
Report SGC 029

**CATALOGUE OF GAS TECHNOLOGY
RESEARCH DEVELOPMENT AND
DEMONSTRATION PROJECTS
IN SWEDEN**

Issue no. 4

September 1992



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Foreword

The present catalogue is the fourth compilation of RD&D (Research, Development and Demonstration) projects in gas research in Sweden. For the present, only natural gas and LPG-related projects are included. However, other areas of energy gas, for example, biogas, coal gas and hydrogen gas, may be added in time. The catalogue is up-dated every year.

The concept RD&D has been given a broad interpretation in the catalogue. Because gas technology is relatively new in Sweden, it seems justified to include even those projects that are not, strictly speaking, RD&D projects, if they contribute to the general advancement of knowledge in the area of gas technology.

The projects have been classified into nine areas in accordance with the list on the next page. Each area encompasses projects that have been completed, are in progress, or are in the planning stage. Projects completed in and before 1989 are not included here, but can be found in the previous issues of the project catalogue. For certain of the planned projects, nothing is found under the headings, "ordered by/financed by" or under "carried out by". Such projects are, for all practical purposes, to be considered project ideas which can be taken up and developed by any interested party.

Information about the projects can be obtained from the persons listed as project leaders, contact persons, etc. At the end of the catalogue, you will find the addresses of the companies where the contact persons may be reached. Reports from Vattenfall (Swedish State Power Board) can also be obtained from their Älvkarleby laboratory. In general all reports are in Swedish.

Swedish companies and organizations conducting or planning to conduct a project not included in this catalogue are encouraged to send in project data to the Swedish Gas Technology Center, Ltd (SGC). The projects will thereby be published in the next issue of the catalogue.

SGC is a joint organization of the Swedish Gas Association (Svenska Gasföreningen), Vattenfall Natural Gas Ltd (Vattenfall Naturgas AB) Southern Gas, Ltd (Sydgas, AB), Southern Sweden Power Supply Ltd, (Sydkraft AB), Malmö Energy Ltd (Malmö Energi AB) and Gothenburg Energy Ltd (Göteborg Energi AB).

Classification by area of Research-Development-and-Demonstration within ENERGY GAS TECHNOLOGY

- 1 General research and development, e.g. combustion, emissions, gas analysis, gas quality, interchangeability
- 2 Exploration, recovery and production
- 3 Transmission, distribution, storage
- 4 Industrial applications
- 5 Space heating, applications for households and related areas
- 6 Gas engines and gas-based cogeneration
- 7 Other uses of gas, e.g. CO₂-in plant cultivation, heat pumps, vehicles and chemical raw materials
- 8 Measurement technologies
- 9 Additional areas of interest, e.g. security, standards, manuals, load management, environmental impact

(The term gas includes as well LPG and LNG.)

ABBREVIATIONS USED IN THIS CATALOGUE

Organizations	BFR	Swedish Council for Building Research, Stockholm (Byggforskningsrådet)
	DTI	Department of Control and Maintenance, Lund Institute of Technology (Drifttekniska Institutionen vid LTH, Malmö)
	EGIL	The Gas Research Institute, Lund Institute of Technology, Lund (Energigasinstitutet vid LTH, Lund)
	FTC	Combustion Centre, Lund Institute of Technology, Lund (Förbränningstekniskt Centrum, LTH, Lund)
	GC	The Gas Centre (GasCentrum). Ceased to exist in the Spring of 1990. Its activities were transferred to the Swedish Gas Technology Center (SGC)
	GE	Gothenburg Energy Ltd (Göteborg Energi AB)
	GU	The University of Gothenburg (Göteborgs Universitet)
	KTH	Royal Institute of Technology (Kungl Tekniska Högskolan, Stockholm)
	LTH	Lund Institute of Technology (Lunds Tekniska Högskola)
	LU	Lund University (Lunds Universitet)
	ME	Malmö Energy Ltd (Malmö Energi AB)
	NGC	Nordic Gas Technology Center (Nordisk Gasteknisk Center)
	NUTEK	National Board for Industrial and Technical Development (Närings- och teknikutvecklingsverket)
	SA	The Swedish Plant Inspectorate, Stockholm (Statens Anläggningsprovningar)
	SAMKO	The Southern Gas Company's Joint Committee (Sydgasföretagens samarbetskommitté)
	SEU	Swedish Energy Development, Ltd (Svensk Energiutveckling AB)
	SG	Southern Gas, Ltd (Sydgas AB)
	SGC	Swedish Gas Technology Center Ltd (Svenskt Gastekniskt Center AB)
	SGF	Swedish Gas Association (Svenska Gasföreningen)
	SK	Southern Sweden Power Supply (Sydkraft AB)
	SKKB	Southern Sweden Power Supply Consultants, Ltd (Sydkraft Konsult AB)
	SNV	National Environmental Protection Agency (Statens Naturvårdsverk)
	SP	National Testing Institute (Statens Provningsanstalt)
	SSF	Sydkraft's Research Foundation (Sydkrafts Forskningsstiftelse)
	STATT	Swedish Technical Attaché system (Sveriges Tekniska Attachéer)
	STEV	The National Energy Administration (Statens Energiverk, now NUTEK)
	STU	The National Board for Technical Development (Styrelsen för Teknisk Utveckling, now NUTEK)
	SV	Swedish State Power Board (Vattenfall AB, Stockholm)
	SVSS	A joint organization of SwedeGas, The Swedish State Power Board, Sydgas and Sydkraft (Ceased to exist in the Spring of 1990. Its activities were transferred to the Swedish Centre for Gas Technology (SGC)
	SWG	SwedeGas, Ltd, now Vattenfall Natural Gas Ltd
	TFB	Transport Research Board (Transportforskningsberedningen)
	TG	Terminal Gas, Ltd (Terminalgas AB)
	TVE	Theorell and VBB, Energy Consultants (Theorell och VBB Energikonsulter)
	VES	Vattenfall Energy Systems Ltd (Vattenfall Energisystem AB)
	VF	Thermal Engineering Research Institute (Värmeforsk, Stockholm)
	VNG	Vattenfall Natural Gas Ltd (Vattenfall Naturgas AB)
	ÅF	The Swedish Steam Users Association Consultants (ÅngpanneFöreningen, ÅF Energikonsult)

Schedule

Compl	The project has been completed
Compl 1990	The project was completed in 1990
Compl Feb 1990	The project was completed in February of 1990
Curr	The project is currently in progress
Curr 1990--1992	The project began in 1990, estimated completion: during the course of 1992
Plan	The project is planned
Plan 1993	The project is planned to be carried out in 1993

1. GENERAL RESEARCH AND DEVELOPMENT

Internal project designation	PROJECT NAME Project description	Ordered by/ Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
STU 88-4139	PULSATING COMBUSTION WITH LOW FREQUENCY SOUND Introduction stage.	STU	Teknisk akustik, CTH	Compl Aug 1990	Elizabeth Lindqvist, NUTEK
VF G8-806	LIMITATION OF NO _x BY WATER INJECTION. PHASE 1 – PRELIMINARY STUDY A study of the feasibility of limiting NO _x formation in boilers by using water injection, including a proposal for a main study comprising practical experiments.	Värmeforsk	TVE	Compl Dec 1990	Göran Fermbäck, VBB VIAK VF report no 384
VF G8-819	CATALYTIC BURNERS FOR NATURAL GAS Development of a catalytic burner for natural gas Part 1. Obtaining model-scale burners.	Värmeforsk	Katator HB	Compl Jan 1991	Jan Brandin, Katator HB VF report no 396
SV 98453 14001	VARIATIONS IN GAS QUALITY Light is shed on the following issues: What variations can occur? How well do various devices available at present cope with such variations? Is it possible to recommend limit values and test methods?	Vattenfall	Vattenfall, BES section	Compl 1991	Kjell Steen, BEP, Vattenfall
VF G8-706	EMISSIONS DURING TURBULENT COMBUSTION The project, designed to provide new knowledge of the area, includes evaluation of various calculation techniques for the prediction of emissions during turbulent combustion.	Värmeforsk	LTH, Värme- och Kraftteknik	Compl 1992	Tord Torisson, Värme- och Kraftteknik, LTH Various post graduate research reports. Internal brief VF report
STEV 656 083	VARIATIONS IN GAS TEMPERATURE AND ITS EFFECT ON OPERATION AND MAINTENANCE An investigation into how temperatures of as low as -30 °C influence the functioning as well as of the reliability of safety and control equipment.	NUTEK	DTI	Compl 1992	Sören Dahlin, DTI
VF G1-103	CATALYTIC BURNER FOR NATURAL GAS. A CONTINUING PROJECT. STAGE 1 <u>Objective:</u> To obtain deeper knowledge of a burner model that was produced earlier as a basis for the development of a prototype burner. <u>Description:</u> In an earlier project (G8-819) a catalytic burner was developed. In the project will be investigated: – other materials, especially ceramic fibers – fuel supply in detail – the activity profile in the bed – alternative material in the thermal buffer – LNG and hydrogen (previously only natural gas)	Värmeforsk	Katator, Lund	Compl 1992	Lars H Andersson, Katator HB VF report is expected during autumn 1992

1. GENERAL RESEARCH AND DEVELOPMENT

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
STEV 276 282	COMBUSTION TECHNOLOGY Basic experimental studies of chemical combustion kinetics.	NUTEK	LTH, Fysik	Curr 1986- -1993	Marcus Aldén, Fysik, LTH
STEV 276 150	CATALYTIC DENITRIFICATION Catalytic reduction of NO _x .	NUTEK	LTH	Curr 1987- -1992	Ingemar Odenbrand, LTH
STEV 656 100	SETTING UP A GAS RESEARCH LABORATORY AT THE LUND INSTITUTE OF TECHNOLOGY	NUTEK	Värme- och Kraft, LTH	Curr 1988- -1992	Tord Torisson, Värme o Kraft, LTH
STU 89-1039 90-928 90-180	SYSTEMS FOR AIR/FUEL-RATIO REGULATION A study of control systems, inter alia control systems with pneumatic (as opposed to mechanic) coupling between air and gas. Post graduate research.	NUTEK	DTI	Curr 1989- -1992	Sören Dahlin, DTI
SV 93741	NATURAL GAS COMBUSTION, A STUDY OF MODELS Development of various methods for calculation of combustion processes with applications for combustion chambers and steam boilers, that is, for production of electricity and heat.	Vattenfall/ /SV, SK, ABB Stal	Värme och Kraft, LTH	Curr 1989- -1992	Tord Torisson, LTH
STU 88-4140	PULSATING COMBUSTION Theoretical aspects of pulsating combustion. Development of simulation models in conjunction with experimental studies	NUTEK	LTH Mekanik, Värme o Kraft	Curr 1989- -1993	Ebbe Lundgren, LTH, Mikael Näslund, LTH
	DIRECT USE OF GAS CONDENSATE Techniques for transit and variations in quality, inter alia, are studied.	Vattenfall	Vattenfall	Curr 1990- -1992	Kari Lähdemäki, Vattenfall Energi-system AB
SGC 90.62	THE 1990--1993 THE GAS TECHNOLOGY PROGRAM AT THE THERMAL ENGINEERING RESEARCH INSTITUTE (VÄRMEFORSK) The objective is to generate R&D results that are useful for the industry. Such results shall be of a scientific nature with the emphasis on research. Individual projects will be approved by the Institutes' research group for gas technology, which includes representatives from SGC. There will be on-going progress reports in the form of Värmeforsk Reports.	Värmeforsk/ /Government and commercial and industrial life		Curr 1990- -1993	Total costs 4,0 MSEK Karin Förstberg, VF Jörgen Thunell, SGC See also particular VF-projects
STEV 276 262	FORMATION AND REDUCTION OF NITROGEN COMPOUNDS Investigation of formation and reduction of nitrogen compounds in laminar flames and flow vectors.	NUTEK	CTH	Curr 1991- -1993	Jim Olsson, CTH

