Petroleum technology for a world-wide market

Just as for other institutes in the petroleum sector, there was less work on us on the Norwegian continental shelf in the 90s. We therefore decided to develop our international markets - and so far, we are fairly well pleased with the results of our overseas efforts.

Towards the end of the 90s, we began systematic marketing of our services in five geographical regions, and obtained positive responses in four of them. Today, we have contracts in the Gulf of Mexico, South America and West Africa. But most important of all is the foothold we have won in Iran - one of the most oil-rich countries in the world.

In winter 2001, the Iranian state oil company NIOC asked SINTEF Petroleum Research to carry out a study of how the huge Azadegan oil-field should be developed. This onshore field contains the biggest petroleum find anywhere in the world during the past 20 years.

In February 2002 we won another major contract with NIOC for a similar study of seven oil fields that are already in operation. In this case we have been asked to suggest ways of increasing recovery rates. This project has a total budget of more than NOK 50 million, half of which will come to us.

The Iran projects utilise modelling and simulation software, with which we have long experience from projects on the Norwegian continental shelf. At the same time, we have taken the opportunity to gain and make use of specialised knowledge of the geology of this region, for while most of Norway’s oil is found in sandstone reservoirs, Iran’s reservoirs lie in fractured carbonate formations.

The other petroleum reservoirs in this part of the world are also found in such formations. We are therefore already considering the possibility of extending our overseas efforts to include other middle eastern countries. In such a perspective, we regard the knowhow we are gaining from the Iran projects as an important addition to our expertise.

David Lysne
President,
SINTEF Petroleum Research
Activities

SINTEF Petroleum Research is a research and development company located in Trondheim.

The Board wishes to thank the staff of SINTEF Petroleum Research for their excellent efforts in carrying out their work in 2001.

Petroleum prices remained high throughout 2001, producing a somewhat improved situation in the market for R & D services. This has had a positive effect on the second half of 2001.

The series of mergers in the petroleum industry continued in 2001, with the result that 14 of the Institute’s most important clients in 1998 have now been reduced to 6. Each of these mergers has meant the loss of an R & D budget, which has led to a significant change in the structure of the Institute’s market during the past four years.

The Institute needs to attract a steadily larger proportion of its turnover from abroad. Our marketing efforts in international growth areas have produced yet more contacts in the Gulf of Mexico, West Africa, South America and Iran. Looking back, we can affirm that the international strategy that we set out in 1999 has been extremely successful. The Institute has moved into the global arena in research-based services, where it has done very well. Given the size and reputation of the SINTEF Group, and not least SINTEF Petroleum Research’s own highly recognised knowhow and technology, we have demonstrated the right of the Institute to exist in the global market.

Organisation

At the end of 2001, SINTEF Petroleum Research was organised in terms of four scientific departments in addition to its management support functions, which consist of the institute staff and the computing department.

Personnel Situation

The Institute performed 71 man-years of work in 2001. At the end of the year SINTEF Petroleum Research employed 73 staff, 53 of whom were research scientists, of whom 27 hold doctorates (51%). A further 4 members of staff are currently working on doctorates. A total of 12 employees left SINTEF Petroleum Research in 2001, while 7 new members of staff joined the Institute.

In 2001, SINTEF Petroleum Research had two consultancy agreements with members of NTNU’s academic staff.

Two members of staff of SINTEF Petroleum Research have spent periods abroad in the course of 2001. One member of staff was appointed to a chair in the University of Thessaloniki and now has a 40% position with us, while another was on an exchange visit with Shell in the Netherlands.

Annual interviews with each individual member of staff are an important element of SINTEF Petroleum Research’s organisation development.

Publications

Fifty-six presentations were made at national and international conferences, and SINTEF Petroleum Research scientists were among the authors of 25 articles published in peer-reviewed journals. This is equivalent to 0.5 publications per Research Scientist man-year (0.3 in 2000).
Work Environment

The Work Environment Committee is a forum for close cooperation with our staff, at which information is exchanged and important work environment topics are taken up. The Committee held four meetings in 2001.

Virtually all suggested HSE measures were implemented in 2001. The following measures are particularly worth mentioning: risk assessments of laboratories, the radiation course, HSE datasheet course, fire and evacuation course, ergonomic improvements in offices and department-level measures to improve work enjoyment, cooperation and innovation.

