoing PhD students in the programme, separate applications for funding of the transitional period will have to be submitted to SEA during January. The applications should describe new goals and research questions and plan for one year's extension.

New projects will not be possible until approximately one year from now; SEA plan to open the next call during autumn 2018. BW/KME continue the dialogue with primarily GKN and Siemens, and the researchers, and SEA on the way forward.

Biopower – thermal conversion of biofuel to power and heat (previously called Steam based process)

The programme is now formally decided at Swedish Energy Agency (EUN, Energiutvecklingsnämnd). 87 MSEK state matching funds over the years 2017-2021 is allocated to the programme (state matching funds in current KME projects amount to approx. 25 MSEK). The topics in the programme seems in line with what KME would like to achieve: fuel flexibility, operating flexibility for biofuel and waste. First call is said to be opened within short.

A press release was published regarding the biopower programme:

<http://www.energimyndigheten.se/nyhetsarkiv/2017/ny-satstning-pa-biokraft-med-fokus-pa-framtidens-hallbara-energisystem/>.

SEA has informed that the call will most probably be open to all project areas directed towards the programme goals. The amount in the call is not known. BW distribute information about the call as soon it is published.

Due to the one month delayed decision at SEA, the KME time plan is updated accordingly (prelaminar, can be further changed):

- 16 November, EUN (Energiutvecklingsnämnd, at the at Swedish Energy Agency) decided the Biopower programme.
- Week 49 or 50, the call opens:
<http://www.energimyndigheten.se/utlysningar/>
- 15 February 2018, final project descriptions sent to KME, for compilation to a "consortium application", a project package.
- 15 March 2018, Consortium application submitted to the Swedish Energy Agency. Call closes.
- 1 July 2018, project start of approved projects.

7.1 Project proposals to programme

Six new initiatives submitted. One more initiative is discussed by Valmet and Ørsted, potential project leader Chalmers/HTC.

7.1.1 Increased fuel flexibility and performance for boilers with challenging fuels

Proposal from Swerea KIMAB as project leader and Mälarenergi, Valmet, EON, Vattenfall, Fortum, Sandvik/Kanthal, MH Engineering, Calderys as project partners.

RH presented the project.

Comments:

- Are goals of the project reflecting on a possibility to predict the status of refractory, and is it relevant to investigate what are the reasons behind poor performance of certain refractories, is it related to manufacturing procedures, or something else?
- Task 1 formulated very general, should be more precise.
- Task 4, should connect to previous projects, so it is clear that the project starts from what is known today.
- Project plan should describe as much as possible, including planned tests
- Falun interested in the project and has joined the discussion.
- There are two new projects dealing with water walls corrosion and it is important to formulate these projects differently and that different aspects will be investigated in the respective projects. The projects should be written so they complement each other. Project leaders shall safeguard this.

7.1.2 Materials development towards Loop seal and water wall corrosion

Proposal from Chalmers/HTC as project leader and EON, Krafrtingen, Sumitomo FW, Sandvik/Kanthal, Sandvik MT, MH Engineering, Vattenfall, Fortum as project partners.

JL presented the project.

Comments:

- Despite the problems with water wall tests in the current project KME-720, it will still be possible to proceed with water wall tests in this new project.
- Vattenfall interest alkali chloride on line monitoring of flue phase. The project could use the equipment installed in Krafrtingen. (Vattenfall will not perform material testing)
- Important to build on and relate to what has been done before. References is needed.
- Increased steam temperature in sand seal SH is relevant for SEA in such way that it leads to increased efficiency. As a research question, it may also be relevant and what it means for the materials and corrosion and what it could bring about in the future when high electrical efficiency could be more relevant (focus not only on current problems, it is also looking into future).
- A potential result of increased temperature in the loop seal SH could be that the SH can be used more than the conventional SH in future, steam temp therefore relevant in that perspective too.
- The phenomena cavitation should be considered (right terminology is important).
- There are two new projects dealing with water walls corrosion and it is important to formulate these projects differently and that different aspects will be investigated in the respective projects. The projects should be written so they complement each other. Project leaders shall safeguard this.

