INTRODUCTION

STEENSEN & VARMING INTERNATIONAL APS

CONSULTING ENGINEERS AND PLANNERS

1980

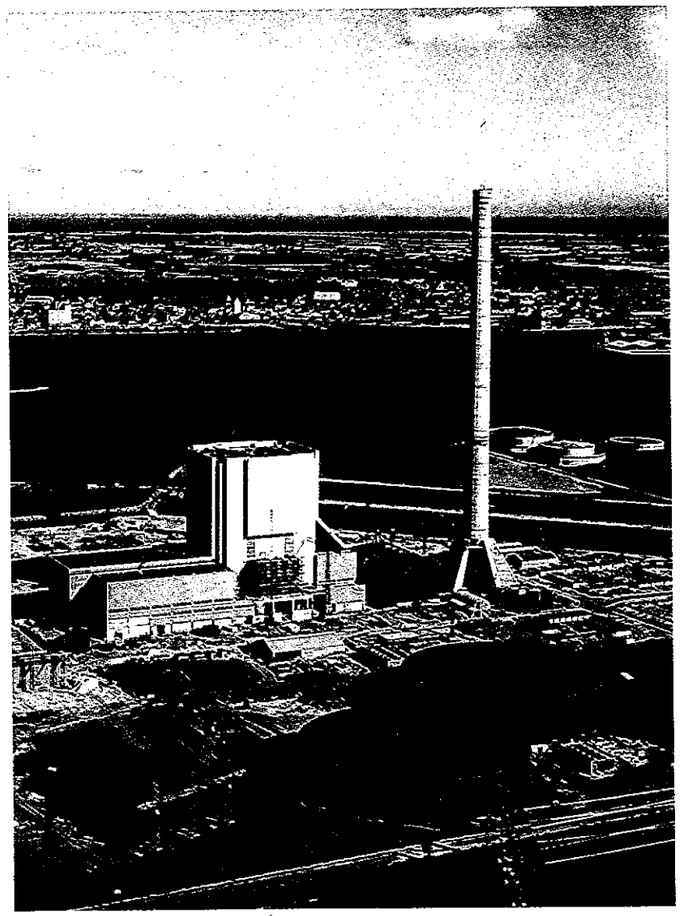
Energy Conservation

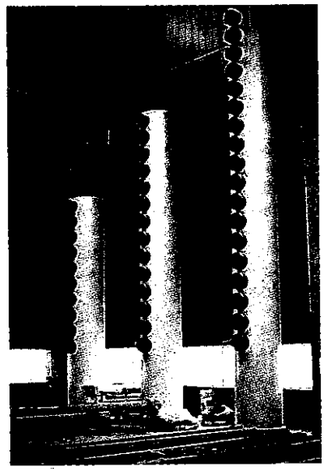
Energy conservation at power plants is essential to obtain optimal running economy of the overall energy production.

At the Asnæsværk, block 5
combustion air is partly taken through the neighbouring buildings in which it is being preheated to approx. 30°C. This amount of air equals approx. 800,000 cu.m/h, which again is approx. 1/3 of the total amount of combustion air. The balance 2/3 of the combustion air is taken in through pressure controlled air intakes in the facades of the boiler hall and together with the first 1/3 of the air led up to the top of the boiler hall being heated by the general heat loss from the boiler. From here a plenum ventilation arrangement brings the total amount of combustion air (approx. 2,300,000 cu.m/h) down to the combustion air intakes at the boiler.

At the air intakes to the neighbouring buildings the supply air is heated by the process cooling water (approx. 38°C) in heating coils (total face area 48 sq.m).

Total annual energy saving equals approx. 100,000 MWh





Ventilation of hall for turbine through diffusers in vertical supply raisers.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Planning and design of the total ventilation system for the generator hall, the boiler hall and the burner galleries and for the combustion air to the boiler itself.