Sick-leave in 2001 was 3.5%, as compared with 6.2% the previous year. The sick-leave picture is dominated by cases of long-term illness.

One accident involving personal injury occurred during the year, although the person concerned did not require sick-leave. The incident has been followed up on and the necessary measures taken.

External Environment

The company's HSE system satisfies the requirements of the internal control regulations. This helps to ensure, for example, that our laboratory activities and handling of chemicals do not lead to contamination of the work or external environments. This means that all chemical substances are dealt with and all waste is disposed of in accordance with current regulations. In 2001 there were no emissions of substances that required emission permits. No specific actions have been demanded by the Labour Inspectorate.

Annual Accounts

SINTEF Petroleum Research’s annual operating profit for 2001 was MNOK 1.3 (MNOK -1.2 in 2000). Net financial income was MNOK 4.6 (MNOK 4.0); this produced an annual profit of MNOK 6.0 (MNOK 2.8).

Investments and acquisitions of scientific equipment in 2001 came to MNOK 4.3 and MNOK 1.7 respectively, i.e. a total of MNOK 6.0.

The cash flow analysis shows a significant improvement in our net cash flow from operations, from MNOK -2.7 in 2000 to MNOK 21.7 in 2001. The Institute's cash holdings rose from MNOK 61.3 million in 2000 to MNOK 78.8 in 2001.

The company has been advised by letter by Trondheim Taxation Department that it is considering making SINTEF Petroleum Research liable to tax from 2001. The Board questions the legitimacy of full tax liability, and the possible effects of taxation have not been taken into account in the annual accounts for 2001.

Apart from the tax issue mentioned above, the Board is not aware of any circumstances that have arisen since the accounts were balanced that are of significance for evaluating the economic position of the Institute.

Continued Operation

The company’s equity has risen to MNOK 64.1, which is 60% of its total capital, of which in turn the Company’s original share capital is MNOK 9. This is a good basis for continued operation of the Company, which is the assumption on which the accounts have been drawn up.
Future Developments

The international petroleum market is still in the process of changing dramatically, and the Institute is rapidly adapting to changes in general conditions. Virtually all of capacity of the Institute for 2002 has been taken up. Our order reserve at the beginning of 2002 was 94% of our budgetted net income, as against 81% in 2001 and 73% in 2000. This is an indication of the positive state of development of the Institute, and the Board believes that it faces a bright future.

Disposition of Profits

The profit of MNOK 5.983 for 2001 will be transferred *in toto* to the company’s equity capital.
First row from left: Erik G. B. Lindeberg, Nils Spidsøe, Jofrid Klokkehaug
Second row from left: Hans Borge, Sverre Aam, Roar Arntzen, Jon Kleppe, Karl A. Berteussen, Ole Lindefjeld and Fridtjof Nyhavn.

Erik-Sverre Jenssen was absent when the photo was taken.
Basin Modelling

A source rock capable of generating petroleum is an essential prerequisite for finding accumulations of oil and gas deep in the earth. Nevertheless, the extent, type and quality of source rocks tend to be some of the least well-understood variables in the field of basin modelling. In order to help tackle this lack of knowledge, SINTEF Petroleum Research has developed the “OF-Mod” software package. This numerical modelling tool is now being used in a number of exploration studies for oil companies, such as in the Vøring area, at the Halten Terrace and off the coast of South America. Companies participating in these studies include Agip, BP, Conoco and TotalFinaElf.

We are currently planning to develop OF-Mod to do 3D modelling, and several oil companies have expressed their interest in such a tool. The other exploration tools that we have developed already operate in 3D (e.g. the secondary migration simulator, SEMI). A 3D version of OF-Mod would therefore fit well into our range of exploration tools. Since 3D OF-Mod will enable us to produce better models of how oil and gas are formed, it will make an important contribution to our ability to predict which phases (oil, water or gas) will be found in a well before it is drilled. Better phase prediction is also the subject of a Strategic Institute Programme (SIP) in basin modelling. This programme will make use of high-resolution “finger-printing” of selected hydrocarbon components to improve phase prediction. An important step forward this year has been the development of a method of modelling petroleum displacement from source rocks (primary migration) based on polymer solution theory. The method can explain the fractionation of petroleum components such as aromatics, polars, and different types of aliphatics, that has been observed in the process of primary migration.