1. GENERAL RESEARCH AND DEVELOPMENT

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
VF G1-202	RESEARCH BOILER AT THE ROYAL INSTITUTE OF TECHNOLOGY (KTH) A research boiler of 14 MW for, inter alia, natural gas has been installed.	NUTEK	KTH	Curr 1992-	Sten Frostäng, NUTEK Gunnar Svedberg, KTH The boiler is in drift.
	CATALYTIC LAYERS IN HEAT EXCHANGERS <u>Objective:</u> To increase the knowledge of catalytic combustion and, at the same time, heat exchange conditions in the industrial processes. <u>Description:</u> The project consists of four parts: - A survey of the areas of application for the technique in question - Investigation of methods for coating of a heat exchanger surface with a catalyst - Development of a simulation model - Practical testing in a model heat exchanger	Värmeforsk	Katator HB Lund	Curr 1992- -1993	Lars H Andersson, Katator HB, Lund Proj cost 0,7 MSEK
	CATALYTIC COMBUSTION Investigation into the conditions for initiating basic research and development efforts in Sweden.	NUTEK	Technology Institute	Plan 1992	Stefan Montin, NUTEK Bengt Kasemo, CTH Sven Järås, KTH

2. EXPLORATION, RECOVERY, PRODUCTION

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SV 98460	THE DEEP GAS PROJECT A geological and scientific evaluation.	Vattenfall	Vattenfall	Compl 1991	Hans Gransell, Vattenfall A number of sub- reports are available.

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SV 98452 02030	DETAILED PLANNING OF NATURAL GAS SYSTEMS WITH PC-CAD Information transfer between different types of CAD-systems, education, evaluation and test-planning.	Vattenfall	Vattenfall	Compl 1990	Lars Winter, BEP, SV
SVSS 89.06 SK 90.24	NON DESTRUCTIVE TEST OF PE-JOINTS. A PRELIMINARY STUDY Literature search and compilation of data on international equipment and experience. Evaluation of reliability.	SG/ /SK, SV	SA, Stockholm	Compl 1990	Rolf Mårtensson, SG
SGC 89.07	THE EFFECTS OF LPG CONDENSATE ON PE-PIPES The project goal was to examine the influence of odourants and LPG condensate on PE-tubes. Used as well as new, black and yellow, PE-tubes have been tested. Results from welding tests show that butt welding should be avoided for tubes which have been in operation with LPG or natural gas for a long period of time.	Lunds Energiverk/ /GC, Vattenfall	TUMAB, Landskrona	Compl 1991	Rolf Jönsson, Lunds Energiverk Fleming Varmedal, TUMAB Report SGC 012
VF G8-911	VACUUM INSULATION FOR CONDENSED NATURAL GAS A study of the conditions required for the introduction of components (pipe lines, etc.) composed of an outer and inner casing with infusorial silicon under vacuum as insulation.	Värmeforsk	Studsvik	Compl 1990	Stefan Swebilius, Studsvik VF report no. 374
	ANALYSIS OF RISKS IN LPG STATIONS The purpose is to determine the risk for personal injury as well as damage of material. The analysis includes determination of the rated cases of injury or damage as well as probability-and-consequence analysis of the dominant sequence of events.	Sydskraft, Neste	Sydskraft, TVQ section	Compl 1990	Sigvard Trönell, SKKB Internal report is available.
SV 93753	COMPONENTS FABRICATED IN COMPOSITE MATERIALS Preliminary study of components in composite material for distribution networks as well as demonstration of pressure vessels for a natural gas bus in Malmö.	SwedeGas, Vattenfall, ABB Plast, Industridep	ABB Plast, Vattenfall, BEP section	Compl 1990	Rolf Mattsson, Sture Öqvist, ABB Plast Björn Svensson, VNG SV report UG 89-2
SK 90.14	REPAIR METHODS FOR HIGH PRESSURE LINES Methods for making welding connections inter alia, under conditions of full operation.	Sydgas/ /Sydkraft	Sydgas	Compl 1990	Philip Östberg, SG Report is available

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SV 98462 10000 SK 90.03	PLASTIC LINERS IN NATURAL GAS STORAGE FACILITIES The objective is to develop a plastic laminate that can constitute a technically and economically competitive alternative for sealing. Long-term testing is included.	Vattenfall, Sydkraft, Studsvik	Vattenfall (BEL), Studsvik	Compl 1990	Anders Bodén, BEL, SV (The project is a part of the Grängesberg project.)
SGC 90.26	SYSTEMS OPTIMIZATION WITH REGARD TO THE LINE PRESSURE A 4 bar system was compared to a 0.1 bar, and a 16 bar system to a 4 bar. No economic advantage was found for choosing a system with the higher pressure. The 16 bar pressure is mainly used for transmission systems. The profitability of such systems, as compared to the 4 bar system, is affected by the fact that 16 bar systems require a load of at least 75 MW and have a minimum of 5 km between the M/R station and the user.	Sydgas	TUMAB	Compl 1991	Rolf Mårtensson, SG Report SGC 001
SV 93791	PLASTIC PIPES FOR GAS DISTRIBUTION An investigation the properties of materials in PE-pipes as well as their commercial applications. Contents: Study of the literature, properties, methods for quick quality control, environmental impact.	Vattenfall, Studsvik, Neste Polyeten AB	Studsvik	Compl 1991	PL: Tomas Tränkner, Studsvik Kari Lähdemäki, BES, Vattenfall
SV	COOLED NATURAL GAS STORAGE FACILITIES The project consists in developing a functioning and economic method for storing cooled natural gas so as to thereby increase storage capacity.	Vattenfall/ /Diff Nordic financers	Vattenfall	Compl 1991	Anders Bodén, BEL, SV Joint Nordic project.
SV 93769	OPTIMAL DESIGN OF M/R-STATIONS Feasibility study and recommendations regarding arrangements for recovering electrical energy from expanding natural gas during pressure reduction in M/R stations.	Vattenfall	Vattenfall	Compl 1991	Rolf Mattson, BEP, SV Only internal SV report.
SGC 91.06	LEAK DETECTION IN GAS LINES. METHODS AND EQUIPMENT Experience shows that leak detection methods used today are satisfactory. The instruments are constructed using one of the following principles: flame ionization, semiconductors, catalytic detectors or difference in sound velocity. The instruments most commonly used in Sweden are of the flame ionization type. The gas distributor's main requirements for the equipment are that 1) it be simple, sturdy and durable, 2) speedy service is provided. 3) Normally, there is no requirement for high sensitivity to low concentrations.	SGC	Sydkraft, Konsult AB, EGS section	Compl Dec 1991	Charlotte Rehn, SKKB Report SGC 009

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SK 90.23	REQUIREMENTS FOR MATERIAL USED FOR PACKING GAS LINES The report deals with the current instructions for packing PE gas lines. In addition, the influence on the pipe of a point load as well as of an uneven bedding are presented. Finally referring to practical experience, recommendations are given, as to how to pack a gas line.	Sydgas	Sydkraft, Konsult AB	Compl 1991	Lars Clemensson, SKKB Report SGC 004
SK 90.20	COATING OF STEEL PIPES IN ROCKY TERRAIN Investigation of suitable form and appropriate material for the coating of steel pipes located in rocky terrain.	Sydgas	Sydkraft	Compl 1991	Göran Tillberg, SG Report from stage 1 is available.
SGC 90.25	NEW METHODS FOR LAYING PE-PIPES The project includes an inventory of various laying techniques with the emphasis on non-conventional methods such as ploughing, horizontal pressure drive and boring. The survey will result in a proposal for a program of action for the development and demonstration of new pipe-laying techniques.	SGC	Ove Ribberström Projektering	Compl 1992	Lars Clemensson, SKKB Total costs 0,04 MSEK
SGC 91.04	BUTT WELDING AND FUSION WELDING. ASPECTS OF COSTS It is possible to achieve satisfactory quality in welding plastic pipes using butt welding and electro fusion welding. The investigation shall show which method is optimal for different dimensions and also compare costs for various manufacturers. Cost comparisons will be carried out for normal laying conditions.	SGC	TUMAB	Compl 1992	Rolf Mårtensson, SG Total cost 0,2 MSEK
SK 90.01	MEASUREMENT OF FLOW BALANCE IN NATURAL GAS STORAGE FACILITIES, INCLUDING CHECKING FOR GAS LEAKAGE Underground storage of natural gas is studied for a number of alternative storage concepts. Measurement methods and measurement accuracy for filling as well as emptying of the storages are of special significance.	Sydkraft	Sydkraft Konsult AB	Compl 1992	Björn Hedén, SKKB
SGC 91.01	PLOUGHING OF GAS PIPES – MALMÖ Using the ploughing technique, 3 km of Dy 90 mm PE-pipes with 2,5 mm thick coating were laid in farmland in Glostorp, just outside of Malmö. The technique worked well and the total cost was ca. 180 SEK/m, as compared to the 390 SEK/m (estimated) cost for conventional pipe-laying for the same distance. Cost differences depend greatly, however, on the terrain conditions.	SGC	Malmö Energi and Statens Geologiska Institut (SGI)	Compl 1992	Håkan Haglund, ME Alf Lindmark, SGI Report SGC 019

