EVALUATION OF ESTONIAN RESEARCH – ENGINEERING SCIENCES

Report to the Estonian Science Fund Council

quality – 1–5
scientific potential 1–3
relevance – 1–3

IVA
INGENJÖRSVETENSKAPSAKADEMIEN
ROYAL SWEDISH ACADEMY OF ENGINEERING SCIENCES

Teknikvetenskapliga ForskningsRådet
Swedish Research Council for Engineering Sciences

EVALUATION OF ESTONIAN RESEARCH
- ENGINEERING SCIENCES

Report to the Estonian Science Fund Council

The Royal Swedish Academy of Engineering Sciences (IVA) and the Research Council for Engineering Sciences (TFR) have together undertaken the task to evaluate Estonian scientific projects within the area of engineering sciences. Out of a total of 400 projects 64 were classified as engineering science when dividing the task between the various academies and research councils.

The Council for Engineering Sciences has distributed the project descriptions, as received from Estonia, to altogether 38 scientists. TFR has used a standard form for evaluation where the scientists have made their rating as to scientific quality (grades 1-5) and scientific potential and relevance respectively (grades 1-3). In addition the evaluator has been asked to give a short written judgement and recommendations as to further work. For the outline of the form, see Apendix 1.

Some evaluations are written after visits to Estonia. However, most projects have been evaluated based on the material received. Appendix 2 contains the written judgements and recommendations for the projects. A few projects (3) have not been evaluated due to insufficient information according to the evaluator.

General comments

The judgements and comments received from the evaluating scientists are widely ranged. Some projects have been characterized as excellent whereas others have been felt to be further away from the front line. A general comment has been that the outline of the project descriptions, research plans etc have varied. Maybe they should follow certain standard descriptions to make sure all relevant information is there.

Quite a few Estonian groups of international level have been pointed out. For them, the evaluators

have often proposed contacts in Sweden, both with industry and university groups, as well as strategic alterations. The suggested contacts should be followed up if they have not yet been taken.

Language barriers

There is a profound understanding in Sweden for not having been able to publish in non-Russian journals. However, this has diminished the usefulness of some researchers in Sweden as evaluators. A few have knowledge of Russian. They have commented though, that to evaluate a scientific paper which is written in and for another environment creates certain problems of understanding. Such an evaluation must be done in a very skilful way to remain stringent. In quite a few cases the Swedish scientists have been forced to abstain from evaluating such a paper. In some cases they have also commented that they have tried to find complementing papers in the literature or through scientific contacts, most often without positive results.

Equipment

The issue of lack of adequate equipment has been raised by several of the evaluators. Many Estonian groups work with obsolete equipment for obvious reasons. This applies to more expensive equipment to be used by more than one group as well as smaller instruments and PCs. For available instruments and computers there is often a lack of spare parts as well as printing paper and e g specialty chemicals.

Judgements and evalutations

The Swedish scientists have rated the projects as to scientific quality, relevance and potential. The average of all projects were 2.8 (out of 5) for quality, 2.1 (out of 3) for relevance and 2.3 (out of 3) for potential.

The motive for a slightly higher rating for potential than relevance may be due to the fact that research is being done in areas of vital importance for Estonia - like environmental technology - but that the scientific quality varies.

Recommendations and action

Many evaluations are concluded by some recommendations. As to contacts with groups in Sweden, IVA and TFR are most willing to help facilitate them.

There are some general elements in a strategy to improve conditions for Estonian research after an evaluation is done and priorities have been made. The availability of scientific journals, exchange of scientists (above and below PhD level), equipment, computers and scientific networks should be addressed. These issues should be discussed with the responsible bodies in Estonia as a follow up of the scientific evaluation of projects and groups.

Contact persons:

Research Council for Engineering Sciences:
Ove Forsberg

Royal Swedish Academy of Engineering Sciences:
Britt Marie Bertilsson

TFR - Utvärdering av estnisk forskning

Beredningsblankett **92-01-15**

Projekttitel:

KVA:s nr *Område (prel):* ***TFR:***

GRANSKARENS UTLÅTANDE

	Please mark "X" for one alternative			Notations
Scientific quality	**Excellent**		(5)	
			(4)	
			(3)	
			(2)	
	Poor		(1)	

	Please mark "X" for one alternative			Notations
Scientific relevance	**High**		(3)	
			(2)	
	Low		(1)	

	Please mark "X" for one alternative			Notations
Scientific potential	**High**		(3)	
			(2)	
	Low		(1)	

Conclusion and recommendation (max 19 lines, 64 chr/line)

Evaluation of Estonian Research
Engineering Sciences

Reports and recommendations based on evaluation of papers from research groups in Estonia.

Altogether 64 projects were received within the area "Engineering Sciences". Evaluations have been made by 38 Swedish scientists. Three projects were not evaluated due to lack of expertise.

The evaluation papers are numbered according to the listing made by the Royal Swedish Academy of Sciences. The project titles correspond to the original project descriptions.

Stockholm
May 1992

74(99)

Systems Modelling and Control; Research Activities 1980 -- 1990
The Royal Swedish Academy of Sciences project number: 1
Scientific area: Control Engineering

Tallinn Technical University, Department of Control Engineering and Control Engineering Laboratory

Conclusion and recommendations

The group is of reasonable size. The number of persons have ranged from 65 to 75 over the period covered by the evaluation. The range of topics investigated by the group is quite wide from continuous process control to rheological measurement equipment. At least, seven diverse project have been mentioned in the material. The scentific output of the group is not impressive considering the number of researchers. The two goals of the group; to serve local industry and to produce high-quality research are strongly conflicting. In order to achieve scentific exellence it is necessary to focus on a much more narrow area.

quality – 3
prot. – 1
rilvance – 2

CAD/CAM Systems, Process Factory Automation
The Royal Swedish Academy of Sciences project number: 2
Scientific area: Engineering Design

Tallinn Technical University, Departments of Production Engineering and Machine Design, Engineering Design

Conclusion and recommendations

This group has a good scientific output. To make a correct judgement of their efforts it would be necessary to find out to what extent the results are applied in practice. I have not been able to find this information in the present documentation.

quality – 3
patens. – 2
relevance – 2

28(88)

Lightweight and Spatial Structures
The Royal Swedish Academy of Sciences project number: 3
Scientific area: Engineering Design

Tallinn Technical University, Department of Civil Engineering, Enviromental & Civil Engineering and Engineering Design

Conclusion and recommendations

For my evaluation I have a list of publications of 20 papers from 1985-90. Most papers are published in Tallinn or in conference proceedings. Only one paper is published in a western journal, Bauingenieur. Only 2 out of the 20 papers were included in the received material. I myself had to retrieve the paper in Bauingenieur. In the material there were also 4 older papers from 1974-84.

Of the received material only the paper in Bauingenieur comply with the formal conditions and newsworthness requested for publishing in well known journals. This paper is written by a scientist in Tallin; Rattasepp, in collaboration with professor H Mang, Technical university in Vienna. The work has been carried out at Mang´s department. It is well done and well presented.