The secondary migration simulator SEMI was licensed to five oil companies last year, and it has been utilised nationally and internationally by our clients in a number of basin modelling studies. We have used the model ourselves in a major study in the northern part of the Norwegian Sea (65 - 68° N, 3 - 10° E). Aker Geo
led this project, and the study has been sold to several oil companies.

The SEMI module for reconstructing palaeo-water depths (SEMI Palaeowater) has been further developed with support from Agip and Conoco. It is now possible to correct for isostasy and flexure, as well as to calibrate with palaeontological interpretations of water depths. The present method makes it possible to reconstruct a palaeobathymetric map for a whole basin in only a few minutes.

For Norsk Hydro we have carried out a study of the origin of the formation water in the Ormen Lange field. Several different possible mechanisms underlying the origin of this abnormally saline formation water have been considered, and the likelihood of each of them has been discussed on the basis of the geological development of this field.

As part of the "SMIFF2" research project, which is being carried out in collaboration with IFE and NGI, we have developed a prototype of a simulator that quantifies the minimum horizontal tension in formation ceiling rocks. This simulator is being used to calculate the time and location of possible hydraulic leakages in high-pressure prospects.

The department has been working for a long time on pore pressure on basin scale, and among other results, has developed the PRES-SIM pressure simulator. In collaboration with the Department of Well and Subsea Technology, we are currently further developing our methods to enable us to estimate pressure conditions along a well-path before drilling takes place. Calculations of this sort are becoming more important as exploration wells are being drilled at ever greater depths. Although this is important on the Norwegian continental shelf, overpressure is an even greater problem in the Gulf of Mexico, particularly where drilling is being carried out through salt domes. This has produced a good response to our technology among operators and service companies in the USA.

Seismics and Formation Physics

The considerable computing power available to the Institute enables us to perform computing-intensive seismic processing applications. The use of 3D AVO inversion to estimate rock parameters on the basis of seismic data has continued in 2001, for the most part in the course of two major interdisciplinary projects.
In SEISBAS, a three-year project that came to an end last year, seismic inversion and geological interpretations were deployed as input for improved basin modelling studies around Sleipner. In addition to internal funding, the project has been supported by two licenses and the EU’s Thermie Programme. This project was carried out in collaboration with Ødegaard A/S. Seismic inversion was also utilised in the EU’s SACS project, which dealt with monitoring CO₂ injection on Sleipner. This project is continuing in 2002.

The department is at the leading edge of research in the processing and analysis of seabed seismics. The IPOBS project has developed software for full elastic imaging of multicomponent (4C) seismics in media with anisotropy and attenuation. At the moment, there is some uncertainty within the industry regarding whether the high costs of gathering ocean bottom seismic data will pay off in terms of improved seismic imaging and thus improved revenues from fields. One of the problems seems to be that the measurement technology itself is more complex than in traditional seismics, and quality control of the data may be of decisive importance in avoiding misinterpretation. In the project “Vector Fidelity”, which is receiving support from five major oil companies, we will develop new methods and standards for such quality control of ocean bottom seismic measurements, in addition to designing and calibrating correction routines to correct these problems. This will be done in collaboration with various members of the service industry.

A new area of major effort for SINTEF Petroleum Research is “seismics during drilling”, as a tool for improving safety during deepwater drilling. This is essential for the exploitation of the important deepwater finds that have been made during the past few years, for example in the Gulf of Mexico. The department has developed concepts for advanced imaging techniques based on Vertical Seismic Profiling (VSP), and some of these have been tested in the course of a project for Statoil. One of the aims is to allow the prediction of potential zones of overpressure that the drill-bit risks encountering, something that is very difficult to do on the basis of seismic data alone. By combining seismic parameter estimation and pressure modelling (see the Basin Modelling Department’s PRESSIM) the reliability of the method can be considerably improved. As part of this we have also started a three-year project entitled “Well Planning from Seismic Data: Establishing the Geomechanical Link”, which has the objective of developing tools for determining recommended drilling fluid density on the basis of seismic data.