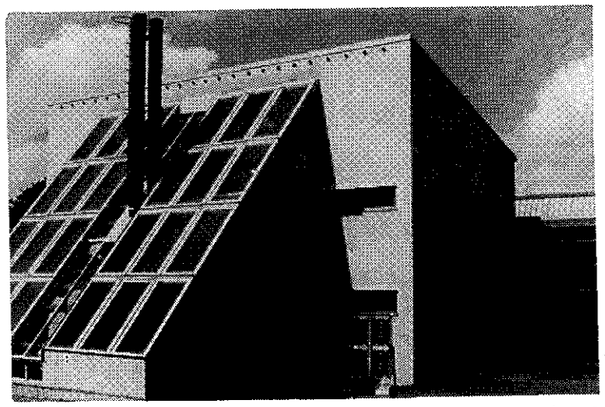
Key figures and selected services data:
Max. continuous output 640 MW
Fuel consumption, coal 230 tons/h
or oil 130 tons/h
Combustion air 2.0-2.3 mill cu.m/h
(600 cu.m/sec.)
Total energy saving approx.
100,000 MWh/year
Construction period 1970-1980
Start up production 1980

Architect:
Gottlieb Høgsted Paludan, m.a.a.

Client:
Elektricitetsselskabet Isefjordværket I/S

SOLAR ENERGY

SELECTED REFERENCES



LOW ENERGY HOUSE, SKIVE ARCHITECTS: THE ARCHITECT GROUP IN ÅRHUS

Low Energy House Skive, Denmark	A 135 m2 residence with the following features: Very high insulation standard, specially designed low temperature floor heating, 30 m2 solar panels, heat recovery from waste water.	1975
Swimming-pool Greve, Denmark	Competition for a pool with Olympic dimensions. Water for showers heated by solar panels.	1976
District Heating Ballerup, Denmark	Study of the rentability of a 700 m2 solar absorber as an addition to an existing oil fired district heating plant.	1976
Kent Ridge Hospital Singapore	Design of 13 separate solar heating systems for supply of domestic hot water to a 750 bed teaching hospital. The total collector area amounts to approx. 2000 m2.	1977
Værebro School Gladsaxe, Denmark	Proposal for 150 m2 solar panels for supply of hot water to a sports' hall.	1978
Dairy Cattle Farm Sidi Jabeur, Tadla Morocco	For a farm with 1000 dairy cows 4 separate solar panel installations each of 36 m2 shall supply hot water for cleaning purposes in the milking parlours.	1978
Private House Nærum, Denmark	10 m2 solar absorbers installed for producing domestic hot water.	1979

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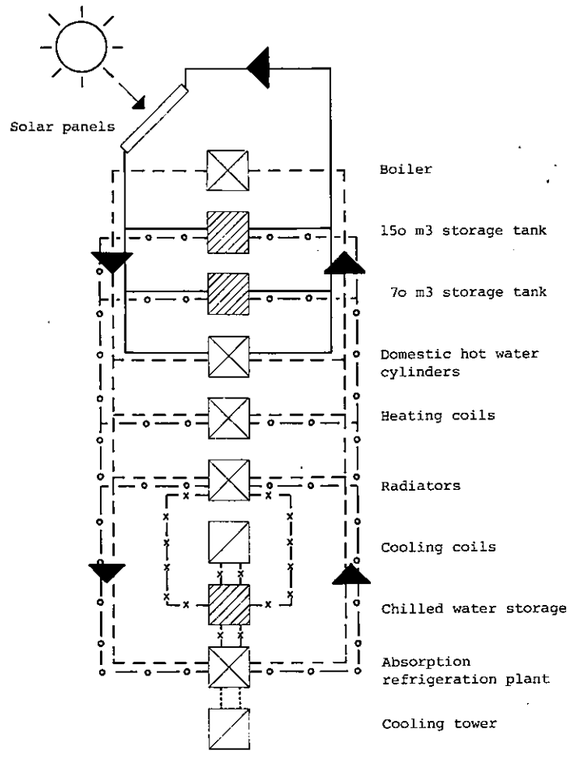
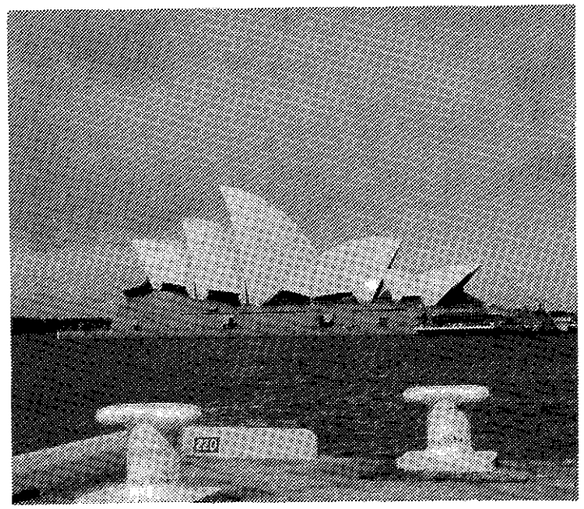