The most rapid way of increasing the level of the research in Estonia is probably by sending out people like Rattasepp to places in Western Europe and the USA

qual. - 0
pat. - 0
rel. - 0

56(63)

Mathematical Modelling and Tuning of Internal Combustion Engines
The Royal Swedish Academy of Sciences project number: 4
Scientific area: Mechanics

Tallinn Technical University, Department of Automotive Engineering, Mechanics and Internal combustion engines

Conclusion and recommendations

During the last five years, 12 diploma theses, no doctoral dissertations and no international scientific papers have been produced. Although gas flows, engine tuning and exhaust characteristics are practicaly and environmentally important topics, my impression is that the scientific level and the scientific ambition are rather low. At least the research group has not endeavoured to expose their results in international scientific fora. They are strongly recommended to do so. Their seven Estonian Transactions and Soviet book chapters on the mathematical modelling of combustion engines may be good and thus worth while. For gas flow studies, there exist more modern calculation methods than those with characteristics and finite differences. Are engines with carburators still worth examining? The systems approach taken (as opposed to a separate treatment of each of the components of the engine) is recommendable.

qual. – 2
pot. – 2
relev. – 2

55(62)

Unsteady Flow In Pipes
The Royal Swedish Academy of Sciences project number: 5
Scientific area: Mechanics (Fluid Mechanics)

Tallinn Technical University, Faculty of civil engineering

Conclusion and recommendations

The group seems to be rather well equipped experimentally (2D LDA and 2 channel CTA) and is developing equipment for unsteady flow measurements. The potential for doing experimental work is good. The evaluation of turbulence data follows traditional lines but data may contain interesting information. The group could benefit from contacts with turbulence modellers and should be encouraged to publish internationally.

qual. - 3
poten. - 3
relev. - 3

52(55)

Special Cements and Concrets On the Basis of the High Calcium Fly Ashes

The Royal Swedish Academy of Sciences project number: 6
Scientific area: Building Materials

Tallinn Technical University,Laboratory of Building Materials

Conclusion and recommendations

Relevance: The project is without doubt of vital interest for Estonian economy. For each ton of oil shale mined for energy production almost 0,5 ton is wasted as ash which has a good potential as raw material for basic building materials such as cement, concrete or building blocks. Even an export of these products is possible. Then, however, major quality problems with the ash to be solved. Research on chemical and physical properties of the ash and of the products produced by the ash is therefore needed.

Quality: The laboraty has been working with a large staff (32 people, 12 researchers) for a long time (35 years) on the actual project. The results do not correspond to the efforts. My judgement is that the work is highly empiric; it seems to have a character of "trouble shooting" where the main objectives are to serve the industry. This lack of a more basic scientific approach is no doubt to a great extent a consequence of the lack of modern equipment.

Recommendation: The project has so great economical, technical and scientific potential that it ought to be continued. Contacts and cooperation must be sought with researchers in "western" countries making research on residual materials used as hydraulic binders. Products that are similar to the Estonian ash are investigated also in other countries. Contacts must also be made with research laboratories of cement industries; viz they often has the best knowledge of hydraulic binders and also the best equipment for the actual type of studies. Important Swedish contacts are The Swedish Cement and Concrete Research Institute and Euroc Research AB in Slite.

quality – 2
relev. – 2
relev. – 3

Excimer Laser Technology for High-Temperature Superconducting (HTSC) Microelectronics
The Royal Swedish Academy of Sciences project number: 7
Scientific area: Physics

54(58)

Conclusion and recommendations

From the material presented in the above proposal it is clear that the project leader has put together an excellent team of experienced colleagues with complementary attributes towards a goal - namely 1) establishing good capabilities in the important area of Laser desposition of complex structures, and 2) selecting a challenging area like high-Tc superconducting films for possible eventual applications like spectral sensitive radial sensors, resonators etc. The critical mass of five well-qualified senior scientists with adequate technical support as well as graduate students I would say promises an efficient and productive group. The proposed plans for research with the already demonstrated good results (although not yet published), certainly, are of a good standard from an international perspective.-

I do not personally know any of the scientists mentioned in this group, although they identify our group in Sweden for possible future collaboration. On reading the present proposal I have no doubt that scentific co-operation with this program will be of mutual benefit.

In short, I rate this proposal to be of a rather high standard with a potential to be competitive, productive and versatile. I would favourably consider a student or postdoctoral from this group at Tallinn.

quality – 4
poten. – 3
relev. – 3

Investigation of the Structure and Properties of Materials With Electron Beam Methods

The Royal Swedish Academy of Sciences project number: 8

Scientific areas: Material science, Applied mathematics and Ecology

53(57)

Tallinn Technical University, Laboratory of electron microscopy and x-ray analysis

Conclusion and recommendations

The laboratory for electron and optical microscopy is used in different fields of research at Tallinn Technical University. The early efforts in electronic materials characterization, which are still going on to some extent, have mainly been published in Russian. The people responsible for the laboratory should be proud, however, that the laboratory in the last few years also has been used in fields outside the physics of materials. The most productive projects at present concern biomaterials, such as steam exploded wood cells and micro-particles in fish ears.

These projects are related to bio energy and ecology and therefore of great applied interest. Those projects have also been rather well documented, even in western literature. The laboratory is reasonably well equipped and seems to have expertise in image analysis and sample preparation and should, if properly updated during the next few years, be able to continue to serve as a procuctive local facility for micro-structural analysis. Scientists and technicians involved should be encouraged to visit laboratories in western Europe to pick new techniques and to develop contacts. In conclusion the problems studied are reasonably up to date but not unique. The laboratory has potential to function as a valuable local facility, if given funding for keeping the equipment up to date.

quality – 3
relev. – 2
relev. – 2

Tallinn Technical University, Faculty of mechanical engineering

Conclusion and recommendations

A better understanding of abrasive/erosive mechanisms of wear, and development of materials to resist these is the prime goal for this project. In addition, extensive work is put to the development of new and better equipment for abrasive/erosive applications. Considering the fact that 12 PhD´s are involved such a comprehensive effort within this field in unique.

A strong relevance for this project is justified by the volume of industrial equipment containing wear parts to resist abration/erosion, e.g. in mining, road construction and maintenance, fluidized bed power plants, pumps, turbines etc. The published modeling and estimates of the erosion resistance of materials is of top quality by todays international standards.

However, the physical and micromechanical understanding of abrasion/erosion could be further strengthened from more extensive microscopy and surface analysis. This could be a matter of cooperation with Swedish research groups. Also, corrosion is frequently a strong element in abrasive/erosive application, and incorporating corrosive aspects would also strengthen the project.

Suggested Swedish partners:

Studsvik Energy	(Corrosion/Erosion) Peter Tarkpea, Ulf Engman
Uppsala University	(Abrasion, Particle erosion, Surface coatings, Electron Microscopy Surface analysis), Sture Hogmark, Staffan Jacobson
University of Linköping	(Thermal spraying, Surface residual stresses) Torsten Eriksson
IVF, Göteborg	(Thermal spraying) Lars Österberg

quality – 4
poten. – 3
relev. – 3

Tallinn Technical University, Department of Electric Power Systems and Laboratory of Power Systems Control

Conclusion and recommendations

Project 1 Electric power systems modelling and control 57(72)

A final statement needs access to more issued publications and possibly a direct contact between Swedish and Estonian scientists.

The report gives the impression of a scientifically based extensive work by a qualified staff.

Project 2 Discharges in high voltage insulation

The work seems mainly directed towards testing and product development without scientific approach.

quality - 3
prakt. - 2
teor. - 2

Oil Shale Power Plants Ecological Cleanness Enhancing and Ash Utilizing

The Royal Swedish Academy of Sciences project number: 11
Scientific area: Power Engineering (oil shale)

Tallinn Technical University, Department and Laboratory of Thermal Power Engineering

Conclusion and recommendations

This project is a very short description of the environmental problems connected with fuel gas cleaning and oil shale ash utilization. The summary of the results is given in a form which does not permit any qualified scientific evaluation. The rest of the report gives a summary of the economic resources. Moreover, the scientific staff is presented with its qualifications. A list of publications and a list of papers to be published are also given. Most of these papers are not available in Sweden.

Influence of Mineral Matter of Fuels On Operating Conditions of Steam Generators

The Royal Swedish Academy of Sciences project number: 12

Scientific area: Power Engineering

Tallinn Technical University, Department & Laboratory of Thermal Power Engineering

Conclusion and recommendations

The behavior of mineral matter of fuels in the combustion process is of great interest also in Swedish technology, although the fuels studied in Estonia are of marginal interest in Sweden.

The applications of interest for Swedish technology are related to the use of biomass fuels or peat for gas turbines.

There are probably good opportunities for cooperation with research groups in Sweden, for example at the Departments of Thermal Engineering and Chemical Technology at the Royal institute of Technology and a research group at Studsvik Energy.

Scientific quality: Preliminary assement based on titles of publications.