INFAMI is a new three-year EU project which we are carrying out in collaboration with Norsk Hydro, BG, University College, Dublin and the University of Aarhus. It centres on the development of software that takes mud lubrication in faults during hydrocarbon migration simulations. The project is based on SEMI, and it includes the development, implementation and validation of the methodology using data from several oil fields. This project is being performed in collaboration with the Department of Basin Modelling.

In the mid-90s the petroleum industry began to realise that hydrocarbon production can be increased if the criterion of zero sand production can be modified and a certain amount of sand production can be accepted. The aims of research on sand production have thus moved from the determination of initial sand production in the 80s to the prediction of total sand production and sand-rate in the 90s. The research project entitled “Volumetric Sand Production I”, which started in 1998 and came to an end in
2001, and was supported by Conoco, Norsk Hydro, Statoil and Shell, developed first-generation sand prediction models capable of estimating the expected mass and rate of sand production throughout the lifetime of a well under given production scenarios. “Volumetric Sand Production II” started in 2001, with Norsk Hydro, Conoco, Statoil, Agip, Shell and Petrobras as participants. This project focuses on developing the prediction models in terms of understanding and proper modelling of the coupling between failure and sand removal in a sandstone formation. Studies already carried out have shown that the presence of water in produced fluids significantly increases the amount of sand produced, and we are currently trying to quantify and model this effect. Sand production in high flow-rate gas reservoirs is also being studied, as such conditions can lead to a different type of behaviour and may require a separate gas-reservoir option in the prediction models.

Well and Subsea Technology

The large-scale facility at Tiller was officially reopened in June 2001 by Conoco, the first new user of the facility for studies of wellstream transport from deepwater fields. In collaboration with Conoco, SINTEF has been working intensively for the past year to implement a continuation of the results of the ACMAR Strategic Institute Programme in a major new long-term programme in multiphase modelling and simulation. In November, we succeeded in establishing a partnership involving Conoco, TotalFinaElf and SINTEF for the development of a next-generation multiphase simulator - LEDA. Our aim is to develop a commercial tool that will be capable of handling multiphase flows in complex geometries, with complex fluids. This tool will function as a virtual laboratory in which it will be possible to study the behaviour of fluids under dynamic flow conditions in wells, pipelines and process plants.

The LEDA project has a time horizon of nine years. The first round will consist of a three-year agreement with a budget of MNOK 51, of which SINTEF will invest MNOK 6.

The demand for our services in the gas hydrate field has been high, particularly in the second half of 2001. A hydrate course has been supplied to Elf Exploration Angola’s operators on the Girassol field and to FMC Kongsberg Subsea, for developers of subsea production systems. We have also made several deliveries in connection with BP’s deepwater fields in the Gulf of Mexico, and have carried out studies of plugging tendencies on Hydro’s Gjøa field, in addition to the start of ice and hydrate studies for Ormen Lange. In connection with contracts for

![Image of well and subsea technology](image.png)

**The large scale SINTEF Multiphase Flow Loop, located at Tiller just outside Trondheim, will be upgraded in several areas in order to deliver new and unique data to the LEDA project (see main text). The flow facility will be fully occupied to mid summer 2004.**
BP we have developed a 1000-bar real conditions wheel simulator. This tool ought also to be of interest to upcoming high-temperature and high-pressure (HPHT) field developments on Haltenbanken in the Norwegian Sea.

On behalf of Statoil we have built a new riser on the three-phase facility, and this has been instrumented to test out control algorithms for damping or removing large fluid plugs in seabed transport pipelines (plug control). The results of these studies have verified the methods implemented by Statoil on the company’s pipeline from Heidrun Nord to Heidrun TLP. Similar measures are being planned for other fields on the Norwegian shelf.

SINTEF’s work in Iran has opened up the prospect of new and interesting challenges in drilling and well technology. A contract with NIOC to draw up a plan for the development of Iran’s Azadegan field has demonstrated that we are fully competent to perform concept design and pre-engineering studies on drilling and well facilities for field developments.

The need for safer and more rapid drilling and improved well productivity places great demands on planning processes and new technology. Risks associated with abnormal pressure regimes, hard formations with low penetration rates and mechanical problems, logistical challenges and heavy oil problems all demand efficient operational solutions. In Iran we can see great potential for improvement in these areas. More stringent environmental requirements, which are particularly evident in the Azadegan project, where field development is taking place in wetlands and other eco-sensitive areas, offer many exciting challenges.