UNIVERSITY OF CALABRIA DIAGRAM FOR SOLAR PLANT

University of Calabria, Italy	Design of 2400 m2 solar absorption plant for a township of 750 students and staff. The plant will supply energy for central heating, for domestic hot water and also for a refrigeration plant with absorption machines for air conditioning of refectory, assembly halls etc.	1977
Farum 5th School Denmark	Design of solar energy plant with 150 m2 absorbers for heating and hot water combined with buried pipes for energy storage and a heat pump for energy recovery from the ground.	1980
Kildegaard Secondary School, Hellerup Denmark	Design of 45 m2 solar plant for for producing hot water for shower facilities.	1980

HEAT PUMPS

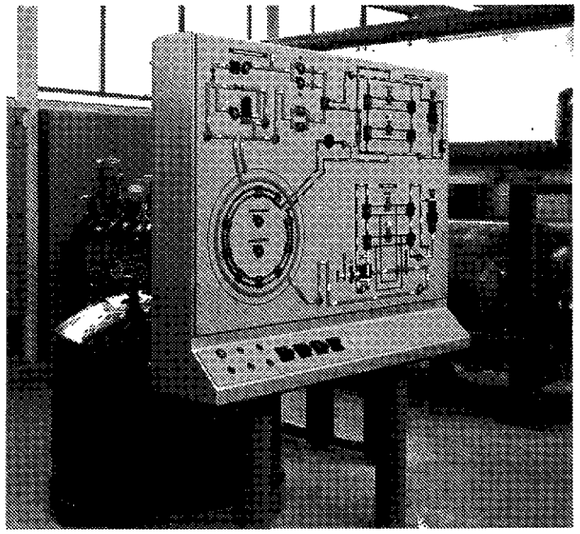


SYDNEY OPERA HOUSE, AUSTRALIA ARCHITECT: JØRN UTZON

SELECTED REFERENCES

Sydney Opera House Australia	3 compressors with 400kW electric motors supply chilled water for cooling, the heat being removed by sea water. When heating is required the same plant may supply hot water, extracting heat from the sea water.	1970
Private House Hundested, Denmark	The house is heated by an air to air heat pump.	1974
Private Swimming-pool Gentofte, Denmark	The air humidity caused by evaporation of pool water is removed by circulating the air through a cooling coil. The latent heat thus recovered is transferred back to the pool water by a heat pump.	1976
Private House Hellerup, Denmark	Heating and domestic hot water is produced by a heat pump drawing heat from 400 m brine filled plastic piping buried in the sea bed.	1979
Farum 5th School Denmark	Design of heating system (floor heating + ventilation) with 400 kW heat pump taking heat from the ground under the sports fields where 13 km polyethylen pipes are buried. The ground is also used as heat store for a solar absorption plant.	1980

P.T.O.



NUCLEAR RESEARCH REACTOR DR 3, RISØ
CONTROL PANEL FOR HEAT PUMP INSTALLATION

Reactor DR3 Risø, Denmark	A plant for heating or cooling of the reactor hall. The plant produces chilled water and hot water. When cooling is required the heat is removed in a cooling tower, when heating is required the exhaust air from the hall heats the chilled water.	1958
Cattle Farm Denmark	Design of heat pumps installation extracting heat from humid air in the cattle house and using it for producing hot water and heat for residences.	1980
District Heating Scheme, Aars Denmark	In connection with a geothermal heating plant a 400 kW heat pump shall cool the geothermal water before re-injection thus augmenting the yield of the geothermal well.	1980 80