Scientific relevance High technical relevance, in particular for gas turbines using dirty fuels.

Scientific potential High technical relevance, in particular for gas turbines using dirty fuels.

Elaboration of Technology for Using of Domestic and Cheap Solid Fuels and Renewable Sources of Energy for Heating Purposes (Since 1988)

The Royal Swedish Academy of Sciences project number: 13

Scientific area: Power Engineering

Tallinn Technical University, Department of Thermal Power Engineering

Conclusion and recommendations

There is a lot of experience and know-how in this field to be collected in Sweden.

The low ranking of "Scientific relevance" does not imply that the activity is unimportant from technical and economical points of view. In fact, a nation like Estonia has good reasons to focus on development and research which can give a quick pay-back of money spent, and this area might be one example.

A possible cooperation with the Swedish organization Svebio may be explored.

Scientific quality	Preliminary assessment based on titles. Appears to be primarily review articles, and no original work.
Scientific relevance	Technical and economical relevance may still be high.
Scientific potential	High technical potential for area - but program must be re-focused.

quality – 2
relev. – 1
pot. – 3

Heat Transfer In Technology 60(70)
The Royal Swedish Academy of Sciences project number: 14
Scientific area: Power Engineering

Tallinn Technical University, Department & Laboratory of Thermal Power Engineering

Conclusion and recommendations

The group appears well established in special studies of heat transfer. The interest has been focused on the influence of fouling and deposits on surfaces in high temperature heat exchangers for helium cooled nuclear graphite reactors and in steam generators with ash desposits. These areas belong to a special group of heat transfer problems and are of importance in power systems, especially such based on fuels used in Estonia (not so much for technology and fuels used in Sweden). Contacts recommended with Studsvik Energy for studies of applications in burning of biomass fuels.

Scientific quality	Preliminary assessment based on list of publications and examples attached.
Scientific relevance	High technical relevance in Estonian power technology.
Scientific potential	Potential for further developments and breakthrough appears low.

quality – 4
potent. – 2
relevance – 1

Economy of Electric Energy and Electromagnetic Compatibility In Electric Power Equipment
The Royal Swedish Academy of Sciences project number: 15
Scientific area: Electrical Engineering

Tallinn Technical University, Power Supply Control Laboratory

Identical with project 16, see corresponding evaluation.

quality - 2
patent - 1
utilization - 2

65(99)

Economy of Electric Energy and Electromagnetic Compatibility In Electric Power Equipment (Comp. Proj 15)
The Royal Swedish Academy of Sciences project number: 16
Scientific area: Electrical Engineering

Tallinn Technical University, Power Supply Control Laboratory

Conclusion and recommendations

The report gives the impression of ambitious and innovative design development rather than a university research.

There are fields of high research potential within the project area, e.g. modelling of the magnetic circuit, impact on supply circuit quality, etc. The project ESTER appears interesting, however it is difficult to evaluate due to the limited information given. Research on superconductor power storages is conducted e.g. in Tampere, Finland by prof., Jarl-Ture Eriksson.

The name of the department seems not relevant to the work done.

Note on the scientfic quality:The work seems mainly design oriented.

quality - 2
relev. - 1
utility - 2

66(80)

Computer-Controlled Linear Induction and Magnetohydrodynamic (MHD) Drives for Casting Industry
The Royal Swedish Academy of Sciences project number: 17
Scientific area: Electrical Engineering

Tallinn Technical University, Department of Electrical Drives

Conclusion and recommendations

Based on the available information sent to me, I am not able to evaluate the project.

Semiconductor Power Electronics Devices and Equipment
The Royal Swedish Academy of Sciences project number: 18
Scientific area: Electrical Engineering

Tallinn Technical University, Department of Electronics

Conclusion and recommendations

The work done appears well in level with other international research. For a deeper evaluation and discussion on possible cooperation it is suggested to contact the Solid State Electronics Department of KTH.

Note on the scientfic quality:

A direct contact between Swedish and Estonian scientists necessary before a final opinion can be given.

quality – 3
relev. – 2
relevance – 2

64(81)

Lock-In Instrumentation and Measurement Technology With Applications In Scientific Experiments, Medical Diagnosis and Industrial Test and Diagnostics
The Royal Swedish Academy of Sciences project number: 20
Scientific area: Electrical Engineering

Tallinn Technical University, Department of Electronics and Measurement Systems Laboratory

Conclusion and recommendations

Seven papers in all are submitted for assessing the quality of the research within the area of lock-in instrumentation and measurements. Roughly, these papers deal with analysis and synthesis of lock-in systems (one paper treats a medical application).
The papers are well written and well-organized and the analysis is carefully performed. A strength is that the theoretical parts are complemented by practical implementations. There is beyond doubt that the group has presented essential contributions to the area of PLL. However, I lack a discussion on the state-of-the-art today as well as a discussion and comparison to similar works of other scientists. The reference lists are to limited.

quality – 3
papers – 2
ref. – 2

Experimental Determination of Parameters of the Induction Machines

The Royal Swedish Academy of Sciences project number: 21
Scientific area: Electrical Engineering

Tallinn Technical University, Department of Electrical Drives

Conclusion and recommendations

The research seems related to induction motors operated at power frequency under transient load conditions. Even if there still may be areas of improved modelling the research is probably not of main interest as a basis for future technical development.

International research and development is today mainly focused upon motor characteristics when they are fed by inverters at high switching frequency and operated at high speed.

Note on the scientfic quality: Can not be evaluated.

quality - 0
relev. - 1
usef. - 1

Tallinn Technical University, Department of structural mechanics

Conclusion and recommendations

The fact that 90 diploma theses but no doctoral dissertations have been produced and that only one paper has been published in an international scientific journal may be somewhat characteristic for the scientific activity reported. My conclusions is that Professor Ulo Tärno and his group in Structural Mechanics have developed a solid understanding of how different reinforced concrete shells (and fiberglass models of them) function but that the theoretical and experimental studies are very much of an ad-hoc nature dictated by current practical problems.

Although the international outlook seems to be satisfactory (for instance, Tärno is a member of the editorial board of The International Journal of Space Structures), modern computational methods for shell calculations have had too little influence on the research so far. The experimental skills of the group may be high.

Scentific quality	A much wider exposure to international quality assess ment by publishing in refereed international journals would have helped.
Scientific relevance	Practical relevance may be high.
Scientific potential	Hard to judge.

71 (89)

The Development of the Construction of Universal Amperometric Oxygen Sensors With Flexible Technology of Manufacturing (Beginning 1991)
The Royal Swedish Academy of Sciences project number: 23
Scientific area: Environmental and civil engineering

Tallinn Technical University, Faculty of civil engineering

Conclusion and recommendations

There are a number of interesting applications for this technology in the field of environmental engineering but also for medical and industrial studies. The research has involved several projects following three different directions:

- oxygen sensors for gas media
- sensors for low oxygen concentration (ppb range)
- oxygen microprocessor analyzers

Various oxygen sensors have been developed in cooperation with different users of this measuring technology. Together with "Kareltek", the Technological Park at the Technical University of Lappeenranta in Finland, two automatic oxygen analyzer systems were manufactured.

The competence of the section has potential to be an important component in the research of the Water Quality Laboratory providing a basis for cooperation with other research departments in environmental and sanitary engineering.

Scientific quality Advanced technological development as an important component in water quality research

Scientific relevance See above.

Scientific potential See above.

quality – 4
relev. – 3
relev. – 3

Traffic and Transportation Organization Problems
The Royal Swedish Academy of Sciences project number: 24
Scientific area: Environmental and civil engineering

Tallinn Technical University, Road department and road and traffic laboratory

Conclusion and recommendations

The Road Department and Road Traffic Laboratory at Tallinn Technical University has developed a traffic flow model. A third version is now in operation. It has been used for a number of interesting applications:

- Traffic Management Assignment Model TRAMOD
- Traffic Flow Forecasting Method
- Car Ownership Forecasting Method
- Traffic Speed Limitation Method
- Public Transport Organisation in Industrial Cities
- Study of Pedestrian Density

The research at the department has been directed toward solving urgent practical problems related to traffic regulation and traffic planning primarily in Estonia but also in e.g. Lithuania. Research contacts have essentially been developed with former Soviet republics but also with Finland.