7.1.3 Thick-walled austenitic stainless steel for the future header and piping material in high-efficient biomass-fired power plants

Proposal from LiU as project leader with Sandvik MT as project partner. The project is a continuation and extension of KME-701.

Comments:

- It should be motivated clearly why Sanicro 25 is relevant for a specific project focusing mainly only this material. It should be described why this project and its topic is interesting and relevant, including the relevance for an energy utility.
- The applications of materials and components considered should be further described (components, high steam data, conventional biofuel boilers or supercritical, etc). It was uncertain if austenitic stainless steels would be relevant for headers.
- Must be clarified that other materials than Sanicro 25 will be investigated and that Sanicro 25 will be compared with commercially available reference materials (P91, P92) to check if it is a new candidate for high steam data (critical and ultra-supercritical boilers).
- Super critical and ultra-supercritical biofuel boilers relevant for boiler manufactures, but relevance for Swedish utilities is more uncertain.
- The project should consider stress relaxation and would it be possible to study and suggest inspection methods.
- After the project was sent to KME, Sumitmo has joined the project.
- This project deals with austenitic steels while another project deals with martensitic/ferritic steels. It must be clarified in under what condition and in what application the respective material has advantages compared to the other. Writing must be coherent and that the projects complement each other. Project leaders shall safeguard this.

7.1.4 Design of a new generation of 12 % chromium steels

Proposal from Chalmers as project leader with Siemens as project partner. The project is a continuation of KME-710.

Comments:

- It is written in results implementation that knowledge can be applied different applications; an explanation on how it can be applied would be good and how to translate the results to other applications.
- Clarify the global potential for power generation if it would be possible to improve the 12 % Cr steels and make them commercial.
- The steel offer thermal properties suitable for flexible operation, but it should also be matched with mechanical properties.
- This project deals with martensitic/ferritic steels while another project deals with austenitic steels. It must be clarified under what condition and in what application the respective material has advantages compared to the other. Writing must be coherent and that the projects complement each other. Project leaders shall safeguard this.

7.1.5 Protective coatings for boilers

Proposal from Chalmers and Högskolan Väst.

Comments:

- No references in draft. Similar projects conducted within Energiforsk programme SEBRA; references needed.
- Similar project, funded via KK, directed towards applications and boilers with less complicated fuel is ongoing with Sandvik/Kanthal, MH Engineering as partners. Clarify what new in this project.
- HVOF is the next generation of coating technology. Interesting topic.
- MH Engineering is interested to participate in project. Sandvik/Kanthal and Ørsted (Dong) could also be potentially interested.
- Höganäs has after the submission of draft proposal shown a great interest in project as well as participate in KME

Decision:

- The potentially new stakeholders Höganäs shall be invited to next KME board meeting (to the part of meeting dealing with the new programme period and project discussions).

7.1.6 Flexible and renewable mid- and large-size powerplants with district heating capacity

Proposal from Lund and KTH.

Comments:

- Interesting topic as such. However, there are many initiatives in the area that needs to be considered. For example, there is a whole programme dealing with flexibility in Finland.
- The project could be relevant as an "umbrella" project similar to project KME-601 *Reference power plant* with the aim higher electrical efficiency conducted in last programme period, but instead with flexibility as subject. But then it must work as a glue to combine the projects.
- Project at a very early stage so difficult to judge, project need to be further elaborated.

8 Programme conference HTC/KME

The 2018 conference will be held **March 20-21, 2018**, at Spårvagnshallarna, Stockholm.

9 Others

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10 Next meetings

2017 meeting

- It was decided that there was no need for an extra board meeting during 2017. Instead, as soon as the call is published, BW invites the project leaders to a workshop with the purpose to analyse the call text, and discuss how the projects could best be formulated. Interested board members are welcome to join.