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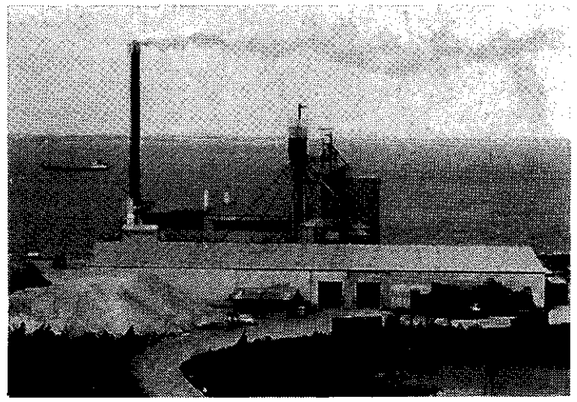
ENERGY CONSERVATION



SKAMOL, MORS, DENMARK

SELECTED REFERENCES

Danish State Railways	Improving existing workshops etc. Insulation of buildings, new double glazing, reduction of infiltration loss, automatic controls.
Copenhagen Transport	Energy reduction in bus cleaning stations. Reuse of water for washing, buses.
The Danish State Veterinary Institute for Virus Research Lindholm, Denmark	Report about rentability of insulation of existing buildings, use of refrigeration plant as heat pump, installation of heat exchangers in ventilation plants etc.
Hinnerup Municipality Denmark	Report on all Municipal buildings regarding rentability of possible energy saving measures.
Dragsbæk Maltfabrik Thisted, Denmark	Installation of heat recovery plant for kiln process in malt production.
Thor Bryggerierne Randers, Denmark	Report on rentability of heat recovery from kiln process.
Roelants Maltings Ruisbroek, Belgium	Report on rentability of energy saving measures in malt production.
Skamol Mors, Denmark	Installation of heat recovery plant for moler (clay) drying and burning.
Raychem Glostrup, Denmark	The waste heat from a linear accelerator is used for heating the rest of the factory.

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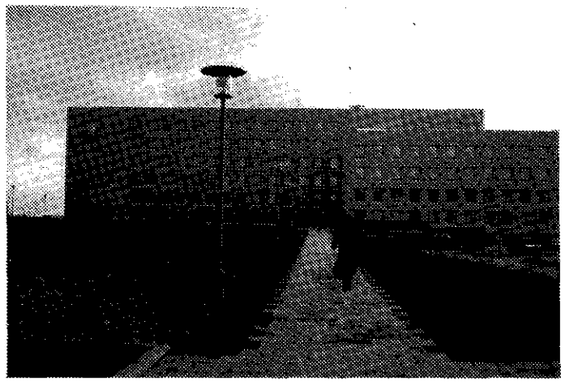

SØNDRE TOLDBOD, COPENHAGEN ARCHITECT: OLE HAGEN

Søndre Toldbod Copenhagen, Denmark	Approx. 20.000 m2 office building with heat transfer from exhaust to air in-take. Also utilization of sea water for cooling the building when sea water temperature is low.
Asnæs Power Station Denmark	Low temperature cooling water is used for preheating combustion air.
Office buildings and dwellings, Denmark	Numerous examples of heat savings by insulation, air-tightning, automatic controls of heat system etc.

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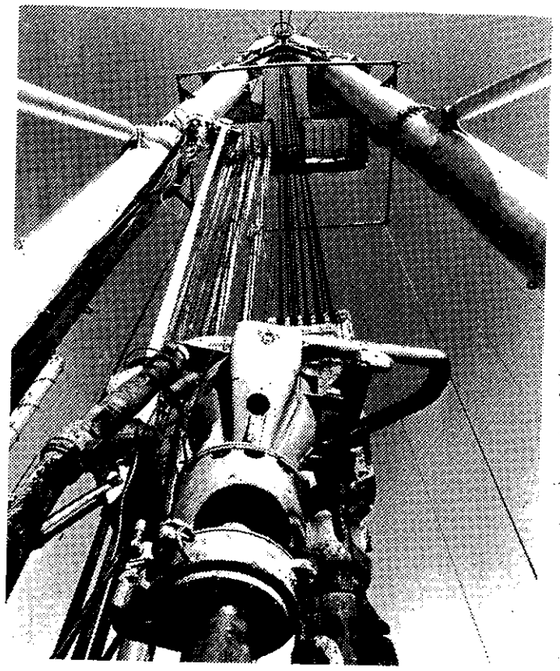
ALTERNATIVE ENERGY