From both scientific and practical point of view this research activity must be looked upon as relevant and with considerable potential. Research contacts with institutions in e.g. Sweden working with similar problems of urban and regional planning would be beneficial for the Estonian research group.

quality - 3
status - 3
value - 3

Investigation of Environmental Engineering Problems Related To the Reduction and Control of Pollution Load To the Baltic Sea, Atmosphere and Surface Waters of Estonia
The Royal Swedish Academy of Sciences project number: 25
Scientific areas: Chemical Engineering, Inorganic Chemistry

Tallinn Technical University, Inorganic Technology Laboratory
Evaluation of research at the Water Protectionrotection Laboratory

Conclusion and recommendations

Background

This laboratory is engaged in investigations of environmental problems related to the reduction and control of pollution load to the Baltic, the atmosphere and surface waters in Estonia. The subject area is interdisciplinary, requiring expertise in chemistry, chemical engineering, atmospheric chemistry/transport, geochemistry, hydrology, limnology as well as more biologically oriented disciplines. There are few research institutions of this type administered by universities.

There is no doubt that research in the area is important and will continue to be so for the foreseable future. From the projects described and the qualifications of the project leaders, it seems clear that the Water Protection Laboratory has the interdisciplinary expertise required to make an impact in the research areas studied.

Evaluation

In order to evaluate the quality of the work performed it is necessary to be able to read at least some of the publications in the List of publications. This has been impossible because of the languages used (Russian or Estonian), perhaps the authors of the Report have anticipated these difficulties, as no reprints were enclosed! Therefore, the evaluation has to be based on the following data:

- the objectives of the various projects.

The titles of the work performed indicate an activity along the main-stream of research in the area. It is impossible to evaluate the quality and originality of the individual work.

The titles in the literature list indicate that the studies include a large amount of environmental monitoring, establishment of emission standards, which in most other countries are made by government agencies (like Naturvårdsverket in Sweden). Data of the type form the necessary basis for decisions by the authorities on environmetal issues, they may also form the necessary data base for scientific investigations of various kinds.

There is a risk that extensive monitoring programmes will lead their own life and not result in more qualified scientific products. It might be better for the university institutions to concentrate their efforts on scientifc issues and leave the rather routine environmental monitoring to another organization.

- international exchange.
The Estonian scientists have established international cooperation within the monitoring area, which indicates that their work has a reasonable quality. Too many of the publications are made in Estonian. The scientists should also be encouraged to publish in non-Russian scientific journals in order to increase their visibility.

- The summary of results indicate that the laboratory has made an extensive survey of pollution sources and loads both for water and airborne pollution, results that have been used by the authorities.

- The staff at the laboratory has the diversity of specialization that is necessary for successful interdisciplinary work on environmental issues. They have produced about 125 publications over a five year period, which seems acceptable. The titles indicate that more scientific interpretations of the field data have been made than is indicated in the SUMMARY OF RESULTS section in the report.
- There are no indications in the report of the number of students engaged in the scientific work. The report mentions four dissertations but no diploma papers. It had been interesting to have some information on the role of the Water Protection Laboratory in the Estonian education systems, especially for the training of students in various "environmental" disciplines.

- The department has organized a number of scientific meetings, which also is an indicator of scientific quality.

Future activities

The plans for the future are very general, and seem to indicate that the work is expected to run along the same lines as in the past. I think that it is worthwhile to make a somewhat more detailed planning, especially the possibilities to broaden the international perspective of the laboratory.

Final comments

Using the indicators given above, the Water Protection Laboratory, seems to be a well functioning unit which has given significant contribution to the Estonian community. The broad expertise available at the laboratory gives it at potential for future development and the possibility fore a large impact on the international scene.

In order to increase its international visibility and to broaden/improve the expertise of the scientists I suggest that an exchange programme is established with some leading laboratories. This programme should have its focus on the training of young scientists on the postdoctoral level abroad. The publishing policy should also be changed so that fewer papers are published in Estonian or Russian, and more English or German publications.

quality - 3
patents - 2
relevance - 2

Fundamentals of Processing - Natural Phosphates Into Fertilizers and Feed Phosphates (1986-1990)/ Mineral Raw Materials and Industrial Wastes (Since 1991)
The Royal Swedish Academy of Sciences project number: 26
Scientific areas: Chemical Engineering, Inorganic Chemistry

Tallinn Technical University, Inorganic Technology Laboratory

Conclusion and recommendations

Background

The main research activities at this department are related to the processing of Estonian/Baltic phosphate resources (which is consided to be of interest to the national economy).

The research programme is focused on applying/modifying existing technologies for the processing of indigneous ore resources. The work thus include studies on three main lines:

1) Acidulation of the phosphate rocks: kinetics of rock decomposition with different acids for the production of several grades fertilizers.

2) Thermal pretreatment of the phosphate rocks; either by calcination of carbonate containing ores to obtain an enriched fraction or by inducting changes in the apatite structure as a result of thermal treatment in presence of additives.

3) Reductive decomposition of phoshogypsum (PG) by decomposition of Ca SO_4 under reducing conditions using CO gas at $900 \pm 20^{o}C$.

The work has been documented in about 67 papers and conference contributions produced during the past five years. Most of them are published in "Trans. Tallin Tech Univ". and "Proc Estonian Acad Sci Chem". In the last year, however, increasing number has been published in International journals and conference proceedings. The Department has produced 11 dissertations (during the same period?).

The department has organized one International conf on phosphorous chemistry (1989) and participated in organizing Swedish-Estonian symposiums on evironmental chemistry and toxicology.

The department is lead by Academician Mihkel Veiderma and have 7 senior scientists. There is no mention of graduate students or freshly graduated staff members.

Evaluation

Current Activities

The processing of phosphate ores is a well developed technology. There are numerous plants worldwide processing a wide variety of raw materials to produce several different products ranging from simple phosphate fertilizers to high value purity phosphoric acid. Most of the know-how on this industry is documented. However, the economical processing of an individual phosphate ore deposit requires an adaptation and modification of the process.

Most of the work reported under 1 and 2 above represents studies of processing parameters for economical utilization of the deposits. The group has produced schemes for the processing but no mention is made of their implementation. These studies have a very modest level of originality. Such work is best carried out by an industrial organization with involvement from the university in solving specific tasks.

The work with gypsum (PG) decomposition is more original, (and is more frequently published in international journals!). while a process scheme is suggested, the feasibility of its realization is yet to be shown.

Future Activities

The "prognosis" seems un-focused and very diversified and not described in sufficient details. The topics "investigation of Estonian mineral wealth and methods for producing mineral fertilizers" are "process-modification" type of research (parameters study). They should be carried out only in cooperation with an organization taking lead towards industrial implementation and/or operation.

Environmetally related topics (coagulants from local raw materials and sulphur dioxide removal...) are of interest. However, there is no details on the proposed work or how it does differ from currently operating processes.

Work on substituted apatites (studies of crystal structures, defects, substitutions, physicochemical characterization, etc, on the dissolution/decomposition as well as thermal transformations) is intersting and have room for originality and innovation. Moreover, it can be useful also in studying the processing of other minerals.

Final Comment

The list of research topics suggested by the department is mainly an extension of previous work. However, with the expertise and facilities available, the department should consider starting work in other fields of inorganic chemical technology e.g. materials sciences.

The department have gained experience and built good facilities during studies of high temperature reactions, e.g. PG and thermal treatment of phosphorite. This can be used in studying other high temperature reactions in the synthesis and processing of some advanced ceramics, i.e., sintering reactions.

The scientists at the department should be encouraged to publish a much larger part of their work in non-OSS international journals, publications in Estonian journals should be discouraged.