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Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 91.08	PLOUGHING GAS PIPES--GOTHENBURG Using direct ploughing, 640 m of PE gas pipe with an outer diameter of 160 mm and without protective coating were laid directly in loose clay. Aspects which were studied in the project are, among others: 1) Compilation of geotechnical conditions 2) Choice of laying methods and machine equipment 3) Tests of methods for passage of intersecting lines 4) Monitoring of performance 5) Economic results.	SGC	Göteborg Energi AB and SGI	Compl 1992	Nils Granstrand, GE Total cost 0,2 MSEK
SGC 91.05	FIELD SORTING OF FILLING MASS WHEN LAYING PE-PIPES WITH A LAYING BOX Demonstration project in which a laying box and sorting of excavated material are employed so as to later use the excavated material as filler in the place of gravel. Sorting works and a laying machine are attached to an excavator which lays the excavated material into the laying box. From this material, one obtains suitable filler, which then goes directly to the laying box via a conveyor. Correctness of covering and fraction of the mass are ensured according to NGDN 90.	SGC	Sydskraft Service AB	Compl 1992	Rolf Mårtensson, SG Göran Lustig, Syd- kraft Service AB Total cost 0,4 MSEK
SGC 90.22	LARGE GAS PIPES OF PE To provide an answer to the question: under what circumstances are PE pipelines with diameters greater than 225 mm suitable for gas distribution?	Sydgas	Sydskraft, Konsult AB	Compl 1992	Sigvard Trönell, SKKB Total cost 0,2 MSEK
SV 98460 05001 SK 90.02	GAS STORAGE DEVELOPMENT IN SCANDINAVIA (GUN) Model calculations of concrete barriers for natural gas in underground storage, both for normal temperatures and in cooled storage areas.	SINTEF (Norway), Statkraft, Neste, SV, SWG, SK	SINTEF, Vattenfall (BEL)	Curr 1988- until further notice	Anders Bodén, SV Mats Alestam, SKKB
STEV 656 108 SK 90.31	BRITTLE FRACTURES IN GAS PIPES Development of design criteria and the like.	NUTEK/ /NUTEK, SK	KTH	Curr 1989- -1992	Rolf Sandström, KTH Anders Molin, SKKB

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
STEV 656 087	STORAGE METHODS FOR NATURAL GAS/LPG (GENERAL PROGRAMME) Area of research: - Models for calculation of rock mechanics - Determination of parameters for underground material - Interaction of storage products/lining/rock The project is being carried out in close connection with the operations at the pilot facility at Röda Sten in Gothenburg.	NUTEK	CTH	Stage 1: Curr 1988-1992 Stage 2: Curr 1992-1994	Project leader Ulf Lindblom, CTH Cost Stage 1: 3 MSEK " Stage 2: 6,5 MSEK
STEV 656 109 STU 89-2294 91-1169	BASIC RESEARCH INTO THE USE OF PLASTIC PIPING FOR GAS DISTRIBUTION Clarification of the relationship between molecular structure fracture mechanics and environmental impact.	NUTEK	KTH and Studsvik	Stage 1: Compl 1991 Stage 2: Curr 1991-1993	Ulf Gedde, Polymerteknologi, KTH Stage 2: 1,2 MSEK
STEV 654 004	CONSTRUCTION OF UNDERGROUND ROCK CAVITY LABORATORY, "RÖDA STEN" Chalmers Institute of Technology is building a permanent test facility for gas storage research in Röda Sten, Gothenburg, in cooperation with Göteborg Energi, NCC, the Swedish State Power Board (Vattenfall), Southern Sweden Power Supply, Ltd. (Sydkraft AB), Shell, British Gas and Brooklyn Union Gas.	NUTEK and others	CTH	Stage 1: Compl 1991 Stage 2: Curr 1991-1992	Ulf Lindblom, CTH
SK 90.19	REFERENCES FOR ULTRASONIC TESTING Swedish authorities require today that ultrasonic equipment for checking of pipe material be calibrated for errors of plus or minus 5 % of the thickness of the material (N5-notch). Internationally, 10 % of thickness (N10) is used. The study will establish requirements for calibration tolerance.	Sydgas	Sydkraft	Curr 1990-1992	Göran Tillberg, SG
SK 90.10	CORROSION PROBLEMS IN DISTRIBUTION LINES Included are alternating current corrosion, measurement methods, cathodic protection, line coating, valve arrangements and corrosion in protection pipes.	Sydgas/ /Sydkraft	Sydkraft Konsult AB	Curr 1990-1992	Åsa Marbe, SKKB Hans Erik Edwall, SG
SK 90.11	HIGH PRESSURE PIPE LINE SYSTEMS Various studies regarding choice of material and welding methods.	Sydgas/ /Sydkraft	Sydkraft, Konsult AB	Curr 1990-1992	Göran Tillberg, SG Philip Östberg, SG
SV 98466 STEV 654 013	PILOT FACILITY FOR NATURAL GAS STORAGE IN GRÄNGESBERG (FIG 3) Construction, testing and evaluation of three storage concepts: thin plate, thick plate and plastic-lined storage facilities.	Vattenfall/ /Sydgas, Sydkraft, NUTEK, VNG, Skanska and others	BPA/ /Skanska	Curr 1991-1992	Christer Kallmén, SG Total cost 4,5 MSEK

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
VF G1-108	WELDING METHODS FOR PE-PIPES FOR GAS DISTRIBUTION <u>Objective:</u> To find and characterize critical processes during welding as well as to show suitable, time efficient methods of quality control. <u>Description:</u> The project includes producing test material (welded PE-pipes), testing (pressure, tension, stress etc), and post-analysis (fractography and structural analyses).	Värmeforsk	Studsvik AB	Curr 1991-1992	Mats Ifwarson, Studsvik AB Total cost 0,7 MSEK
SGC 90.60	TESTING OF PE-PIPES FOR LPG DISTRIBUTION <u>Objective:</u> To investigate the resistance of PE-pipes to long-term exposure to LPG condensate. <u>Description:</u> PE-pipes that were used for five years for distribution of LPG in Kalix will be dug up and transported to Studsvik for tests and analyses. Tests will also be carried out on unexposed pipes.	SGC	Vattenfall, BES	Curr 1991-1992	Bo Berggren, SV Jonas Forsman, VES Total cost 0,3 MSEK
SK 90.34	DISTRIBUTING LPG IN THE LIQUID PHASE Advantages and limitations of the distribution of LPG in the liquid phase, e.g. material and length of lines.	Terminalgas/ /Sydkraft	Sydkraft Konsult AB	Curr 1991-1992	Mikko Ronkainen, TG
SGC 91.10	THE INTERNATIONAL PE-PIPE PROJECT EVOPE The project is a joint effort of the Swedish State Power Board, Gaz de France and Italgas. The Swedish research activities will be carried out by Studsvik AB. Taking into consideration a number of factors that influence the length of life of PE-pipes, a calculation model shall be developed. The Swedish part in the project will mainly consist of studies of reological behavior and slow crack growth.	SGC, SV, Gaz de France, Italgas	Studsvik AB	Curr 1991-1994	Bo Berggren, SV Cost Swedish share: 3,5 MSEK
SGC 92.01	TENSION IN JUNCTIONS IN LONG PE-PIPELINES Longitudinal movement in PE-pipes caused by temperature variations could give rise to tensions in junctions between a main pipe and its branches. Theoretical and practical investigations should answer the question of whether the tensions are acceptable or not.	SGC	Sydkraft Konsult AB	Curr 1992	Olle Johansson, ME

3. TRANSMISSION, DISTRIBUTION, STORAGE

Internal project designation	PROJECT NAME Project description	Ordered by/ Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost etc.
SGC 92.02	DESIGN CRITERIA FOR GAS DISTRIBUTION PIPES. A LITERATURE SEARCH There exist a number of computer calculation programs for design criteria in gas distribution lines. There are as yet no "reliability analyses" of such programs. The project as a whole includes an evaluation of some existing programs, measurements of an existing gas network as well as a comparison between the measured and the calculated data for the existing networks. This partial project includes only a literature search.	SGC	Sydskraft Konsult AB	Curr 1992	Rolf Mårtensson, SG Total cost 0,05 MSEK
SK 90.35	MODUL-BASED LPG STATIONS Standardization and simplification in the design of LPG stations aims at adapting the stations to new areas of use for LPG.	Terminalgas/ Sydkraft	Sydskraft Konsult AB	Curr 1992	Mikko Ronkainen, TG Ola Hall, SKKB
SK 90.06	CONVERSION OF EXISTING UNDERGROUND ROCK RESERVOIRS TO LPG STORAGE FACILITIES Storage of LPG through conversion of existing underground reservoirs for oil storage.	Sydgas, Terminalgas	Sydskraft	Curr 1992	Mikko Ronkainen, Terminalgas Christer Kallmén, SG
SK 90.08	STORAGE OF COOLED NATURAL GAS IN VAPOUR PHASE	Sydgas/ Sydkraft	Sydskraft, CTH	Plan 1992	Christer Kallmén, SG
SK 90.07	STORAGE OF LPG IN SMALLER UNDERGROUND ROCK RESERVOIRS. PILOT FACILITY	Terminalgas/ Sydkraft	Sydskraft	Plan 1992	Mikko Ronkainen, Terminalgas
SK 90.33	PREPAREDNESS REQUIREMENTS FOR LPG/NATURAL GAS	Terminalgas/ TG, SG	Sydgas, Terminalgas	Plan 1992	Mikko Ronkainen, TG
SK 90.04	DEMONSTRATION FACILITY FOR NATURAL GAS STORAGE Demonstration of natural gas storage in lined underground rock reservoirs.	Sydgas/ Sydkraft	Sydskraft	Plan 1993-1994	Christer Kallmén, SG
	INCREASING THE PRESSURE IN PE-SYSTEMS An investigation of the feasibility of working with higher pressures than PE-pipes at present are rated for.	Sydgas	Svenska Gasföreningen	Plan	Rolf Mårtensson, SG A study from British Gas is expected.
	PLOUGHING GAS PIPES – METHOD DEVELOPMENT WITH REGARD TO DRAIN PIPE PROBLEMS	SGC	Statens Geologiska Inst	Plan 1992	Olle Johansson, ME