2018 meetings – the dates for meetings will be planned according to the dates in call. Tentative plan, doodle poll will be distributed to set the dates:

- Telephone meeting in end of February or beginning of March, mainly to discuss the consortium application
- Physical meeting in April/May, Stockholm

2018 conference

- KME/HTC programme conference 2018, March 20-21, Stockholm

Minutes by

Bertil Wahlund

Minutes approval

Vesna Barišić, SFW

Minutes approval

Erik Skog, chairperson

Projects

Budget follow up, total costs

Programme budget [kSEK]	Programme and project financing				Funds used, kSEK					
	Total	SEA	%	Industrv	Cash SEA, req		Industry total			
					kSEK	%	In-kinds	cash	%	
For projects	115 000	46 000	40,0%	69 000						
Programme management	8 950	3 800	42,5%	5 150						
Sum:	123 950	49 800	40,2%	74 150						
Decided projects										
KME-701 (39297-1)	7 180	2 872	40,0%	4 308	2224	77%	4124		96%	
KME-702 (39279-1)	14 435	5 735	39,7%	8 700	5162	90%	8791		101%	
KME-703 (39296-1)	5 447	2 167	39,8%	3 280	2167	100%	3280		100%	
KME-705 (39298-1)	1 000	400	40,0%	600	351	88%	593		99%	
KME-706 (39283-1)	12 500	5 000	40,0%	7 500	2873	57%	5828		78%	
KME-707 (39281-1)	7 238	2 895	40,0%	4 343	2436	84%	3692		85%	
KME-708 (39270-1)	7 383	2 963	40,1%	4 420	2963	100%	4849	15	110%	
KME-709 (39287-1)	10 612	4 245	40,0%	6 367	3643	86%	5950	23	94%	
KME-710 (39286-1)	2 000	800	40,0%	1 200	700	88%	1137		95%	
KME-711 (39299-1)	12 460	4 984	40,0%	7 476	3833	77%	5913	627	87%	
KME-713 (40038-1)	2 400	960	40,0%	1 440	828	86%	189		13%	
KME-714 (40118-1)	7 590	3 036	40,0%	4 554	1932	64%	3570	76	80%	
KME-715 (40040-1)	2 361	944	40,0%	1 417	518	55%	1389		98%	
KME-717 (40892-1)	4 491	1 796	40,0%	2 695	590	33%	1383		51%	
KME-718 (41515-1)	2 633	1 053	40,0%	1 580	261	25%	1158		73%	
KME-719 (40893-1)	9 102	3 500	38,5%	5 602	2451	70%	3800		68%	
KME-720 (41048-1)	5 205	2 082	40,0%	3 123	658	32%	933		30%	
Programme management, tot	8 950	3 800	42,5%	5 150	3686	97%	3649		71%	
Tot. for projects:	114 037	45 433	39,8%	68 605	33589	74%	56579	741	84%	
Remaining budget:	963	567	58,9%	396	3 686		3649			
Share decided, %	99,2%	98,8%		99,4%						
Share remaining budget, %	0,8%	1,2%		0,6%						

Kraft och värme
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Date 2018-02-26

Project initiatives within KME programme 2018-2021

A summary of up to now started project initiatives, in a first batch of projects within KME 2018-2021, with focus steam based processes. The research questions in the initiatives will be updated when the final project descriptions are elaborated. Matching state funds will be applied from the Swedish Energy Agency, both for the research activities and for programme management. The project portfolio will be complemented and further developed during the programme period. If you would like to participate in a specific project, contact Bertil Wahlund.

New gas turbine projects are due later during autumn 2018. However, four applications for extensions of ongoing KME-projects have been submitted to the Swedish Energy Agency.

Projects with focus on Steam based processes

Increased fuel flexibility and performance for boilers with challenging fuels

Research questions summary:

- Increased fraction of recycled wood as fuel, leads to increased corrosion due to Pb and their chlorides
- Threshold values for Pb, is the corrosion increased with increased Pb content in fuel. Temperature limits.
- Performance of cooled metallic parts (SH and furnace wall). Measures for reduce corrosion – material selection, low alloy vs high alloy Ni base material
- Performance of uncooled parts such as vortex finder, support of SH, tube shield
- Refractory lining behaviour, corrosion behind in studs and tubes, effects of flue gas composition, how improve possibilities for cyclic operation, methods for inspections
- Field tests planned at Mälarenergi/Block 6, EON/Händelö boiler 14

Project participants

- Swerea KIMAB as project leader
- Mälarenergi, Valmet, E.ON, Vattenfall, Stockholm Exergi, Falun Energi och Vatten, Sandvik/Kanthal, MH Engineering, Calderys as project partners.