The department has consciously gone in for the development of good relationships with Iranian professionals, and a good basis has been developed for future deliveries of drilling and well technology services. Collaboration has been initiated with Statoil with the aim of solving drilling and well technology problems in Iran. This field of cooperation also includes the engagement of, and provision of professional and financial support to, Iranian students in connection with their M.Sc. and Ph.D. studies at NTNU.

Environmentally safe field development both in Norwegian Waters (Norwegian Sea and Barents Sea) and the mid-East is a growth area, with a need for both innovatory operational solutions and more R & D. Several of the projects that started in 2001 have indispensable environmental requirements as technology drivers. This gives us room for further interdisci-
plinary cooperation, both in order to minimise potential initial problems and to develop efficient measures for dealing with them. Examples include safer drilling, improved pressure prediction and better ways of dealing with produced water with the aid of advanced well and subsea production technology.

In the Strategic Institute Programme “Intelligent Wells” we are currently developing a new simulator concept: “Smart Asset Value Evaluation” (SAVE), a process simulator for oil and gas fields based on the use of remote monitoring and steerable control systems for selective production and injection in pay zones in wells. The simulator is being designed to function as a real-time monitoring and control system for the optimisation of production from this type of fields. At the same time, the simulator will be capable of being used as a planning aid. A demonstration version of the simulator is expected to be ready in the second quarter of 2002. SAVE is being developed in cooperation with SINTEF Electronics and Cybernetics, which has developed process simulators for the Norne, Heidrun and Åsgard fields.

The department intends to increase its efforts in well instrumentation, with special emphasis on new downhole sensors and wireless communication. For this reason, we have built up a sensor development laboratory at Tiller. In 2000, we supplied an acoustic communication system for Petrotech’s downhole fluid sampler. SINTEF is Petrotech’s preferred partner for its new SILD project (DEMO 2000), in which the company is collaborating with Halliburton and Statoil in the development of a system for downhole well and fluids testing.

In connection with the instrumentation of the HPHT gas condensate wells on the Kristin field, we are cooperating with Poseidon and Siemens Technology to develop a wireless downhole reservoir monitoring system for permanent pressure and temperature recordings at depths of about 5600 m and temperatures close to 170°C.

Multi-component (4C) seabed seismics is a methodology with a large potential for enhancing subsurface characterization, and its becoming more widely used. The methodology is particularly interesting for permanent monitoring in so-called instrumented oilfields or e-fields. A critical factor, often limiting the usefulness of today’s 4C seismic is the “vector fidelity” of the data acquisition system or its ability to render the true seismic vector field. Together with the Department of Seismics and Formation Physics, we have now established a long-term industry consortium called Vector Fidelity. Five oil companies and 3 service companies participate in the consortium. The objectives are to establish an industry standard for specifying data quality as well as developing correction methods for data lacking vector fidelity and as well as providing an experience database to improve the success rate of applying multi-component seabed seismics.

Reservoir Technology

In 2001, the department experienced a rise in project commissions in comparison with the year before. One important reason for this is that the goal-oriented efforts of the Institute and the department to secure contracts in Iran have brought in a number of projects, some of them large. However, we have also experienced an upturn in more traditional R & D work.

Following the first Iran project in autumn 2000, the Institute was given the task of drawing up a master development plan for the Azadegan field. This field is one of the biggest petroleum discoveries that has been made during the past ten years. A master development plan is equivalent
to the simplified plan for recovery and production that is drawn up for all Norwegian fields. The department was responsible for reservoir modelling and simulation, calculating surface equipment requirements and drawing up simple financial calculations. A wide range of activities in this project were also carried out by other departments, enabling the Institute to hand over a complete product in cooperation with our joint venture partner RIPI (the research institute of the Iranian National Oil Company NIOC). RIPI staff were located at SINTEF Petroleum Research for a large part of the project. Since completing the project we have assisted NIOC on several occasions on a project basis dealing with questions relating to development of this field.

In collaboration with NIOC and Norwegian oil companies, we have been working for some time on setting up a research programme in Iran that will focus on improved petroleum recovery. Following the signing of a cooperative agreement by NIOC, Statoil and SINTEF Petroleum Research, the department has participated in implementing the aims of this agreement.