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
VF G5-515	IR-RADIATORS FOR INDUSTRIAL USE – – MEASUREMENT REPORT Further studies with results from, inter alia, CO and NO _x -measurements. Concentrations immediately adjacent to the radiator are between 10 and 40 ppm for CO and between 10 and 20 ppm for NO _x .	Värmeforsk	DTI, Malmö	Compl March 1990	Michael Johansson, DTI (Internal VF report)
VF G5-601	RECUPERATIVE AND REGENERATIVE BURNERS IN INDUSTRIAL PROCESSES. EMISSION MEASUREMENTS ON RECUPERATIVE BURNERS Measurements of NO _x from an existing burner. NO _x contents as a function of the air preheat temperature are given.	Värmeforsk	DTI, Malmö	Compl March 1990	Sören Dahlin, DTI (Internal VF report)
STU 89-1266	CONVERSION FROM OIL TO NATURAL GAS IN PUSHER TYPE FURNACES Study of changes in productivity, energy consumption and oxide scale formation during conversion of a furnace at Fundia Bygg AB (formerly Halmstad Jernverk) from oil to natural gas. KTH have carried out mathematical modelling.	STU SWG SK	Fundia Bygg, Jernkontoret, KTH and others	Compl 1990	Birgitta Lindblad, Jernkontoret Rolf Collin, KTH Mats Johansson, AGA Jernkontoret report is available.
SWG U1.3	CONVERSION OF A BAKERY OVEN FROM ELECTRICITY TO NATURAL GAS Demonstration project with the conversion of an existing oven.	SwedeGas	El- och Gasteknik AB, Dahlén AB	Compl 1990	Thomas Carlqvist, SV Lars E Andersson, El- o. Gasteknik AB Report is available.
SGC 90.55	GASEOUS FUELS IN GLASS FURNACES. A PRELIMINARY STUDY <u>Objective:</u> To develop a basis for possible decisions regarding extensive research and development efforts concerning natural gas and LPG as fuels for glass furnaces. <u>Description:</u> The preliminary study includes investigation of the literature, market analyses, study visits and contacts with British Gas. The study will also result in the presentation of proposals for continued efforts in this area.	NGC and others	Glasforskningsinstitutet, Växjö	Compl 1991	Internal NGC-report.
	HEATING OF ZINK BATHS WITH NATURAL GAS IMMERSION HEATERS A pilot project including heating and melting of zink with natural gas in the place of electricity.	SwedeGas	El- och Gasteknik AB	Compl 1991	Ingemar Gunnarsson, NGC Internal report is available.

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 90.53	INTEGRATED USE OF NATURAL GAS IN LAUNDRIES The project goal was to build a demonstration plant for direct heating with natural gas in a drying drum. A Passat 253 d drying drum was converted from steam heating with a steam pressure of 10 bar to direct heating with natural gas. The energy demand decreased by 55 % and the drying time by 15 %. In addition NO _x and CO ₂ emissions were reduced by 55 %, due to the lower energy consumption. Pay-off time is three years with present gas price and operating time.	Helsingborg Energi/GC, Tvättman	Sydskraft Konsult AB, EGU section	Compl 1991	Göran Persson, Helsingborg Energi Ola Hall, SKKB Total cost 0,4 MSEK Report SGC 011 Demo sheet no 2
SGC 90.59	CONVERSION OF ALUMINUM MELTING FURNACES. A PRELIMINARY STUDY The aim of this study was to evaluate different techniques for recuperation in pot furnaces in metal foundries. In Sweden the number of pot furnaces is estimated to be 400 to 500. Most of them are heated electrically. The energy used in 1988 amounted to 190 GWh. Aluminum is melted at a temperature just above 700 deg C. A new furnace with recuperator gives fuel savings of about 30% compared to one with cold air burners.	SGC	Sydskraft, Konsult AB, EGU section	Compl 1991	Anders Molin, SK Ola Hall, SK Total cost 0,1 MSEK Report SGC 010
SGC 91.02	GAS IR-TECHNIQUES WITHIN INDUSTRY. APPLICATIONS AND A MARKET SURVEY IR-technology based on gaseous fuels is a method of heating which has a great potential in industry. The report contains an analysis of different applications and an attempt to estimate the potential market in a number of industrial branches. Paper, printing, textile and metal industries, but also the food industry, are of special interest. It is, however, difficult to estimate the potential market.	SGC	Sydskraft, Konsult AB	Compl 1991	Per-Arne Persson, SGC Per Carlsson, SKKB Total cost 0,09 MSEK Report no SGC 007
VF G8-815	CONVERSION TO NATURAL GAS IN DIFFERENT BRANCHES OF THE ENERGY INDUSTRY A study of the conversion to natural gas within the food industry. A case study: Arla Dairies in Gotene.	Värmeforsk	ÅF	Compl 1991	Project leader: Per Göransson, ÅF
SSF 308 SGC 88.08 NUTEK 88-1226 92-772	DECENTRALIZED USE OF GAS FOR HEATING OF LIQUIDS An investigation of the general effects of a change-over to decentralized gas heating within industry as well as a survey of technical and economic factors during such a change-over two industrial firms, Scan Vast and Falkens breweries. The project also includes literature searches and study visits at industries and manufacturers abroad.	STU, GC SwedeGas, ÅF	ÅF, Malmö	Compl 1991	Rolf Christensen, ÅF Malmö Lars Nilsson, SG Total cost 1,1 MSEK Report as a post graduate research report on English. Internal brief SGC report is expected during autumn 1992.

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 91.13	<p>MODERN GAS TECHNOLOGY IN GALVANIZING PLANTS Within the project a technical and economic study of a zinc furnace with a capacity of 15 000 ton/year was carried out. Two different gas firing techniques, with high velocity burners and immersion tubes respectively, were compared to conventional electric heating. With a gas price of 20 öre/kWh, the energy cost is less for both gas alternatives compared to electric heating.</p>	SGC	Vattenfall Energisystem	Compl Oct 1991	Per-Arne Persson, SGC John Danelius, VES Total cost 0,13 MSEK Report SGC 014
	<p>NATURAL GAS DRIVEN FORK LIFTS The study is a survey of technical and economic factors for natural gas driven fork lifts and describes the pro and cons for natural gas compared to LPG and diesel fuel. A conversion requires a rebuilding of the engine and a supplementary fuel tank. No Swedish rules or standards exist for natural gas driven vehicles. Conversion of diesel fuel driven fork lifts to natural gas is economically viable. Conversion from LPG is, however, not justifiable.</p>	Lunds Energiverk/ /GasCentrum	Sydskraft Konsult AB	Compl Dec 1991	Åsa Marbe, SKKB Total cost 0,1 MSEK Report SGC 015
SGC 91.07	<p>LIQUID HEATING WITH GAS ANALYSIS AND PROGRAM PROPOSAL The analysis includes descriptions of the technology, development status, problem areas, development potential and Swedish market conditions. Based on the analysis a development program is proposed.</p>	SGC	ÅF-Eerengi-konsult AB	Compl Dec 1991	Rolf Christensen, ÅF, Malmö Lars Nilsson, SG Total cost 0,07 MSEK Report SGC 017
SGC 90.51	<p>CUTTING WITH ACETYLENE AND WITH NATURAL GAS. A COMPARISON Practical tests show that natural gas is superior to both quality and costs when cutting thick sheet metal (>50 mm). Energy consumption is reduced by up to 20% and oxygen consumption by ca. 45%. Natural gas is preferable even for so-called package-cutting, that is, cutting of several thin plates placed on top of each other. With a normal mix of sheet metal thicknesses in industrial production, natural gas is on the whole the most advantageous.</p>	SGC	Sydskraft, Konsult AB	Compl Apr 1992	Lars Nilsson, SG Åsa Marbe, SK Total cost 0,15 MSEK Report SGC 018
VF G1-106	<p>FEASIBILITY OF USING GAS WITHIN THE PULP AND PAPER INDUSTRY The investigation's aim is to identify and quantify the feasibility of using natural gas and LPG within the Swedish pulp and paper industry.</p>	Värmeforsk	Jaako Pöyry, Finland	Compl 1991	Per Jerkeman, Pöyry, Olle Olsson, Papyrus, Mölndal VF report autumn 1992

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
NUTEK 89-1265 90-2780	REPLACEMENT OF ELECTRICITY WITH NATURAL GAS WITHIN THE IRON AND STEEL INDUSTRY. STAGES I AND II The project shall show which processes or activities are of interest for conversion from oil or electricity to natural gas. In stage II cost calculations will be carried out for the conversion of two ovens from electricity to natural gas.	SwedeGas, Jernkontoret, STU	Jernkontoret	Compl 1992	Mats Johansson, AGA Birgitta Lindblad, Jernkontoret See article in Energi- teknik no 1 1989
SGC 88.06	CERAMIC FIBER BURNERS Demonstration and evaluation of operational and environmental properties as well as of performance of a ceramic fiber burner at ca 150 kW.	Sydgas/ /SGC	Sydkraft Konsult AB	Compl 1992	Per Carlsson, SKKB Lars Nilsson, SG Total cost 0,6 MSEK Report SGC 006 Demo sheet no 3
VF G8-817 STU 88-4726 SGC 88.09	GAS-FIRED IR-RADIATORS FOR DRYING PROCESSES A FTIR infrared spectrometer was purchased by DTI. This was used to determine the spectral characteristics as well as radiation efficiency for two gas-fired IR-radiators. The radiators were manufactured by Maarsden and Gogas, respectively. The radiation efficiency, including gas radiation, was measured at 60% for the Marsden radiator and 55% for the Gogas radiator at rated output. Emissions and surface temperatures for the radiators were also measured.	VF/VF, STU, SGC	DTI	Compl 1992	Sören Dahlin, DTI Total cost 1,0 MSEK Report SGC 013 VF report no 424
SGC 89.10	CO ₂ -PLANT CULTIVATION WITH EXHAUST GASES FROM NATURAL GAS FIRED BOILERS CO ₂ -plant cultivation was carried out using exhaust from natural gas boilers that were installed at Nygaard's Greenhouses in Halmstad. The air quality in the greenhouses will be measured as well as the production of vegetables, etc. The latter will be compared with the values obtained before CO ₂ -plant cultivation was introduced. The objective is to show to governmental agencies that the direct emission of exhaust from gas combustion can occur without health risks.	SGC, Lantbruks- nämnden, NGC, Nygaards	Nygaards trädgårdsodl, Halmstad	Compl 1992	Lars Nilsson, SG Total cost 1,7 MSEK SGC demo sheet no 1 SGC report autumn 1992
SGC 88.20	RECUPERATIVE NATURAL GAS BURNERS (SVEDALA-ARBRA) <u>Objective:</u> Full scale demonstration of recuperative burners in car-type furnaces for the heat treatment of castings. <u>Description:</u> At Svedela-Arbrå eight oil burners are being replaced with recuperative gas burners of the low NO _x type for a total of 1.5 MW. Measurement will be made to evaluate productivity, heating quality, energy consumption and emissions.	SGC	Sydgas, MEFOS, Sydkraft Konsult AB	Compl 1992	Anders Molin, SK Total cost 0,5 MSEK NGC report is available. SGC demo sheet no 3