Applied Researches In Chemical Engineering and Environmental Engineering
The Royal Swedish Academy of Sciences project number: 27
Scientific area: Chemical Engineering

Tallinn Technical University, Department of Chemical Engineering

Conclusion and recommendations

This project consists of seven papers so it is therefore impossible to give comments on all these in detail on this form. Please refer to the enclosed appendix for further comments. The main contribution of this project is the four papers dealing with the kinetics of the ozonation of lake water and waste water. Closely connected to these studies in the mathematical modelling of the reactor used for the ozonation and the experimental test of this model. Since the present evaluation is performed by the Swedish Research Council for Engineering Sciences, the fundamental issues, including chemical kinetics and transport phenomena, are the most important to evaluate while environmental and applied chemical aspects are of less interest here.

The four ozone papers are examples of good engineering work with the application of conventional wisdom to the behaviour and properties of a gas-liquid process. The results are well described and the conclusions are well founded. It is also easy to read the text. Rather few citations are given and the results from the western world are sparsely referred to. Some critical comments are given as to the kinetic work in paper no 1.

The papers do not give any new contribution, to our knowledge, about reactions proceeding in a gas-liquid system. With reference to great number of ozone treatment plants in the western world, it is not likely that the result of the ozone treatment given in the papers is unique. There are many people with competence in this field in Sweden whom may be contacted. I would like to recommend Dr. Tibor Nemeth VBB Viak AB, Mölndalsvägen 85, S-412 85 Göteborg, telephone +46-31-833120 for further information.

GENERAL COMMENTS

This "project" consists of seven separate papers of which two are general discriptions of the educational and research organization in chemical engineering in Estonia. One paper is only a summary of a symposium contribution concerning biocatalytic reactors. The remaining four papers all deal with ozone treatment of lake water and/or waste water. The first paper, published in Ozone Sci. Eng. in 1988, concerns the kinetics of ozonation of some model substances. The other three are more directed towards engineering studies on how to perform the ozonation on a technical scale. Two of these are proceedings from conferences in

Belgrad (1990) and Moncaco (1991) and the third one was published in Ozone Sci. Eng. in 1990.

As may be clear from above, this evaluation can only include the four ozone papers and will not deal with the important environmental and economic reasons for treating water and waste water with ozone but will only discuss fundamental aspects of chemical reactions between a gaseous reactant and reactants in an aqeous solution.

An important engineering objective is to derive the rate equation of this process based on a qualified kinetic study in order to be able to select and design an efficient reactor, which is not a trivial problem in itself, and also to find the optimal way to operate this reactor. A fundamental chemical task, partly connected to the engineering problem, is to unravel the reaction mechanism in order to understand the kinetic result. The reaction mechanism of the ozone oxidation most probably includes reaction loops with different free radicals.

A fair evaluation of these four ozone papers requires, in addition, that the expert knows whether the scientists in question have modern experimental facilities and the latest information from recently published papers from the western part of the world.

The experimental equipment seems to be sufficient to perform a qualified study. A comparison is made here with the papers published by Sotelo et al. (1988-1991), which are some of the best contributions, to my knowledge, in this field of engineering chemistry. Concerning the literature, the Estonian scientists give the impression of being well informed of the fundamental theoretical works by Danckwerts about gas-liquid processes. Western results in ozone chemistry and chemical engineering, which correspond to a great number of papers are very sparsely referred to and are, therefore, assumed to be unknown.

COMMENTS ON THE SPECIFIC PAPERS

I S. Preis, R. Munter, and E. Siirde, *Kinetic Description of Industrial Wastewater Ozonation Processes*, Ozone Sci.Eng., **1988**, 10, 379-392.

This is a applied chemical study of the ozonation kinetics of some model substances which may be representative for different types of waste waters. In the intructory theory it is suggested that the chemical oxygen demand (COD) be used as the single variable that will represent the different oxygen consuming compounds in the waste water, so the rate equation is formulated in terms of COD. This is a common way to describe the kinetics of a sum of compounds which react simultaneously and in parallel in the same type of reactions. But this simplification of

the kinetics has a lot of hidden problems. The theory behind this kind of formulation of the rate equation has been thorougly discussed for about twenty years in western literature, called "lumping", and first came up when formulating the kinetics for desulfurization of petroleum oils. Nothing of this theory is mentioned in the paper. The reading of the theoretical part of the papers is, moreover, made difficult by the fact that the units are not consistent. Nothing is mentioned about whether any test has been performed to show that the influence of the diffusional steps has been eliminated. These cretical comments are only valid for the theoretical part of the paper and do not reflect on the possible value of these results for waste water treatment in Estonia.

II R. Munter, S. Preis, E. Siirde, And J. Sutt, *Methodology of Ozone Introduction into Water and Wastewater Treatment*, Proc, European Ozone Conf. Belgrade, **1990**, p.458 - 479.

This is a well performed design of a reactor for a gas-liquid process including the oxidation of waste water with ozone based on generally accepted theory and practice. However, no references are given as to the source of the different equations. Some of these are easily recognizable, but not, for example, those describing the pressure drop, the specific contact area, the power dissipation density, and the rate constant for ozone decomposition. These critical comments are only valid for the theroretical part of the paper and are not intended to reflect on the value of these results for the waste water treatment process. As already mentioned, this paper is a good demonstration of how to design a reactor for a gas-liquid process.

III R. Munter, S. Preis, S. Kamenev, E. Siirde, J. Sutt, and H. Lond, *Preozonation of Lake Ulemiste Water*, Proc. 10th Ozone World Cong., Monaco, **1991**, p. 401-413.

A very interesting description is given about the water quality of Lake Ulemiste and the present treatment of this water in the Tallinn Water Purification Plant. The expected improvement in the water quality after ozone treatment based on laboratory and pilot plant studies is also described. The capacity and efficiency of the ozone reactor is discussed on the basis of these studies and pre-ozonation of the lake water is found to be superior to pre-chlorination. Economic aspects are not included in this discussion. It should be mentioned that, based on the experience in Sweden, it is likely that the ozonation is about ten times as expensive as the chlorination. The paper is, in any case, a good presentation of a well performed engineering project and seems to provide a basis for the decision on whether a pre-ozonation plant should be built. This decision can, however, not be made only on the basis of the water quality just after the ozone treatment plant. It is a well-

known fact that the contamination of the water continues in the long and often dirty pipes after the purification plant. Ozone does not have the same effective lifetime as chlorine. The four figures referred to in the paper were lacking.

IV R. Munter, S Kamenev, and L. Sarv, *Design and Modelling of a Staged Downflow Bubble Reactor*, Ozone Sci.Eng., 1990, 12, No4

This paper is a comprehensive description of the mathematical model for the ozonation of water in a staged downflow bubble reactor similar to the description already given in paper II. This paper also gives an experimental test of this model by ozonation of a lake in the same way as given in paper III. Paper IV may, therefore, be looked upon as an small extension and completion of papers II and III.

Conclusion and recommendations

Recommendation:

1. The work on Prolog systems and other software products should be better able to continue and grow if it is organized as a software company; international cooperation is essential.

2. The expertise on information systems would be a valuable basis for a consulting company in the area of adminstrative office information systems. The group seems to have good familiarty with modern software technology, and should be able to provide first-quality services. However such a company could be advised to find out quickly also about software products that may be imported from international markets.

3. The group on data analysis and machine learning is addressing a significant basic research topic, and should be encouraged to continue. It could be important for them to make contacts with European cooperation (e.g. in Esprit context) in the area of machine learning. Renewed evaluation can then be done on the basis of the international response and publication.

Same observations as in evaluation of number 34.

Scientific quality (difficult to tell)

Scientific relevance higher as applied research, lower as basic research

Scientific potential higher as applied research, lower as basic research

Signal Processing Algorithms and Equipment for Various Fields of Radio Engineering
The Royal Swedish Academy of Sciences project number: 29
Scientific area: Systems and Computer Engineering and Electrical Engineering

Tallinn Technical University, Department of radio engineering and signal processing laboratory

Conclusion and recommendations

The area of signal processing is very dynamic and has excellent scientific potential. It is also of the greatest importance for the industrial development. However, as far as I can see the research reported on this project is far below the average of the field.