SELECTED REFERENCES



GEOTHERMAL ENERGY RIG ON LOCATION AT AARS

GEOTHERMAL ENERGY

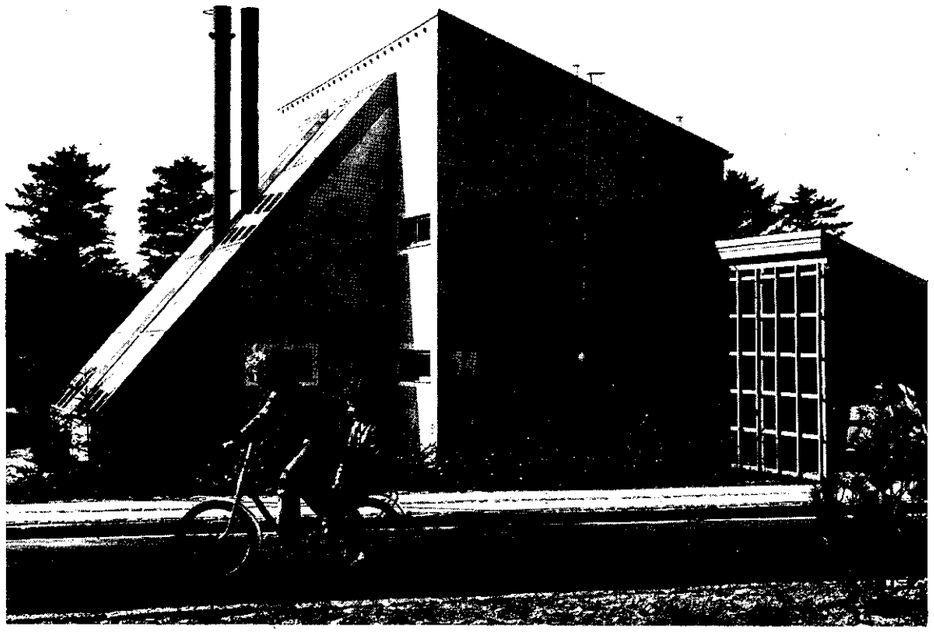
District Heating
Aars, Denmark

Two boreholes are drilled to a depth of 3 km. Hot water is circulated through a heat exchanger and the heat is used in the district heating system of the town.

HEAT PUMPS

Nuclear Research Risoe, Denmark	Heat recovery from exhaust air by a heat pump supplying heat to the reactor hall.
Sydney Opera House Australia	The building is heated by a large heat pump extracting heat from sea water.
Private Swimmingpool Gentofte, Denmark	The humidity of the room air is removed by a cooling coil and the latent heat is transferred to the pool water by a heat pump.
Private House Hellerup, Denmark	The house is situated at the beach of the Sound. Approx. 500 m plastic pipe is buried 0,5 m below the sea bed and a heat pump chills the sea water and heats the house.
Cattle Farm Denmark	A heat pump extracts heat from the cattle house exhaust and heats two dwellings and produces hot water for domestic as well as for farm use.
Private House Birkeroed, Denmark	An existing house with floor heating system is being fitted with a heat pump extracting heat from outside air.

P.T.O.



LOW ENERGY HOUSE, SKIVE

ARCHITECTS: THE ARCHITECT GROUP IN ÅRHUS

SOLAR ENERGY

Low Energy House Skive, Denmark	A 135 m2 residential house with 30 m2 solar absorbers supplying heat to a specially designed floor heating system.
University of Calabria Italy	2000 m2 solar panels for heating, hot water and cooling.
Kent Ridge Hospital Singapore	13 separate solar absorption plants with a total area of 2000 m2 for supplying hot water to a 750 bed hospital.
Private House Naerum, Denmark	10 m2 solar panels for supplying domestic hot water.
School Farum, Denmark	A new school with 500 pupils to be fitted with 150 m2 of solar panels to work in conjunction with a heat pump.

BIOGAS

Dairy Cattle Farm Moen, Denmark	A pilot plant with 10 m3 reactor produced biogas which was used for heating and hot water for the milking parlour.