Participation in the SACS project, in which CO$_2$ injection into the Utsira formation is being followed up, was another important activity for the department in 2001. Problems associated with CO$_2$ deposition were also dealt with in other projects, both in connection with the Utsira injection programme, the use of CO$_2$ for improved oil recovery and elsewhere. In the latter category we might mention our participation in the international "Carbon Capturing Project" (CCP), in which the department will study the possibility of CO$_2$ leaking from deposits via abandoned wells. The great interest shown in the general problem of CO$_2$ by the authorities and industry may lead to a further growth in demand for the expertise of the department in this wide-ranging field.

The department is taking part in the Strategic Institute Programme "Intelligent Wells", in which we have been working primarily on developing simplified reservoir models for use in automatic control systems for intelligent wells. Another project has developed a method for making history matching of various reservoir models more efficient, in order to enable production prognoses to be drawn up with a greater degree of confidence.

The department operates a high-pressure and temperature laboratory for fluid analysis and advanced core analysis, using equipment that also allows various other types of special study to be carried out. Good cooperation with Statoil has led to a number of projects that focus on profile control and various other aspects related to near-well phenomena. Other activities in the laboratory included measurement of relative permeability, studies of precipitation and transportation of asphaltenes in porous materials and measurements of interfacial tensions. The department is also involved in a number of multidisciplinary projects within SINTEF, which make use of our laboratory resources and general expertise.

Simulated convective plumes of CO$_2$ rich brine propagating from a gas/brine contact.
## Income statement (mNOK)

### Operating income

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>External projects</td>
<td>57,380</td>
<td>50,003</td>
</tr>
<tr>
<td>Project funding from Research Council of Norway</td>
<td>17,601</td>
<td>18,796</td>
</tr>
<tr>
<td>Basic funding from Research Council of Norway</td>
<td>4,000</td>
<td>4,500</td>
</tr>
<tr>
<td>Other income</td>
<td>143</td>
<td>695</td>
</tr>
<tr>
<td><strong>Gross project income</strong></td>
<td><strong>79,125</strong></td>
<td><strong>73,994</strong></td>
</tr>
<tr>
<td>- Direct project expenses</td>
<td>-19,623</td>
<td>-16,357</td>
</tr>
<tr>
<td><strong>Net operating income</strong></td>
<td><strong>59,502</strong></td>
<td><strong>57,637</strong></td>
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### Operating expenses

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages and social expenses</td>
<td>37,367</td>
<td>37,844</td>
</tr>
<tr>
<td>Ordinary depreciation</td>
<td>2,201</td>
<td>4,489</td>
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<tr>
<td>Other operating expenses</td>
<td>18,597</td>
<td>16,529</td>
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<tr>
<td><strong>Total operating expenses</strong></td>
<td><strong>58,166</strong></td>
<td><strong>58,863</strong></td>
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</table>

### Operating income / loss

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating income / loss</strong></td>
<td>1,336</td>
<td>-1,226</td>
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### Financial income and expenses

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>4,673</td>
<td>4,500</td>
</tr>
<tr>
<td>- Financial expenses</td>
<td>-26</td>
<td>-462</td>
</tr>
<tr>
<td><strong>Net financial income</strong></td>
<td><strong>4,647</strong></td>
<td><strong>4,038</strong></td>
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### Income

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income</strong></td>
<td><strong>5,983</strong></td>
<td><strong>2,813</strong></td>
</tr>
</tbody>
</table>

### Dispositions

<table>
<thead>
<tr>
<th>Source</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferred to the equity</td>
<td>5,983</td>
<td>2,813</td>
</tr>
</tbody>
</table>
Distribution of gross operating income by client

Contracts 73%
- industry and commercial enterprises 43%
- international contracts 28%
- public sector 2%

Research Council of Norway 27%
- strategic programs other SINTEF institutes 7%
- strategic programs 15%
- basic grants 5%
Distribution of gross operating income by project duration

- Short terms commissions 28%
- Programs < 2 years 39%
- Programs > 2 years 33%

Distribution of employees by position

- Researchers 73% (of whom Dr.ing. 50%)
- Administrative staff 9.5%
- Engineers 9.5%
- Technical staff 8%
Balance sheet (mNOK)  
Balance sheet on 31 December