I recommend an emphasis on theory and methodology. Less effort should be devoted to the development of software and hardware. Furthermore, the equipment is not adequate for research on signal processing. It is clear that the group suffers from a lack of international contacts. Almost all publications and conference contributions have been within the former USSR. Furthermore, their papers have not been published in the strongest Soviet journals. Participating in international conferences and longer visits abroad are of vital importance for the scientists in this group.

quality – 2
nation. – 1
relev. – 1

76(101)

Research and Development of Methods for Digital Systems Testing and Design (Beginning in 1975)
The Royal Swedish Academy of Sciences project number: 30
Scientific area: Systems and Computer Engineering

Tallinn Technical University

Conclusion and recommendations

Project TEST DESIGN OF DIGITAL SYSTEMS is evaluated. Test design is today's topic, worldwide, in Science and Industry.

The project is based on the Alternative Graph (AG) technique, a further development of the Binary Decision Diagramme technique. The AG-technique seems to solve many real test design problems in an elegant way. The algorithms are demonstrated in TURBOTESTER, a software package intended for student and test engineer education.

Subproject FTGEN for functional test generation can be very useful for verification in design synthesis as well as for MCM test generation. Adapted to the VHDL environment, as planned, FTGEN will have the potential of international acceptance.

I recommend to continue the TEST DESIGN project in co-operation with Swedish industry to evaluate the AG technique applied to modern, complex, designs. Ericsson, Digsim and Svenska Mikrosystem are among the possible candidates. Scientific co-operation with KTH (Tillämpad elektronik), Chalmers (Datorteknik), LiTH (IDA) and NTH (Einar Aas in Trondheim) is proposed. The project needs financial support.

quality - 4
patents - 3
relevance - 3

(Papers To Proj. 30)
The Royal Swedish Academy of Sciences project number: 31
Scientific area: Computer Engineering

Tallinn Technical University, Systems & Computer Engineering
Copies of scientific papers (13)

Conclusion and recommendations

Projektct DECOMPOSITION METHODS FOR DIGITAL CONTROL SYSTEMS is evaluated. The topic is relevant but the algorithms are heuristic and based on old theories (1966). After 1979 algorithms have been implemented in software and evaluated, but no further scientific reports of the topic have been published.

The project deals with a generalised approach to finite automated decomposition. I covers design synthesis and verification. The authors claims that the technique can handle more inputs and states that competing techniques. No proofs are available.

Positive is the up-to-date report from evaluation of VHDL as an input language to the decomposition algorithms.

I recommend an investigation of the DILOS software package to find out how useful it is in practise and what scientific potential the project really has.

Project DECOMPOSITION METHODS FOR DIGITAL CONTROL SYSTEMS is evaluated during a visit to Tallinn. The project covers high-level synthesis, verification and testability. These combined areas are of great interest in Science and Industry, worldwide. In former Sovjet the project has been appointed "one of the five best ranked Scientific works" the years 1985, 1986 and 1988. It has produced eight doctors degrees.

Project results are implemented in the DILOS package, written in C and runs on PC´s and Workstations. A subset of VHDL can today be used as the input language. Output can be realised in PLD-structures or correspondent structures. ASIC designs may be the best target. Some original ideas implemented in DILOS are the use of entropy complexity measurement and complexity pumping between sub-units. The decomposition technique, based on Hartmains algorithms and added heuristics can in DILOS handle designs with more than 100 inpus and 1000 states.

I recommend a financial support from "West", a scientific co-operation with KTH and IM as well as an industrial co-operation with ABB and SAAB Combitech.

quality — 2
papers — 3
relevant — 2

Solid Mechanics
The Royal Swedish Academy of Sciences project number: 32
Scientific area: Mechanics

Institute of Cybernetics, Estonian Academy of Sciences

Conclusion and recommendations

This package or materials sent to me is the same as number 33 except for an enclosed Russian-language paper from 1988, entitled (in translation) "Alternative Graph and Technical Diagnosis of Discrete Objects" (55 pp). My Russian is poor and I have had no possibilities to appreciate the contents of the paper. My evaluation concerns the Solid Mechanics group as a whole.

quality - 4
intro - 3
relev - 3

Institute of Cybernetics, Estonian Academy of Sciences

Conclusion and recommendations

The Division of Mechanics at The Institute of Cybernetics within The Estonian Academy of Sciences is a research centre of high international reputation since long, with among others, academicians Uno Nigul (died 1990) and Juri Engelbrecht in its staff. The Division cooperates with several Western universities, participates in (and organizes) international meetings, and publishes in high-standard international scientific journals. Quite naturally, no diploma theses and no doctoral, dissertations are produced.

A general point of criticism on this Estonian system (shared by so many other, usually eastern, countries) with separate academies is that a stronger coupling of the research to undergraduate and graduate teaching might promote a better dissemination of knowledge within Estonia. As to Scientific Quality, I had a hard choice between putting a 4 or a 5. (5 is considered the highest, 1 the lowest)

quality - 4
relev - 3
viir - 3

Conclusion and recommendations

The major part of these activities are the development of frontline software for use in industry and other applications. It corresponds to work done in applied research institutes sush as SICS in Sweden or Fraunhofer Institute in Germany. As far as I can tell from the report, the work has very good quality.

There is also report of some basic research activities. They seem to have good quality, but it is my guess that the researches have not allowed a lot of time for basic research.

Recommendation: To continue the applied work in a commercial context, e.g. by forming a software company. Also to encourage the basic research of the DESEG group and to enable them to increase their international contacts in the West.

Scientific quality	difficult to tell
Scientific relevance	higher as applied research, lower as basic research
Scientific potential	higher as applied research, lower as basic research.

Conclusion and recommendations

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Scientific quality difficult to tell
Scientific relevance higher as applied research, lower as basic research
Scientific potential higher as applied research, lower as basic research.

37 (96)

Control Systems

The Royal Swedish Academy of Sciences project number: 36
Scientific area: Software Engineering

Conclusion and recommendations

I can only evalutate sections 5-6-7 in the list of contents. It seems likely that the systems which have been developed reflect very good technical competence, but there is a problem for the group since on one hand there is no basic research content in this work and on the other hand it is very difficult to compete against the strong western and Japanese companies who specialize in this area. The research on phonetic technology of course has local relevance but may find it diffucult to "go international".

Recommendation: The group should consider how to change to a new direction and strategy, not by fault of its own but because of the circumstances.

Regarding sections 2-3-4 I refer to the other reviewer.

Scientific quality for 5-6-7, near excellent, especially for the systems that have been developed.

quality – 4
potens. – 2
relev. – 2

Conclusion and recommendations

I can only evalutate sections 5-6-7 in the list of contents. It seems likely that the systems which have been developed reflect very good technical competence, but there is a problem for the group since on one hand there is no basic research content in this work and on the other hand it is very difficult to compete against the strong western and Japanese companies who specialize in this area. The research on phonetic technology of course has local relevance but may find it diffucult to "go international".

Recommendation: The group should conzider how to change to a new direction and strategy, not by fault of its own but because of the circumstances.

Regarding sections 2-3-4 I refer to the other reviewer.

Scientific quality for 5-6-7, near excellent, especially for the systems that have been developed.

qual. –
not –
inter –

Conclusion and recommendations

The research of this group has the highest international standards, combining basic research with applications. It should be a mentional interest to facilitate the participation of the group in bilateral and European research cooperation.

The group is also in a strong position to generate a spin-off company. However it is very important that the basic research of this group can continue whithout obstacle.

Scientific quality is excellent applying to both quality of basic research and of industrial applications.

Conclusion and recommendations

I can only evalutate sections 5-6-7 in the list of contents. It seems likley that the systems which have been developed reflect very good technical competence, but there is a problem for the group since on one hand there is no basic research content in this work and on the other hand it is very difficult to compete against the strong western and Japanese companies who specialize in this area. The research on phonetic technology of course has local relevance but may find it diffucult to "go international".