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 90.65	HEATING OF LIQUIDS AT A CONCRETE PLANT – KOCKS TRELLEBORG <u>Objective:</u> Demonstration of gas-based heating of liquids at a concrete plant. <u>Description:</u> A decentralized liquid heater will be installed at KOCK's concrete plant in Trelleborg. The technique will be evaluated by measurements of emissions, and follow-up of operations and maintenance costs.	SGC	Sydgas	Curr 1990-1992	Lars Nilsson, SG Total cost 0,2 MSEK
SGC 91.14	INSTALLATION AND EVALUATION OF A POT FURNACE WITH RECUPERATOR. VÄRNAMO PRESSGJUTERI A gas-fired pot furnace with recuperative heat recovery will be built as a demonstration project at a foundry in Värnamo. Performance data will be compared with data for the conventional pot furnace being replaced. The result should also be useful for other foundries.	SGC, NGC, SEU	Sydkraft Konsult AB, EGU section	Curr 1991-1992	Anders Molin, SKKB Total cost 0,6 MSEK
VF G1-104 SGC 90.63 NUTEK 91-52065	METHODS FOR DETERMINATION OF OVERALL EFFICIENCY FOR IR RADIATORS <u>Objective:</u> Development of methods for determining the overall efficiency of IR radiators. <u>Description:</u> The project is a continuation of SGC 88.09 and includes, inter alia, purchase of a monochromator which allows the measurement of the entire emission spectrum, even in the case of electrically operated IR radiators.	Värmeforsk STU, SGC	DTI, Malmö	Curr 1991-1992	Michael Johansson, DTI Per-Arne Persson, SGC Total cost 0,4 MSEK
SGC 91.15 NUTEK 92-1646	PAINT DRYING WITH CATALYTIC GAS-IR AT AB HEURLINS LACKERING, VARBERG The purpose of the project is to achieve better product quality by pre-heating painted details before final drying in a drying oven. The project will be carried out at a subcontractor painting car details for Volvo. The pre-heater will be a catalytic gas-IR heater.	SGC NUTEK	EnergiAnalys Lerum, Heurlins Lackering, Varberg	Curr 1991-1992	Per-Arne Persson, SGC Total cost 0,2 MSEK
SGC 91.16	CO ₂ -PLANT CULTIVATION WITH EXHAUST GASES FOR NATURAL GAS FIRED GREENHOUSE BURNERS In a greenhouse four PRIVA-burners for heating and cultivating purposes will be installed. In addition to gaining experience in Sweden from such burners, the aim of the project is to demonstrate the technique for the health authorities.	SGC, NGC/SGC, NGC K E Pettersson Lantbruksnämnden, Helsingborg Energi	Sydgas AB, K E Petterssons Handels-trädgård, Görarp	Curr 1991-1992	Lars Nilsson, SG Total cost 0,3 MSEK

4. INDUSTRIAL APPLICATIONS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 90.70 NUTEK 92-1657	NORDIC POT FURNACE PROJECT <u>Objective:</u> To obtain higher quality glass, lower operational costs and lower NO _x emission by use of new and improved burning techniques and optimal placement of burners. <u>Description:</u> The project will be carried out in three steps: 1) Preliminary studies 2) Tests in a model furnace at DTI, Malmö 3) Full scale test melting at two glass works	NGC, SGC, NUTEK, Glafo and others	Glasforskningsinstitutet (Glafo), Växjö	Curr 1991-1993	Stellan Persson, Glafo Per-Arne Persson, SGC Total cost 4 MSEK
SGC 90.64	GAS-FIRED IR RADIATORS IN PAPER COATERS. MODO HUSUM PLANT Measurements on and evaluation of an IR-installation on a paper coater at MoDo's Paper Factory in Husum, Sweden. With a Fourier spectrometer the radiation spectra, the radiation efficiency and the absorption spectra of the paper will be determined. Also an evaluation of the total drying efficiency will be carried out.	SGC NUTEK NGC Neste Gas MoDo	DTI, Malmö MoDo, Husum	Curr 1992-1993	Michael Johansson, DTI Per-Arne Persson, SGC Total cost 0,4 MSEK
SGC 92.06	LPG IN THE ENAMEL INDUSTRY The purpose of the project is to study the replacement of a furnace and a simultaneous change of energy supply from electricity to gas in an enameling factory. The study will include a technical as well as an economic comparison of gas and electric operation before and after the change-over. In addition, there will be a calculation of investment costs for rebuilding.	SGC	Vattenfall Energisystem AB	Plan 1992	Jan Brännström, Vattenfall Västsverige Total cost 0,1 MSEK
SGC 91.03 NUTEK 92-5437	GAS-FIRED DIRECT LIQUID HEATERS – MODEL STUDIES AND APPARATUS DEVELOPMENT The objective is to produce, through experimentation, a calculation program for an optimal design of gas-fired immersion tubing as regards efficiency, emissions, choice of material, tube configuration, etc. (Doctoral thesis.)	SGC, NUTEK Sydkraft, NGC	Kemisk Apparatteknik, LTH	Plan 1992-1994	Rolf Christensen, DTI Lars Nilsson, SG Total cost 2,2 MSEK

5. SPACE HEATING APPLICATIONS FOR HOUSEHOLDS AND RELATED AREAS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SVSS 89.02	IR TECHNOLOGY FOR SPACE HEATING Measurements were carried out in a warehouse at Trelleborg AB.	Vattenfall/ /SV, SG	Vattenfall	Compl Jan 1990	Nils Erik Carlstedt, VES
	NO _x - MEASUREMENTS BEFORE AND AFTER CONVERSION TO GAS FIRING (HALMSTAD AMONG OTHER LOCATIONS) Measurements were carried out at five facilities containing, inter alia, a furnace as well as apartment house boilers.	Sydgas/ /SAMKO	Sydkraft	Compl Jan1990	Per Carlsson, SKKB GC report 90.02
VF G8-812	INDOOR AIR QUALITY DURING DIRECT EMISSION OF FLUE GASES FROM NATURAL GAS COMBUSTION A description of environmental consequences from direct emissions as reported in the international literature.	Värmeforsk/ /VF, NGC	TVE	Compl Dec 1990	Ulrika Jantze, TVE VF-report no 407
	CONVERSION FROM DIRECT ELECTRICAL HEATING TO NATURAL GAS BASED AIR HEATING A single-family house has been converted from direct electrical heating to air-borne heating with natural gas as the heat supply. Evaluation of capital and operational costs after ca. one year's operation.	Sydkraft/ /Sydgas 50 %, Sv Fläkt 50 %	Svenska Fläkt and Sydkraft	Compl 1990	Roland Nilsson, Jönköpings Tekn Verk (No report)
VF G8-805	CONVERSION TO NATURAL GAS, CHANGES IN PERFORMANCE AND EMISSIONS Measurements and evaluations in Varberg (inter alia Monark AB, Arla, Scan Väst).	Värmeforsk	Statens Provn.anstalt	Compl 1990	Lennart Gustavsson, SP VF report no 381
SWG D6.1	DEMONSTRATION OF HEATING SYSTEMS FOR SINGLE FAMILY HOUSES Conversion of 2-3 residences in Stockholm and Varberg to gas heating, inter alia with installation of water-borne socket convectors.	SwedeGas	Vattenfall, BFS section	Compl 1990	Leif Bodinson, Söderenergi SWG report is available.
VF G5-607	CONDENSATING GAS BOILERS FOR A SINGLE FAMILY HOUSE, A FURTHER STUDY The study shall result in guidelines for required re-heating in the case that smoke stacks can be used without any modification.	Värmeforsk	LTH, Värme- o Kraftteknik	Compl 1991	Mikael Näslund, LTH VF report no 423
	HEATING OF VENTILATION AIR WITH GAS Comparison of three different systems.	Vattenfall	Vattenfall Energi-system AB	Compl 1991	J Forsman, VES SV report 90/8

5. SPACE HEATING APPLICATIONS FOR HOUSEHOLDS AND RELATED AREAS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SV 98441	NATURAL GAS INSTALLATION IN PUBLIC BUILDINGS A study to shed light on: – currently available techniques – development requirements for the introduction of such technology in Sweden.	Vattenfall	Vattenfall	Compl 1991	
SGC 88.25	PULSATION BOILER IN VELLINGE Evaluation of an existing 250 kW boiler at the Central Clinic in Vellinge in Scania. Inter alia, measurements of efficiency, NO _x , waste fume temperature and sound level will be taken.	Sydgas/ /Sydgas and Sydskraft	Sydskraft, Konsult AB, EGU section	Compl March 1992	Per Carlsson, SKKB Lars Nilsson, SG Total cost 0,4 MSEK
SGC 88.04	MEASUREMENTS OF ENERGY AND EMISSIONS WHEN CONVERTING TO NG IN A MULTIFAMILY HOUSE The project goal was to find out how efficiency and emission levels change when a hot water boiler is converted from gas oil to natural gas. Measurements were made on two Parca Wirbex S with max power ratings of 172 respectively 280 kW when gas fired. The measured annual efficiency was 79,2 % with gas oil and 84,6 % with natural gas, i. e., an energy saving of 6,4 %. When converting to natural gas the NO _x -emissions decreased by 25 %.	Sydgas/ /SGC, SAMKO	Sydskraft, Konsult AB	Compl March 1992	Per Carlsson, SK Lars Nilsson, SG Total cost 0,04 MSEK Report SGC 016
VF G8-816	CONSTRUCTION OF A PROTOTYPE OF A FLUE GAS REHEATING CONDENSATING BOILER Construction of and measurements to verify theoretical arguments put forth in an earlier project (VF G5-607).	Värmeforsk	Värme- o Kraft, LTH	Compl March 1992	Mikael Näslund, LTH
VF G8-908	NATURAL GAS FIRED RADIATORS NO _x measurements on direct-fired radiators in Gothenburg.	Värmeforsk	Göteborg Energi	Compl 1992	Per Carlsson, GE Will be reported as a periodic paper.
SEU 06392	REPLACEMENT OF ELECTRICITY WITH NATURAL GAS IN SINGLE FAMILY HOUSING, LUND In at least five electrically heated residences, natural gas heating was installed as well as equipment for measurements and follow-up.	SEU/ /SEU and others	Lunds Energiverk	Curr 1989-1992	Christer Böös, Lunds Energiverk
STEV 276 430	SYSTEM STUDY OF NATURAL GAS FIRING Doctoral research. Studies of the interaction between the building and the gas heating system in single-family houses.	NUTEK	LTH Värme- och Kraft	Curr 1989-1993	Project leader: Lennart Thörnqvist, LTH Mikael Näslund, LTH