Materials development towards loop seal and water wall corrosion

Research questions summary:

- High material loss in loop seal superheaters. Understanding of environment and phenomena to find measures.
- Relation waterwall corrosion and recycled wood fraction, means to combat corrosion
- Field tests planned at Krafringen/Örtofta, EON/Händelö boiler 15

Project participants:

- Chalmers/HTC as project leader
- E.ON, Krafringen, Sumitomo Foster Wheeler, Sandvik/Kanthal, Sandvik MT, MH Engineering Vattenfall, Stockholm Exergi as project partners.

High performance coatings to combat erosion-driven damage in power plants

Research questions summary:

- The aim is to develop cost-effective protective coatings with improved performance and reliability coatings
- Various advanced coating materials will be investigated
- Different coating microstructures (HVOF, HVOF, laser cladded, etc) and multi-layered and composites influence on coating behaviour will be investigated.

Project participants

- Chalmers and Högskolan Väst as project leaders
- Höganäs, Ørsted (Dong) and MH Engineering as project partners. Mälarenergi is a potential partner; discussions are ongoing. Sandvik/Kanthal is another potential partner.

Thick-walled austenitic stainless steel for the future header and piping material in high-efficient biomass-fired power plants

Research questions summary:

- Investigation of material properties for thick-walled components, such as headers and piping, in biomass-fired power plants with higher efficiency and with cyclic operation.
- Evaluate a new candidate material compared to currently used material using FE-models of the applications.
- Mechanical properties and behaviours such as creep, fatigue crack propagation, thermo-mechanical fatigue and toughness for different materials (casted, extruded, hiped and welded).
- Welding issues, such as the effect of long-term service on toughness of welded material.
- The project is a continuation and extension of KME-701.

Project participants

- Linköping university as project leader.
- Sandvik MT and Sumitomo Foster Wheeler as project partner.

Design of a new generation of 12 % chromium steels for steam turbines and other energy applications

Research questions summary:

- Design of a new test 12 % chromium steel with fine-tuned chemical composition, aiming for a combination of optimized properties, for boiler components and steam turbine blades
- Mechanical and creep testing
- Testing of microstructural evolution
- Optimisation of heat treatment
- Manufacture, test and install turbine blades in a test steam turbine
- The project is a continuation and extension of KME-710.

Project participants

- Chalmers as project leader
- Siemens as project partner.

Flexible and renewable mid- and large-size power plants with district heating capacity

Research questions summary:

- System aspects of cogeneration plant
- Flexible operation, limits and possibilities.

Project participants

- Lund university and KTH as project leaders. In

Materials handbook, tool to calculate the total cost for fuels

Compilation of knowledge about materials for CHP plants with the aim to understand total cost for a specific fuel. The proposal is not yet developed, but several stakeholders are interested. The ambition is to elaborate the project during the programme period. The initiative is broad, including not only KME.

Projects with focus on Gas turbines, extensions submitted to SEA

LCF and TMF crack growth in cast nickel-based superalloys, KME-702

Project participants: Linköping university as project leader and Siemens as project partner.

Durable MCrAlX Coatings for demanding applications in gasturbines, KME-703

Project participants: Linköping university as project leader and Siemens as project partner.

Weldability of nickel-base superalloys for energy applications, KME-706

Project participants: Chalmers as project leader and GKN as project partner.

Development of weldability assessment and understanding of hot cracking in boiler and gas turbine materials, KME-719

Project participants: Chalmers as project leader and GKN as project partner. Sumitomo SHI and Ørsted participate without financial commitment.