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Regarding sections 2-3-4 I refer to the other reviewer.

Scientific quality for 5-6-7, near excellent, especially for the systems that have been developed.

Serviceability of Agricultural Buildings
The Royal Swedish Academy of Sciences project number: 40
Scientific area: Mechanics

Estonian Agricultral Academy, Tartu, Research group of the department of theory of tructural mechanics

Conclusion and recommendations

The department of Theory of Structural Mechanics of the Estonian Agricultural Academy in Tartu has a research group studying the efficiency of agricultural building particularly in terms of serviceability. Serviceability expresses the quality of a building with respect to the quality of the materials and structures used and the quality of the planning solutions and functioning of the building.

Deteriorations of farm buildings was studied both theoretically and experimentally by field observations. The theoretical processes of deterioration were solved for real conditions and compared with prognosis of the durability of structures on the basis of data of real exposure or in the result of accelerated experiments. Models for deterioration of single structures as well as for whole buildings were established.

The research that is presented in this report has both from scientific and practical point of view considerable relevance.

Elaboration of Technological Measures for Agricultural Water Pollution Control

The Royal Swedish Academy of Sciences project number: 41
Scientific area: Environmental and civil engineering

University of Tartu, Department of Water Management,

Conclusion and recommendations

This project deals with agriculture as a major source of water pollution in rural Estonia. The Department of Water Management at Tartu University has laboratory facilities in sanitary engineering. Special methods for waste water treatment has been developed as well as a method for assessing the pollution load in the small rivers of Estonia.

An evaluation of this research without more information is difficult.

It would be valuable to establish contact and cooperation between Estonian institutions in water resources and environmental engineering and corresponding departments in Sweden. KTH in Stockholm is well suited for such a cooperation and exchange of students and researchers/teachers. Our department of Water Resources engineering has long research experience in waste water treatment and we are expanding our curriculum to include two new courses in English: Environmental Engineering and a course in Sustainable Urban Infrastructure and Natural Resources Development.

Note on the scientific quality: Evaluation of scientific aspects of this research is difficult without more information on ongoing research at the department of Water Management at Tartu.

Working Out the Methods of Determination of the Residual Stresses In Coats By Deformation of the Elastic Substrate
The Royal Swedish Academy of Sciences project number: 42
Scientific area: Mechanics

Estonian Agricultural Academy, Research group of the department of theory of structural mechanics

Conclusion and recommendations

It is indeed difficult to make a fair assessment of the present scientific achievements with only a summary and one scientific paper (a supplementary one added in Russian) furnished. Work on determination of residual stresses is said to have been in progress since 1958 and apparently mostly of a theoretical nature (perhaps so for natural reasons).

The documented methodology applied is not an original one but rather relies on a standard technique, i.e. calculation, based on ordinary structural mechanics and some assumptions, of the resulting distorsion of a member, such as a beam, ring or shell, due to removal or addition of a stressed surface layer. Associated experimental investigations have been carried out via a thermoelastic analogy and in situ results are referred to a German journal of 1975. Within proposed "future development", experimental investigations seem most appealing. No details are, however, given regarding specific materials and experimental procedures. Any progress will, I believe, rely heavily on local experimental means.

Development of Aerodynamics of Gas-Dispersed Flows and Laser Diagnostic Methods

The Royal Swedish Academy of Sciences project number: 43

Scientific area: Mechanics

Institute of Thermophysics and Electrophysics, Estonian Academy of Sciences, Department of aeromechanics

Conclusion and recommendations

The work on dispersed flows seems to be well composed both experimentally and theoretically. The application to aeronautical and space programs is technologically relevant. The quality of the work on vortex rings and other topics is difficult to asses without access to the actual publications, but the areas of interest seems important from an application point of view. Weak appreciation of work done elsewhere on these topics.

quality – 3
[illegible] – 2
[illegible] – 3

Conclusion and recommendations

In terms of theoretical and mathematical potential the group around prof. Krumm is ahead of the corresponding Swedish research. However, as most Baltic researchers they lack computing power and experimental facilities. This make their education and research suffer.

The potential for the group is very good and - given adequate funding - can definitely compete internationally.

The scientific and economic relevance of the area is very high and of strategic importance for Estoina.

Combustion of Low-Grade Fuels In Fluidized Bed
The Royal Swedish Academy of Sciences project number: 45
Scientific area: Power Engineering, Physics (oil shale)

Conclusion and recommendations

The group is addressing a very relevant problem - fluidized bed combustion of coal and elimination of sulphur and fly ash emissions. The limited evaluation material does not allow strong cnclusions. The strong part of the project appears to be (i) the problem addressed is very relevant and (ii) the group possesses a broad spectrum of relevant competence ranging from heat power engineering to, chem.engineering to chemistry to thermophysics. Weak points are (i) a fairly low publication output and no dissertations or diploma papers are reported. The group could benefit from contacts/collaborations with prof Bo Lechner, CTH, Göteborg and Studsvik Energy AB, Sweden. There are also strong related activities in Swedish industry (ABB and others). Publication in western journals is recommended.

Comments on the scientific quality and scientific potential: The limited evaluation material does not allow strong conclusions. The project is on the high side of 3. (5 being the highest, 1 the lowest ranking)

quality - 3
relev. - 3
utv. 2

93(62)

Elaboration of Scientific Bases, Principles and Mechanisms for the Guidance of Estonian Energy Management
The Royal Swedish Academy of Sciences project number: 46
Scientific area: Power Engineering

Institute of Thermophysics and Electrophysics, Estonian Academy of Siences

Conclusion and recommendations

Several of the papers on the supplied list of publications are descriptive, aimed at a dissemination of a specific energy policy rather than a critical evaluation of policy or technology options. There are, however, some interesting papers about the development of concepts and models for the analysis and management of energy systems. The group also stresses these developments in their "A summary of the results". But it remains unclear to what extent the models are actually used as practical tools for decision support and energy-economy-environmental analysis.

Considering the Estonian situation, it is important that an energy systems engineering competence at an academic level is maintained. The modeling work has considerable potential, but with the caveat that practical applications are the ultimate objectice in any systems engineering exercise. The group should be urgent to seek publications in refereed journals to obtain feedback on quality and relevance. The group could participate in the Nordic cooperation planned for the CHALLENGE network.

Note on the scientific quality: The evalution is based on papers in English selected from the supplied list of publications. Most papers are conference contributions. No publications in refereed international journals. Note on the scientific potential: High value for model developments and applications.

quality - 3
prakt - 2
rilev - 3

206(34)

Investigation and Diagnostics of Power Semiconductor Devices By the Method of Registration of Infrared Recombination Radiation

The Royal Swedish Academy of Sciences project number: 47
Scientific area: Power Engineering

Institute of Thermophysics and Electrophysics, Estonian Academy of Sciences
Workning group of Power Semiconductor Device Diagnostics

Conclusion and recommendations

Based on the available information sent to me, I am not able to evaluate the project.

good —
not —
ill —

Study of D. C. Supply for Nonlinear Electrotechnological Group Loads

The Royal Swedish Academy of Sciences project number: 48
Scientific area: Power Engineering

Institute of Thermophysics and Electrophysics, department of converter devices, Estonian Academy of Sciences

Conclusion and recommendations

Based on the available information sent to me, I am not able to evaluate the project.

good —
not —
win —

91(73)

Arc Plasma Jet and Cathode Investigation
The Royal Swedish Academy of Sciences project number: 49
Scientific area: Physics

Institute of Thermophysics and Electrophysics, "Plasma Group", Estonian Academy of Sciences

Conclusion and recommendations

Project in its present form contains lack of information and it can not be compared with known existing projects.

Particular topics as well as future goals of the project have to be specified in more details, and with respect to recently obtained international findings.

More efforts have to be paid to characterize the arc plasma itself (plasma diagnostics - probes, spectroscopy, etc.) at different power source parameters. Study of the cathode surface effects with respect to the plasma parameters would be of great scientific importance.

Translated publications are necessary for evaluation.