5. SPACE HEATING APPLICATIONS FOR HOUSEHOLDS AND RELATED AREAS

Internal project designation	PROJECT NAME Project description	Ordered by/ Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
	IR-HEATERS AT PRIPPS IN GOTHENBURG Demonstration of IR-radiators for space heating at Pripps Brewery in Gothenburg.	SwedeGas, Göteborg Energi, BFR	Pripps Göteborg, Chalmers Industriteknik	Curr 1990-1992	Eianr Änghede, GE Will be published as a BF-report.
VF G1-102	VERIFICATION OF A SMOKE STACK MODEL <u>Objective:</u> To verify through measurements the calculation model developed in project G5-609 (Condensating boiler. Smoke stack cycle) <u>Description:</u> Measurements will be carried out on a test stack at LTH. Measurements include, inter alia, temperatures in the flue gas flow and the stack's inner wall as well as the amount of condensate.	Värmeforsk	Värme o Kraft, LTH	Curr 1991-1992	Mikael Näslund, LTH
SGC 90.68	HUMIDIFYING OF COMBUSTION AIR FOR CONDENSATION BOILERS. A PRELIMINARY STUDY An investigation into the advantages of humidifying, especially at relatively high condensation temperatures.	SGC	KW Energi-produkter	Curr 1991-1992	Kjell Wanselius Lars Nilsson, SG Total cost 0,08 MSEK
SGC 90.66	SYSTEM EFFICIENCY CHANGES IN SMALL BUILDINGS AT CONVERSION FROM WATER-BORNE ELECTRIC HEAT TO GAS <u>Objective:</u> An investigation of the annual average efficiency that is obtained with a system especially developed for docking of a gas boiler to an electric boiler in small buildings. <u>Description:</u> Measurements will take place in a converted house in Södra Ängby, Bromma.	SGC	Vattenfall Energi-system AB	Curr 1991-1992	Jan Brännström, Vattenfall Västsverige Jonas Forsman, VES Total cost 0,14 MSEK
SGC 91.12 VF G1-118	CORROSION OF INNER STAINLESS STEEL TUBES IN SMOKE STACKS The project goal is to find out why the inner stainless steel tubes in some stacks from natural gas fired boilers have corroded. The project includes literature studies, mapping of the environment (including Cl-concentrations) where corrosion has occurred and laboratory experiments. Counter measures should be proposed.	SGC, VF	LTH, Värme o Kraft	Curr 1992-1993	Anders Molin, SKKB Mikael Näslund, LTH Total cost 0,35 MSEK
SGC 92.05	GAS FIRED ONCE-THROUGH HEATER FOR HEATING TAP WATER IN SINGLE-FAMILY HOUSES. STAGE 1 The project involves installation of a gas fired once-through heater for tap water in a single-family house and subsequent measurements for one year of fuel consumption and heat pruction. Phase 1 includes a literature search and an evaluation of the installation conditions. Phase 2 includes the installation and the measurements.	SGC	Vattenfall Energisystem	Curr 1991-1992	Jan Brännström, Vattenfall Västsverige Jonas Forsman, SV Stage 1: 0,05 MSEK

5. SPACE HEATING APPLICATIONS FOR HOUSEHOLDS AND RELATED AREAS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 89.11	A COMPUTER MODEL FOR NATURAL GAS-IR FOR SPACE HEATING Development of a computer program for the calculation of, inter alia, power requirements and optimal location of IR-heaters for space heating.	SGC		Plan 1992	Per-Arne Persson, SGC
SGC 92.03	CONDENSATION BOILER WITH HUMIDIFYING OF COMBUSTION AIR	SGC		Plan 1992	Anders Molin, SKKB

6. GAS ENGINES AND GAS BASED COGENERATION

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
VF E7-811	THE TECHNICAL STATUS OF GAS ENGINES A survey of the technical status of gas engines suitable for, of example, heat pumps as regards performance, standard units, reliability, safety and maintenance.	Värmeforsk	ÅF	Compl Oct 1990	Lars Wrangensten, ÅF
	PRINCIPLES FOR CONNECTION INTO HEATING SYSTEMS AND ELECTRICAL GRIDS	Vattenfall	Vattenfall Energisystem AB	Compl 1990	Tove Ekeborg, Vattenfall Energisystem AB
	COGENERATION FOR ISOLATED FARMS	Vattenfall		Compl 1990	A Bengtsson SV report 90/13
SGC 89.14	MICRO-COGENERATION PLANTS FOR GREENHOUSES A gas engine, MAN E 2842 LE, was installed in AB K-E Pettersson's Handelsträdgård in Helsingborg. The cogeneration plant generates 300 kW electricity and 500 kW heat. During the time period 26 Jan to 31 March 1990, an evaluation of engine performance was carried out. The following results were measured: efficiency 89 %, availability 97 %, NO _x -emission at full load 400 mg/MJ and at 50 % load 150 mg/MJ	Helsingborgs Energiverk/ /GasCentrum	Kjessler & Mannerstråle	Compl 1991	Göran Persson, HE Roy Ericsson, K&M Report SGC 002
	LIMHAMN'S HEATING PLANT. REBURNING WITH NATURAL GAS Reburning with natural gas has been tested in a 125 MW pulverized coal boiler in Limhamn. The results will serve as a basis for, inter alia, mathematical modelling of reburning.	SEU, STEV, Malmö Energi	Malmö Energi AB (Limhamn)	Compl 1991	Olle Göransson, ME Report is available and can be ordered by Olle Göransson.
	TECHNICAL AND COMMERCIAL STATUS OF GAS-BASED MINI-COGENERATION The report constitutes an analysis of the technical and commercial status for gas based mini cogeneration in Scandinavia. In Sweden a great number of potential gas turbine/exhaust gas boiler and gas engine plants have been studied. All cases have been shown to be unprofitable. In Denmark and Finland it is a commercial technology. Plants and operation experiences from the nordic countries are presented.	SGC	SGC	Compl 1991	Per-Arne Persson, SGC Report no SGC 005
SV 98454 06030	SMALL GAS ENGINES FOR HEATING AND ELECTRICITY A study of technology and cost for one or more typical cases with sizes of less than 1 MW. Clarification of optimal layout for an actual case.	Vattenfall	Vattenfall, BES section	Compl 1991	Annika Bengtsson, SV

6. GAS ENGINES AND GAS BASED COGENERATION

Internal project designation	PROJECT NAME Project description	Ordered by/ Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
STU 90-161	INTERNAL POWER PRODUCTION WITHIN THE IRON AND STEEL INDUSTRY An investigation.	STU	Jernkontoret	Compl Jan 1992	
	NO _x REDUCTION IN A NATURAL GAS FIRED COGENERATION PLANT Conversion to natural gas has been carried out in the Heleneholm plant in Malmö. Normal NO _x -emission is ca 100 mg/MJ. The project involves reducing NO _x contents to under 50 mg/MJ by using different combustion technologies.	SEU/ /SEU, Malmö Energi	Malmö Energi and Värme- o ugnsteknik, KTH	Compl May 1992	Staffan Nortén, Malmö Energi AB Rolf Collin, KTH Report is available, and can be ordered by Staffan Nortén
	NATURAL GAS DRIVEN FUEL CELLS 200 kW Planning, purchasing, installing, operating, maintaining and evaluating of a 200 kW fuel cell of the phosphoric acid type.	Sydskraft/ /Sydkraft NUTEK, SSF	Sydkraft	Curr 1987-	Lars Sjunnesson, SK Per Carlsson, SKKB
STEV 566 002	DIESEL/CFB-BOILER Study of a diesel/CFB-boiler for heat-and-power generation with low NO _x properties.	NUTEK	Energiteknik, CTH	Curr 1988- -1991	Proj.lead: Bo Leckner, Energiteknik, CTH
STEV 566 007	STUDY OF THE STIG-SYSTEM FOR COGENERATION Doctoral research project.	NUTEK	Värmeteknik, KTH	Curr 1988- -1991	Proj.lead: Gunnar Svedberg, Värmeteknik, KTH
STEV 566 009	GAS COMBI SYSTEM Doctoral research project.	NUTEK	Värme- och Kraftteknik, LTH	Curr 1988- -1991	Proj.lead: Tord Torisson, Värme- och Kraftteknik, LTH
STEV 566 010	OPTIMIZATION OF COGENERATION SYSTEMS Doctoral research project.	NUTEK	Värme- och Kraftteknik, LTH	Curr 1988- -1991	Proj.lead: Tord Torisson, Värme- och Kraftteknik, LTH
STEV 616 048	INTERNAL REFORMING OF NATURAL GAS IN MOLTEN CARBONATE FUEL CELLS Doctoral research project.	NUTEK	Kemisk Teknologi, KTH	Curr 1988- -1991	Olle Lindström, KTH
STEV 565 002	COGENERATION IN STENUNGSUND LPG-engine for 600 kW power production and heat pump operation in Stenungsund. Follow-up of performance	NUTEK	Stiftelsen Stenungsund Fjärrvärme and CTH	Curr 1989- -1991	Sten Åfeldt, NUTEK
STEV 616 077	MOLTEN CARBONATE FUEL CELLS Basic research. (A doctoral research project)	NUTEK	Teknisk Elektrokemi, KTH	Curr 1989- -1992	Daniel Simonsson, KTH