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>2001</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific equipment</td>
<td>4,429</td>
<td>2,571</td>
</tr>
<tr>
<td>Office equipment, vehicles, inventories</td>
<td>217</td>
<td>15</td>
</tr>
<tr>
<td>Deposits, companies within the SINTEF Group</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Other shares</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td><strong>Total fixed assets</strong></td>
<td>4,696</td>
<td>2,712</td>
</tr>
<tr>
<td><strong>Current assets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project in progress</td>
<td>1,961</td>
<td>1,545</td>
</tr>
<tr>
<td>Accounts receivable</td>
<td>21,352</td>
<td>27,706</td>
</tr>
<tr>
<td>Acc. receivable, companies within the SINTEF Group</td>
<td>343</td>
<td>1,979</td>
</tr>
<tr>
<td>Other accounts receivable</td>
<td>404</td>
<td>253</td>
</tr>
<tr>
<td>Other shares</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Investments</td>
<td>47,081</td>
<td>23,282</td>
</tr>
<tr>
<td>Cash, bank accounts</td>
<td>31,717</td>
<td>37,972</td>
</tr>
<tr>
<td><strong>Total current assets</strong></td>
<td>102,934</td>
<td>92,737</td>
</tr>
<tr>
<td><strong>TOTAL ASSETS</strong></td>
<td>107,630</td>
<td>95,449</td>
</tr>
</tbody>
</table>

| EQUITY AND LIABILITIES | | |
| **Equity** | | |
| Share capital (900 shares at NOK 10,000) | 9,000 | 9,000 |
| Other equity | 55,111 | 49,128 |
| **Total equity** | 64,111 | 58,128 |
| **Liabilities** | | |
| Long-term liabilities | 1,163 | 711 |
| Delivery liabilities | 3,131 | 1,349 |
| Liabilities, VAT, tax deductions, social security, etc. | 3,822 | 3,715 |
| Payment in advance | 24,995 | 22,113 |
| Liabilities, companies within the SINTEF Group | 5,470 | 3,673 |
| Other short-term liabilities | 4,938 | 5,759 |
| **Current liabilities** | 42,356 | 36,610 |
| **Total liabilities** | 43,519 | 37,321 |
| **TOTAL EQUITY AND LIABILITIES** | 107,630 | 95,449 |
### Net profit/Net operating income

![Net profit/Net operating income graph](image)

#### Equity/Equity-to-assets ratio

![Equity/Equity-to-assets ratio graph](image)
Employees as of 1 January 2002

Administration Support
- Berg-Hanssen, Harald
- Flo, Rune
- Fossum, Berit
- Sagmo, Mette A.
- Sneen, Marit

Basin Modelling
- Borge, Hans
- Guldseth, Bodil
- Hamborg, Martin
- Kjennerud, Tomas
- Lind, Kristin
- Mann, Ute
- Myhr, May Britt
- Mork, Mai Britt E.
- Ritter, Ulrich
- Tømmerås, Are
- Weiss, Hermann M.
- Zweigel, Janine

Seismic and Formation Physics
- Bøe, Reidar
- Causse, Emmanuel
- Cerasi, Pierre
- Dong, Hefeng
- Fjær, Erling
- Gotusso, Angelamaria P.
- Holt, Rune Martin
- Larsen, Idar
- Lothe, Ane Elisabet
- Lund, Hans
- Lynum, Ingunn
- Maa, Frank
- Nes, Olav Magnus
- Papamichos, Euripides
- Schei, Grethe
- Stavrum, Johannes
- Sylta, Øyvind
- Sønstebø, Eyvind F.
- Zweigel, Peter
- Østmo, Svend

Subsea and Well Technology
- Carlsen, Inge Manfred
- Dahl, Arne Morten
- Gustavsen, Karl G.
- Habetinova, Eva
- Jacobsen, Kjell Arne
- Kjølaas, Jørn
- Kristiansen, Olav
- Ladam, Yves
- Larsen, Roar
- Larsen, Rolf Erik
- Lervåg, Johan H.
- Mjåland, Svein
- Nakken, Erik I.
- Nyhavn, Fridtjof
- Onsrud, Gisle
- Sneeggen, Cecilie
- Straume, Erland
- Sorvik, Atle
- Wanvik, Hilde
- Ytrehus, Jan David
- Øyangen, Terje