Research field and general orientation of the project are, however, fully acceptable.

Note on the scientific quality: Lack of information to evaluate properly. No international comparison. Publications only in Russian.
Note on the scientific relevance: Uncertain specifications of both results obtained and what is to be studied.
Note on scientific potential: Research directed mainly to technical applications.

quality – 3
potent – 2
relev – 2

Synthesis and Design of Power Converters With Reduced Distortions Using Optimal Energy Exchange Control

The Royal Swedish Academy of Sciences project number: 50

Scientific area: Power Engineering

Conclusion and recommendations

Given the available information and only second information the group seem to be of high quality. They lack computing power and experimental facilities, which is crucial for this field. However, their theoretical level is very high. The power electronics area is of great national interest, since it will influence both savings (speed regulation of electrial drivers) and the production industry (drive systems for all kinds of electrical actuators).

94(85)
TEFI

Study of Interaktion Between Semiconductors and their Treating Media

The Royal Swedish Academy of Sciences project number: 51

Scientific area: Physics

Conclusion and recommendations

The report is very general in its content. The type of results obtained are stated but no quantitative details of what the results really consist of, are given.

The same holds for methods - no information whatsoever about methods of investigation is given. Consequently it is hard to make specific conclusions or recommendations.

A general comment is that the programme addresses a broad range of problems, maybe too broad. A focus on some of the problems would probably be beneficial considering the level of funding and personel. Also it appears that contact with the enormous amount of research already done on these types of problems in the west (understandably) has been poor. There are excellent opportunities for collaboration with several groups in Sweden, e.g. Linköping and Gothenburg.

Investigation of Physical Phenomena In Thin Solid Films and Application of the Films In Electroluminescence Devices
The Royal Swedish Academy of Sciences project number: 52

Tartu University, Laboratory of Electroluminescence and Semiconductors

Conclusion and recommendations

The efficiency of thin electroluminiscent panels depends on the properties of the active layers as well as the dielectric and conducting layers from which these devices are made. Obviously surface and interface properties have a great influence on the overall performance of these panels. This had also been recognized by this group as indicated by their efforts to improve the characteristics and stability by different surface treatments. It seems however that so far electron spectroscopy as a tool for a deeper understanding of surface properties has not been used to any extent. Such characterization methods are believed to be of the greatest importance for a successful research program on thin film devices.

Today little known about the materials CaS and SrS. Although the group sholud not be discouraged from the research on these materials, this part of the program should be watched closely. It is by no means certain that the success of the ALE growth of ZnS:Mn EL panels can be repeated in a different materials system.

In the past the group has performed a great deal of basic studies of the ALE growth process. The experience thus gained makes the group well suited for the proposed extension of the ALE technology to the growth of dielectrics as well as conductive semitransparent thin films used in EL panels.

At present the scientific staff involved in the program is quite large. If the reason for this is that a considerable amout of time had been devoted to the development of more or less standard scientific equipment such as vacuum equipment, then the staff could be reduced in the future.

quality - 3
physics - 2
relev - 2

Elaboration and Development of Non-Invasive Computer-Aided Methods and Equipment for Measurement of the Main Physiological Variables In Man

The Royal Swedish Academy of Sciences project number: 53

Scientific areas: Physics, Biomedical Engineering

Tartu University, Institute of General and Molecular Pathology (IGMP of TU), Laboratory of Adaptation and Neuroendocrinal Processes, Group of Biomedical Engineering

Conclusion and recommendations

This projekt is of general medical importance with an aim of developing nonevasive methods for measuring blood flow. Today the method of choice is based upon ultrasound, an area which is extremly rapidly developing. The small group of prof T Karu and cand.biol.. J Vedru will in collaboration develop new methods, now based upon "electrical impedance plethysmography". The project leaders describe possibilities with the new method and how it could complement methods available today. Instrumental and methodological development in medical technology today involves several big groups together with a large budget. I do not think that, unless companies or larger groups are involved, this project has a reasonable chance of success. However, there are research groups in Sweden that could be possible collaborating groups. The competence of the group is difficult to evaluate since publications are in Russian.

Note. Publications in Russian.

Informational Aspects of Computer Aided Design (CAD) Foundations
The Royal Swedish Academy of Sciences project number: 61
Scientific area: Engineering Design

Conclusion and recommendations

A number of standard methods exist for characterizing "standard discrete objects", including predicate logic and the structures used in data bases (relational, object oriented, etc). It is not clear from the report why the resercher bypasses the methods and introduces his own.

Notes om the scientific quality, relevance and potential: Difficult to tell, very brief report.

87 (12)
TEFI

Theoretical and Experimental Investigations of Cryotechnological Processes
The Royal Swedish Academy of Sciences project number: 62
Scientific area: Physics

Conclusion and recommendations

The project is directed towards mathematical modelling of cryotechnical processes and finding the solution of these models. Various application areas are mentioned, like storing of agricultural products and utilization of industrial waste.

From a mathematical point of view it seems like the models would be fairly well known in principle. After all, the equations for heat conduction and mass transfer have been around for some time. However, the question of finding certin parameters leads to computational problems, which may be quite difficult to solve, like inverse nonlinear problems. This is probably where the main effort should be concentrated. It seems like the group are not doing numerical computations, but possible cooperation with Tartu University is mentioned. This is probably a good idea, a joint effort would strengthen both groups.

Almost all listed papers are written in Russian and published in less well known proceedings and books. The competence and the potential of the group is good, and with the new opening towards the West, something good may come out. However, there is a long way to go before the research may have any significant impact "in the national economy of the republic" as indicated in the report.

quality – 2
national – 2
relevance – 2

Dynamic Processes In Thin-Walles Structures
The Royal Swedish Academy of Sciences project number: 63
Scientific areas: Mechanics, Applied Mathematics

Tallinn Techical Univerity, Department of Structural Mechanics and Applied Mathematics

Conclusion and recommendations

The group is well informed of the development of the general problem area. They adopt relevant analytical and numerical techniques but could benefit from better computational capacity. The motivation for the problem seems directed to submarine applications but the techniques used can be adapted to other areas such as structure-borne sound.

350(36)

Investigation of the High-Frequency and Pulse Discharge formation Mechanism In Molecular and Inert Gases At Near-Atmosperic Pressures

The Royal Swedish Academy of Sciences project number: 64

Scientific area: Physics

University of Tartu, General Physics, Gas Discharge Laboratory

Conclusion and recommendations

This project is of very good scientific quality and has a high scientific relevance. The main line of research, studying high frequency and pulse disharge formation mechanisms, has many important applications of which the group has exploited a few, e.g., control of discharge mechanism for point discharges using a combination of high frequency and dc fields.

The scientific approach to the research is good with systematic studies using advanced experimental equipment (most of which is homebuilt), Another application is in the field of excimer lasers where the group has already achieved good results in developing laser systems for medical applications. Furthermore the group has a sound approach in combining theoretical and experimental efforts and pursue the programs to reach international publications. The field of research is unique and the group has establisched contacts internationally,. members of the group participate in and contribute to international conferences.

The strenuous financial situation in the country also affects this group. Investment in modern electronics and computers could enhance the possibility for the group to further develop the research. The structure of the group is healthy with senior and junior research members and the group can attract students both for Diploma and PhD thesis.
This type of research could also be of interest for Swedish industry and some contacts had already been taken. The group could greatly benefit from such contacts and possible support for investment in capital equipment and foreign travel for the members. Furthermore, the group is also fully capable of hosting guest scientists.

quality – 4
potential – 3
rel – 3

Laser Measurement and Communication Systems

The Royal Swedish Academy of Sciences project number: 19

Scientific area: Laser Physics

(Not evaluated due to lack of expertise)

Radon In Dwellings

The Royal Swedish Academy of Sciences project number: 55

Scientific area: Byggforskning (radon)

(Not evaluated due to lack of expertise)

History of Architecture and Town Building In Estonia

The Royal Swedish Academy of Sciences project number: 57
Scientific area: Arkitektur

(Not evaluated due to lack of expertise)