6. GAS ENGINES AND GAS BASED COGENERATION

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
	REMOTE CONTROL AND MONITORING OF SMALL COGENERATION PLANTS	Vattenfall	Vattenfall Energisystem AB	Curr 1989-1991	Johan Danelius, Vattenfall Energisystem AB
STEV 566 015	GENERAL RESEARCH IN GAS ENGINE TECHNOLOGY AT LTH A survey of the relation between cycle to cycle variations in the flame propagation and speed in fuel/air mixing as well as the spark's current and voltage cycle.	NUTEK	Värme- o Kraft, LTH	Curr 1989-1992	Gunnar Lundholm, KTH
STEV 616 038	THE INTEGRATION OF NATURAL GAS IN EXISTING POWER SYSTEMS Doctoral research project.	NUTEK, Vattenfall	Elektriska Energisystem, KTH	Curr 1989-1992	Göran Andersson, KTH
STEV 566 022	PART LOAD PROPERTIES IN GAS COMBI PLANTS FOR POWER PRODUCTION Doctoral research project.	NUTEK	Värme- o Kraft, LTH	Curr 1989-1992	Tord Torisson, Värme- o Kraft, LTH
STEV 566 024	TWO-MEDIA PROCESSES FOR POWER AND COGENERATION PLANTS Doctoral research project.	NUTEK	Värmeteknik, KTH	Curr 1989-1992	Gunnar Svedberg, KTH
STEV 566 006	METHODS FOR THE ANALYSIS OF MEASURES TO INCREASE OF EFFICIENCY AND LIMIT OF EMISSIONS IN CO-GENERATION SYSTEMS Research position.	NUTEK	Värme- o Kraft, LTH	Curr 1989-1992	Tord Torisson, Värme- o Kraft, LTH
	DEMONSTRATION AND EVALUATION OF OTTO CYCLE ENGINES	Vattenfall	Vattenfall Energisystem AB	Curr 1990-1991	Anders Tvärne, Vattenfall Energisystem AB
	DEMONSTRATION AND EVALUATION OF A FUEL CELL	Vattenfall	Vattenfall	Curr 1990-1992	Nils-Erik Carlstedt, Vattenfall Energi-system AB
STU 90-3239	PREMIX COMBUSTION CHAMBERS FOR ENGINES Theoretical and practical investigation of ultralow emissions in premix combustion chambers.	NUTEK	Värme o Kraft, LTH	Curr 1990-1992	Gunnar Lundholm, Värme o Kraft, LTH
STEV 564 006	EVALUATION OF GAS TURBINES FOR LPG CONNECTED TO A SOLID FUEL BOILER IN SANDVIKEN	NUTEK	Sandviken Energi, Vattenfall	Curr 1990-1994	Sten Åfeldt, STEV

6. GAS ENGINES AND GAS BASED COGENERATION

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
	SMALL SCALE COGENERATION Construction, operation and evaluation of three gas engines (Kockums Fritid, PLM and Gasverket).	Malmö Energi	Malmö Energi	Curr 1991-1992	Lennart Bengtsson, ME
SGC 91.11	CONVERSION OF STANDBY DIESEL GENERATORS TO NATURAL GAS FUELLED POWER PLANTS An investigation of the feasibility of more efficiently using existing standby diesel generators by converting them to natural gas and running them more continuously. The technical conditions necessary, the environmental consequences and the economy should be considered.	SGC	Sydskraft Konsult AB	Curr 1991-1992	Per-Arne Persson, Gunnar Sandström, SKKB Total cost 0,06 MSEK
SGC 90.69	NO_x REDUCTION BY REBURNING WITH NATURAL GAS/LAND FILL GAS IN A WASTE COMBUSTER IN MALMOE <u>Objective:</u> To demonstrate whether it is possible to reduce NO _x emissions from refuse incineration facilities by reburning with natural gas and/or biogas. <u>Description:</u> SYSAV's refuse incineration facility in Spillepengen in Malmö will be supplied with reburning equipment for gas. Measurements of emissions, temperatures, boiler load, etc. will be carried out and adjustments will be made so as to make reburning as effective as possible.	NUTEK SEU SNV NGC/GRI SGC SYSAV REFORSK RVF	SYSAV, Malmö	Curr 1991-1992	Erik Nord, SYSAV Lars Nilsson, SG Total cost 8,5 MSEK
EP 0770	NATURAL GAS BASED COGENERATION WITH GAS TURBINES Demonstration of a combustion chamber of low NO _x type.	Lunds Energi- verk/SEU	Lunds Energiverk	Curr 1991-1994	Curt Lindahl, LE Mats Olsson, LE

7. OTHER USES OF GAS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
SGC 89.09	HOME-REFUELING OF NG-DRIVEN VEHICLES	Vattenfall	Vattenfall	Compl 1990	T Ekeborg, SV SV report 90/5
	PRESSURE VESSELS FOR NATURAL GAS DRIVEN VEHICLES	Vattenfall	Vattenfall	Compl 1990	M Losciale SV report 90/15
	THE ENVIROMNENTAL IMPACT OF EXHAUST EMISSIONS FROM VEHICLES <u>Objective:</u> To make a study of the literature in order to document exhaust emissions from vehicles that operate with various fuels. <u>Description:</u> The material shall be used mostly in discussion and debate about the environmental effects of various vehicles that use various fuels.	TFB, SNV, SWG, SV, SG, EiG	EcoTraffic AB	Compl 1990	Mats Ekelund, Ecotrafic SV reports 90/62 and 90/63 with the title "Automotive fuels from source to end use. Phase 1".
SV 98454 07010 SVSS 88.15	NATURAL GAS DRIVEN VEHICLES-DEVELOPMENT OF ENGINES FOR CITY BUSES (THE SCANDINAVIAN GAS-BUS PROJECT) STAGE 1 Aims at optimizing, in a laboratory environment, two types of bus engines for operation with natural gas so as to obtain low exhaust emissions.	Nordisk industrifond, NUTEK Vattenfall, Sydskraft, SwedeGas and others	Traffic comp, engine manufactures, Vattenfall and others	Compl 1991	Tove Ekeborg, SV Proj.lead: Mats Ekelund, EcoTraffic Report in springtime of 1991.
	NATURAL GAS FOR INDUSTRIAL TRUCKS. A PRELIMINARY STUDY The study gives an account of the technical and economic factors relevant for natural gas driven trucks as well as sheds light on the pros and cons relative to LPG and diesel oil. A conversion requires a rebuilding of the engine and a supplementary fuel tank system. No rules or norms exist in Sweden for natural gas driven vehicles. Conversion of diesel trucks are economically profitable. The profitability of converting to LPG driven trucks is more questionable.	Lunds Energi-verk/Gas-Centrum	Sydskraft, Konsult AB	Compl Dec 1991	Lars-Göran Nilsson, LE Åsa Marbe, SKKB Report SGC 015 Total cost 0,1 MSEK
SGC 89.10	CO ₂ -PLANT CULTIVATION WITH EXHAUST GASES FROM NATURAL GAS FIRED BOILERS CO ₂ -plant cultivation was carried out using exhaust from natural gas boilers that were installed at Nygaard's Greenhouses in Halmstad. The air quality in the greenhouses will be measured as well as the production of vegetables, etc. The latter will be compared with the values obtained before CO ₂ -plant cultivation was introduced. The objective is to show to governmental agencies that the direct emission of exhaust from gas combustion can occur without health risks.	SGC, Lantbruks-nämnden, NGC, Nygaards	Nygaards trädgårdsodl, Halmstad	Compl 1992	Lars Nilsson, SG Total cost 1,7 MSEK SGC demo sheet no 1 SGC report autumn 1992

7. OTHER USES OF GAS

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
	NATURAL GAS DRIVEN VEHICLES – – DEMONSTRATION OF NATURAL GAS BUSES IN MALMOE	TFB, Malmö Energi AB, Malmö Lokaltrafik	Malmö Energi AB, Malmö Lokaltrafik	Compl 1992	Åke Svensson, Malmö Lokaltrafik, Report no TFB 1992:19
SGC 91.09	INCINERATION OF GASEOUS WASTES. ANALYSIS AND DEVELOPMENT PROGRAMME PROPOSAL A number of methods for reducing the emissions of volatile organic compounds (VOC) are described and the role of natural gas in this context is clarified. The most common methods are: Thermal combustion, catalytic combustion, adsorption, absorption and condensation. Included in a proposal for a course of action are, inter alia: Cleaning of styren, cleaning of vulcanization smoke, follow-up of the EVOC system and an inventory of research. Applications are recommended within, inter alia, the graphic industry, foundries, bakeries and the forest and timber industry.	SGC	Sydskraft Konsult AB, Avd EGU	Compl 1992	Lars Nilsson, SG Thomas Ehrstedt, SKKB Total cost 0,2 MSEK Report SGC 020
SGC 90.50	HOME-REFUELING OF NATURAL GAS DRIVEN VEHICLES A small electric compressor for home-refueling will be installed in a single-family residence and the owner's automobile will be converted to natural gas. A 1 year demonstration period will provide experience of the unit's functioning under Swedish conditions as regards installation, driving experience and operation. The results will provide a basis for a subsequent full-scale project or a commercial project.	SV, VNG, SG, ME, GE, STU	Vattenfall Energisystem AB	Curr 1990-1992	Tove Ekeborg, SV Jan Brännström, SV Total cost 0,4 MSEK
SGC 90.69	NO _x REDUCTION BY REBURNING WITH NG/LANDFILL GAS IN A WASTE COMBUSTOR IN MALMOE To demonstrate whether it is feasible to reduce NO _x emissions from refuse incineration facilities by reburning with natural gas and/or biogas. SYSAV's refuse incineration facility in Spillepengen in Malmö has been supplied with reburning equipment for gas. Measurement of emissions, temperature, boiler load and adjustment will be carried out for optimal reburning.	NUTEK SEU SNV NGC/GRI SGC SYSAV REFORSK RVF	SYSAV AB, Malmö	Curr 1991-1992	Lars Nilsson, SG Erik Nord, SYSAV Total cost 8,5 MSEK
SGC 90.58	NATURAL GAS FUEL STATION FOR VEHICLES The objective is to develop a simple and cost-efficient filling station for buses and distribution vehicles by connecting in parallel four simple home-compressors that will be placed together with a gas storage in a 20-foot container. Testing will take place over a 2 year period.	SGC	Göteborg Energi AB	Curr 1991-1993	Einar Änghede, GE Total cost 0,5 MSEK

8. MEASUREMENT TECHNOLOGIES

Internal project designation	PROJECT NAME Project description	Purchaser/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
	ACCURACY IN FLOW-MEASUREMENTS OF NATURAL GAS	Vattenfall		Compl 1990	K Steen SV report 90/11
SV 98452 03011	FOLLOW-UP OF GAS-FLOW METERS Investigation of accuracy of gas meters for customer billing.	Vattenfall	Vattenfall, BEP section	Compl 1991	Rolf Mattsson, BEP, Vattenfall
VF G8-903	INSTRUCTIONS FOR MEASUREMENTS ON GAS ENGINES Within the project has been developed guidelines and instructions for how emission measurements, etc. should be carried out on gas engines.	Värmeforsk	VIAK	Compl March 1991	Lennart Eriksson, VIAK, Vänersborg VF report no 404
STEV 656-085 VF G8-912	ABSOLUTE CALIBRATION OF GAS FLOW METERS BASED ON ULTRASONICS Measurement of the developed ultra sonic meter (see project G3-405) against a calibrated reference can establish performance in absolute measure for the ultrasonic technique.	Värmeforsk, NUTEKz	Värme- o Kraftteknik, LTH	Compl 1992	Jerker Delsing, Värme- o Kraftteknik, LTH Only internal VF report is available until further notice.
VF G1-117	ABSOLUTE CALIBRATION EQUIPMENT FOR GAS FLOW METERS <u>Objective:</u> To develop and adapt equipment for precision calibration, etc, of ultrasound-based measurement equipment that is at present being developed at LTH (cf. project G8-405) <u>Description:</u> A calibration rig will be constructed that will give stable references, stable gas flow, a wide dynamic measurement range and high measurement precision.	Värmeforsk/ /VF, NUTEK, SK, SSF	Värme- och Kraftteknik, LTH	Curr 1992-1993	Jerker Delsing, Värme o Kraftteknik, LTH