Reservoir Technology
- Akervoll, Idar
- Bergmo, Per Erik
- Bjørkvik, Bård
- Bjørseth, Eva Kristin
- Frigård, Oddmund
- Ghaderi, Amir
- Holt, Torleif
- Lindeberg, Erik G. B.
- Moen, Arild
- Mark, Atle
- Vassenden, Frode
- Wessel-Berg, Dag

Employees legend by % as of 1 January 2002

Legend
- scientist
- engineer
- technical staff
- administrative personnel

- Researchers 73%
- Engineers 9.5%
- Administrative personnel 9.5%
- Technical staff 8%
Organisation as of 1 January 2002

Management

David Lysne .................. President
Grethe Schei ................ Research Director, Seismics and Formation Physics Department
May Britt Myhr ............... Research Director, Basin Modelling Department
Erik Iversen Nakken .......... Research Director, Subsea and Well Technology Department
Torleif Holt .................. Research Director, Reservoir Technology Department

Board of Directors, 2002

Nils Spidsøe (chairman) ...... Managing Director, Sinvent AS
Roar Arntzen ................ President, SINTEF
Karl Andreas Berteussen ...... Director, PGS Reservoir AS
Hans Borge ................... Senior Scientist, SINTEF Petroleum Research
Erik-Sverre Jenssen .......... Director, Norsk Hydro ASA
Jon Kleppe .................... Professor, IPT, NTNU
Jofrid Klokkehaug .......... Sector Manager, Statoil
Erik Lindeberg ............... Senior Scientist, SINTEF Petroleum Research
Ole Lindefjell ................. Sr. Technical Development Coordinator, Norske Conoco AS
Fridtjof Nyhavn .............. Senior Scientist, SINTEF Petroleum Research
SINTEF Group

With its 1700 employees, Norway’s SINTEF Group is the largest independent research organization in Scandinavia. We supply intelligent and profitable solutions to our customers’ problems. Our products consist of knowledge and related services based on research in technology, the natural and social sciences and medicine. Our turnover in 2001 was NOK 1.7 billion. Contracts for industry and the public sector generate more than 90% of our income, while 7% came in the form of basic grants from the Research Council of Norway.

Our vision and mission: SINTEF’s vision is technology for a better society. We sell research-based knowledge and related services to Norwegian and international clients. SINTEF contribute to the value-adding processes of our customers and a sustainable social development.

Partners in cooperation: SINTEF collaborates closely with the Norwegian University of Science and Technology (NTNU) and the University of Oslo (University of Oslo). Personnel from NTNU work on SINTEF projects, while SINTEF staff teach at NTNU. The SINTEF-NTNU community involves the widespread joint use of laboratories and equipment. We are in the course of developing a similar program of cooperation with the Faculty of Mathematics and Natural Sciences at the University of Oslo.

International cooperation: Contracts for overseas clients generated 13% of our turnover in 2001. About half of our international turnover is derived from EU research programmes.

Quality assurance: SINTEF is committed to ensuring that we produce high quality deliverables. This means that our products are to be relevant and useful for our clients, maintain high scientific and quality standards, and be presented professionally. If required by clients, our quality assurance ensures that our projects meet the requirements of NS-EN ISO 9001 quality standards. Many of our laboratories are accredited according to EN 45001 or the GLP scheme.

The SINTEF foundation consists of eight research institutes:

- SINTEF Applied Chemistry
- SINTEF Applied Mathematics
- SINTEF Civil and Environmental Engineering
- SINTEF Electronics and Cybernetics
- SINTEF Industrial Management
- SINTEF Materials Technology
- SINTEF Telecom and Informatics
- SINTEF Unimed

The SINTEF Group includes four research companies:

- SINTEF Energy Research
- SINTEF Fisheries and Aquaculture
- SINTEF Petroleum Research
- MARINTEK - Norwegian Marine Technology Research Institute

The SINTEF Group identified business areas:

- SINTEF Oil and Gas
- SINTEF Public Sector
- SINTEF BioMarine Industry