9. ADDITIONAL AREAS OF INTEREST

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
STU 89-1655 89-4289	THE NATURAL GAS MARKET IN SCANDINAVIA An investigation into the infrastructure relating to natural gas for operation of vehicles.	NUTEK TFB EFN Nordiskt Ministerråd	Ekonomisk historia, Göteborg University	Compl 1990	Sven-Olof Olsson, GU
VF G2-701	DISPERSION OF NO _x FROM NATURAL GAS FIRED BOILERS	Värmeforsk, level 2- projekt	FTC	Compl 1990	Göran Holmstedt, FTC
VF G8-906	CARBON DIOXIDE EMISSIONS AND ENVIRONMENTAL CONSEQUENCES A survey of the state of knowledge as regards the consequences of carbon dioxide formation with various types of fuels and power plants.	Värmeforsk	LTH, Värme och Kraftteknik	Compl Dec 1990	Per Rosén, Värme- o Kraftteknik, LTH Handl: Tord Torisson, Värme- o Kraftteknik, LTH VF report no 373
SK 90.32	OPTIMAL PURCHASING METHODS FOR LPG TERMINALS Evaluation of partial purchasing versus total contracting. Examples of application: Karlshamn and Sundsvall.	Sydskraft/SSF	LTH	Compl 1991	Sigvard Trönell, SKKB Prof Jan Söderberg, LTH Report is available.
	OPERATION AND MAINTENANCE HANDBOOK FOR RECIPROCATING ENGINE DRIVEN COGENERATION PLANTS	Vattenfall	Vattenfall Energisystem AB	Compl 1991	Christer Sandstedt, Vattenfall Energisystem AB Report is available
VF G8-002	RESOURCES AND COMPETENCE WITHIN SWEDISH GAS TECHNOLOGY RESEARCH <u>Objective:</u> A survey of the resources and competence in Swedish institutions, firms and organizations within the area of gas technology. <u>Description:</u> The survey shall, inter alia, be of use when evaluating the qualifications of different institutions and firms to carry out specific research and development tasks.	Värmeforsk	Energi-konsult A Bauer AB	Compl 1991	A C Bauer Jörgen Thunell, SGC VF-report no 399
SV 93756	GAS SAFETY. A SURVEY The study shall result in guidelines for the analysis of cases of error and for the calculation of emissions. It will also propose measures for reduction of gas leakage risks, for limitation of the quantities of gas emitted, for the prevention of explosions as well as for the reduction of the consequences of an explosion.	Vattenfall	Vattenfall	Compl 1991	Rolf Mattsson, SV
SK 90.17	ODOURIZING Analysis of problems during odourizing of natural gas and recommendations for improvements.	Sydgas/ /Sydkraft	Sydkraft	Compl 1991	Niclas Widing, SG Report is available

9. ADDITIONAL AREAS OF INTEREST

Internal project designation	PROJECT NAME Project description	Ordered by/ /Financed by	Carried out by	Time Schedule	Contact persons Report designation Project cost, etc.
VF G8-813	DISPERSION MODEL ADAPTED FOR USE WITH PERSONAL COMPUTERS Development of a PC program with a model for describing critical pollution levels from small, free-standing natural gas fired plants.	Värmeforsk	SMHI	Compl 1991	Sture Ring, SMHI VF report no 401
	OPERATION AND MAINTENANCE HANDBOOK FOR LPG PLANTS	Vattenfall	Vattenfall Energisystem AB	Curr 1989-1991	Christer Sandstedt, Vattenfall Energisystem AB

**Addresses of certain of the companies and
organizations referred to in the project catalogue**

Appendix
1(1)

Byggforskningsrådet
S:t Göransgatan 66
112 33 STOCKHOLM

Svensk Energiutveckling AB
Box 1765
117 87 STOCKHOLM

Drifttekniska institutionen vid LTH
Stora Varvsgatan 11 H
211 20 MALMÖ

Svenska Gasföreningen
Box 6405
113 82 STOCKHOLM

Energigasinstitutet vid LTH
Box 118
221 00 LUND

Swedegas AB (Se Vattenfall Naturgas AB)

Göteborg Energi AB
Box 53
401 20 GÖTEBORG

Sydgas AB
Box 19006
200 73 MALMÖ

Förbränningstekniskt Centrum i Lund
LTH
Box 118
221 00 LUND

Sydkraft AB
205 09 MALMÖ

Inst för Elektrisk Mätteknik
LTH
Box 118
221 00 LUND

Sydkraft Konsult AB
205 09 MALMÖ

Inst för Värme- och Kraftteknik
LTH
Box 118
221 00 LUND

Terminalgas AB
Box 84
374 22 KARLSHAMN

Inst för Värme- och Ugnsteknik
KTH
100 44 STOCKHOLM

Theorell och VBB Energikonsulter (TVE)
(Se VBB VIAK)

Malmö Energi AB
Box 50510
202 50 MALMÖ

Tumab
Box 718
261 27 LANDSKRONA

Nordisk Gasteknisk Center
Dr. Neergårdsvej 5
DK-2970 HÖRSHOLM
Danmark

Vattenfall AB
162 87 VÄLLINGBY

NUTEK
117 86 STOCKHOLM

Vattenfall Energisystem AB
Box 528
162 15 VÄLLINGBY

Stiftelsen Värmeteknisk Forskning
(Värmeforsk)
Box 6405
113 82 STOCKHOLM

Vattenfall Naturgas AB
Box 12530
102 29 STOCKHOLM

Studsvik AB
611 82 NYKÖPING

VBB VIAK AB
Box 5038
102 41 STOCKHOLM

VIAK AB (Se VBB VIAK)

ÅF Energikonsult AB
Stensjögatan 3
217 65 MALMÖ

ÅF Energikonsult AB
Box 8133
104 20 STOCKHOLM

92-10-20

RAPPORTFÖRTECKNING

SGC Nr	Rapportnamn	Rapport datum	Författare	Pris kr
001	Systemoptimering vad avser ledningstryck	Apr 91	Stefan Grudén TUMAB	100
002	Mikrokraftvärmeverk för växthus. Utvärdering	Apr 91	Roy Ericsson Kjessler & Mannerstråle AB	100
003	Katalog över gastekniska FUD-projekt i Sverige. Utgåva 3	Apr 91	Svenskt Gastekniskt Center AB	100
004	Krav på material vid kringfyllnad av PE-gasledningar	Apr 91	Jan Molin VBB VIAK	50
005	Teknikstatus och marknadsläge för gasbaserad minikraftvärme	Apr 91	Per-Arne Persson SGC	150
006	Keramisk fiberbrännare - Utvärdering av en demo-anläggning	Sep 92	R Brodin, P Carlsson Sydkraft Konsult AB920212	100
007	Gas-IR teknik inom industrin. Användnings- områden, översiktlig marknadsanalys	Aug 91	Thomas Ehrstedt Sydkraft Konsult AB	100
008	Catalogue of gas technology RD&D projects in Sweden (På engelska)	Jul 91	Swedish Gas Technology Center	100
009	Läcksökning av gasledningar. Metoder och instrument	Dec 91	Charlotte Rehn Sydkraft Konsult AB	100
010	Konvertering av aluminiumsmältugnar. Förstudie	Sep 91	Ola Hall, Charlotte Rehn Sydkraft Konsult AB	100
011	Integrerad naturgasanvändning i tvätterier. Konvertering av torktumlare	Sep 91	Ola Hall Sydkraft Konsult AB	100
012	Odöranter och gasolkondensats påverkan på gasrörsystem av polyeten	Okt 91	Stefan Grudén, F. Varmedal TUMAB	100
013	Spektralfördelning och verkningsgrad för gaseldade IR-strålare	Okt 91	Michael Johansson Drifttekniska Instit. vid LTH	150
014	Modern gasteknik i galvaniseringsindustri	Nov 91	John Danelius Vattenfall Energisystem AB	100
015	Naturgasdrivna truckar	Dec 91	Asa Marbe Sydkraft Konsult AB	100
016	Mätning av energiförbrukning och emissioner före o efter övergång till naturgas	Mar 92	Kjell Wanselius KW Energiprodukter AB	50

92-10-20

RAPPORTFÖRTECKNING

SGC Nr	Rapportnamn	Rapport datum	Författare	Pris kr
017	Analys och förslag till handlingsprogram för området industriell vätskevärmning	Dec 91	Rolf Christensen ÅF-Energikonsult Syd AB	100
018	Skärning med acetylen och naturgas. En jämförelse.	Apr 92	Åsa Marbe Sydkraft Konsult AB	100
019	Läggning av gasledning med plöjteknik vid Glostorp, Malmö. Uppföljningsprojekt	Maj 92	Fallsvik J, Haglund H m fl SGI och Malmö Energi AB	100
020	Emissionsdestruktion. Analys och förslag till handlingsprogram	Jun 92	Thomas Ehrstedt Sydkraft Konsult AB	150
021	Ny läggningsteknik för PE-ledningar. Förstudie	Jun 92	Ove Ribberström Ove Ribberström Projektering AB	150
022	Katalog över gastekniska FUD-projekt i Sverige. Utgåva 4	Aug 92	Svenskt Gastekniskt Center AB	150
023	Läggning av gasledning med plöjteknik vid Lillhagen, Göteborg. Uppföljningsproj.	Aug 92	Nils Granstrand m fl Göteborg Energi AB	150
024	Stumsvetsning och elektromuffsvetsning av PE-ledningar. Kostnadsaspekter.	Aug 92	Stefan Grudén TUMAB	150
025	Papperstorkning med gas-IR. Sammanfattning av ett antal FUD-projekt	Sep 92	Per-Arne Persson Svenskt Gastekniskt Center	100
026	Koldioxidgödsling i växthus med hjälp av naturgas. Handbok och tillämpn.exempel	Aug 92	Stig Arne Molén m fl	150
027	Decentraliserad användning av gas för vätskevärmning. Två praktikfall	Okt 92	Rolf Christensen ÅF-Energikonsult	150
028	Stora gasledningar av PE. Teknisk och ekonomisk studie.	Okt 92	Lars-Erik Andersson, Åke Carlsson	150



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