WINDMILLS

School Farum, Denmark	Design of a school for 500 pupils to be heated by a heat pump extracting heat from the soil. The heat pump to be driven by electricity produced by a windmill.

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00-94-05-79

Industrial Plants

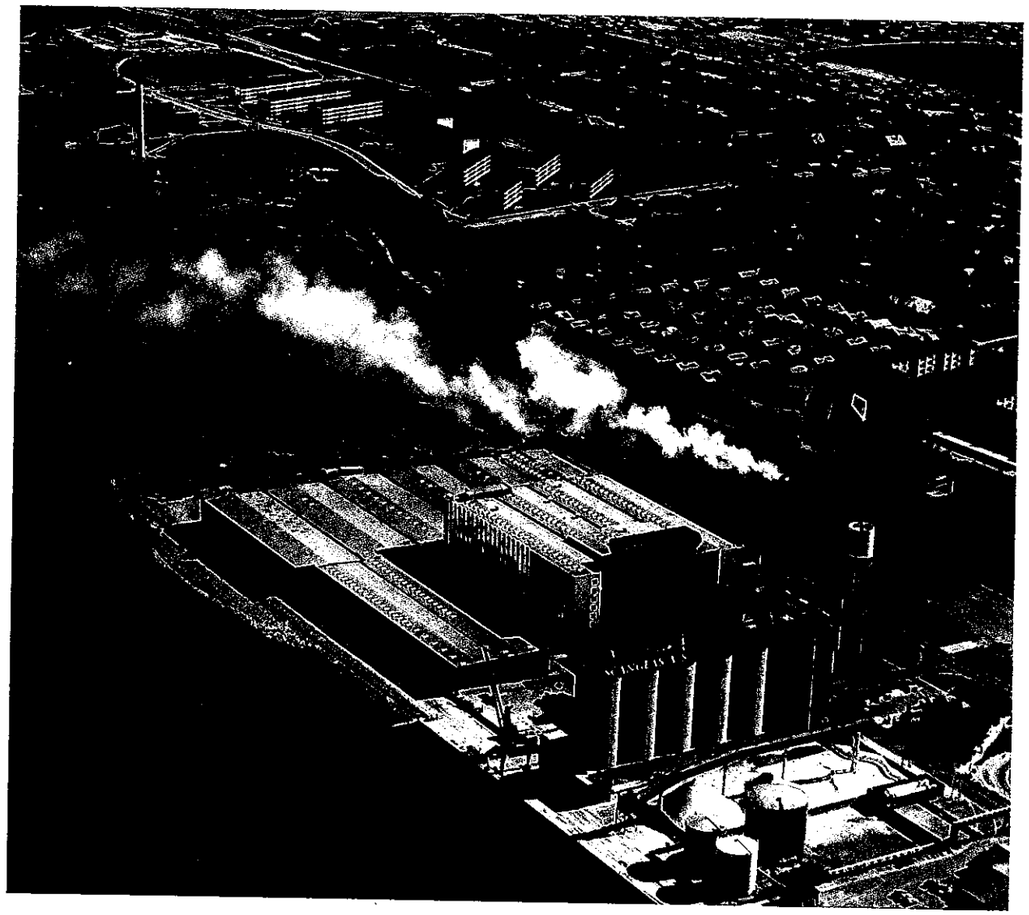
The CIC member firms have acted as consultants on the projects referred to, in own capacity or in cooperation with other firms

Further information regarding scope of professional services and names of other consultants connected with the specific projects may be obtanied at CIC

CIC

06-05-02-79 P75

Scandinavian Window Glass Factory
Denmark



The factory is based upon the U.S.A.-Pittsburgh Plate Glass Co.'s expertise on the plate glass technology.

The factory was ready for production only 2 years after the decision was made to build the factory. This naturally meant a very short design period and design/construction in parallel.

Total capacity of the factory is 20 mill. sq.m of glass per year.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Participation in the overall design team as responsible for mechanical services and for part of the process services, including:

- cooling water system
- cooling panels for the plate glass drawing
- process ventilation
- H.T.H. oil system
- fuel oil system
- fire protection system
- drying system for roller-cylinders

Selected key figures:

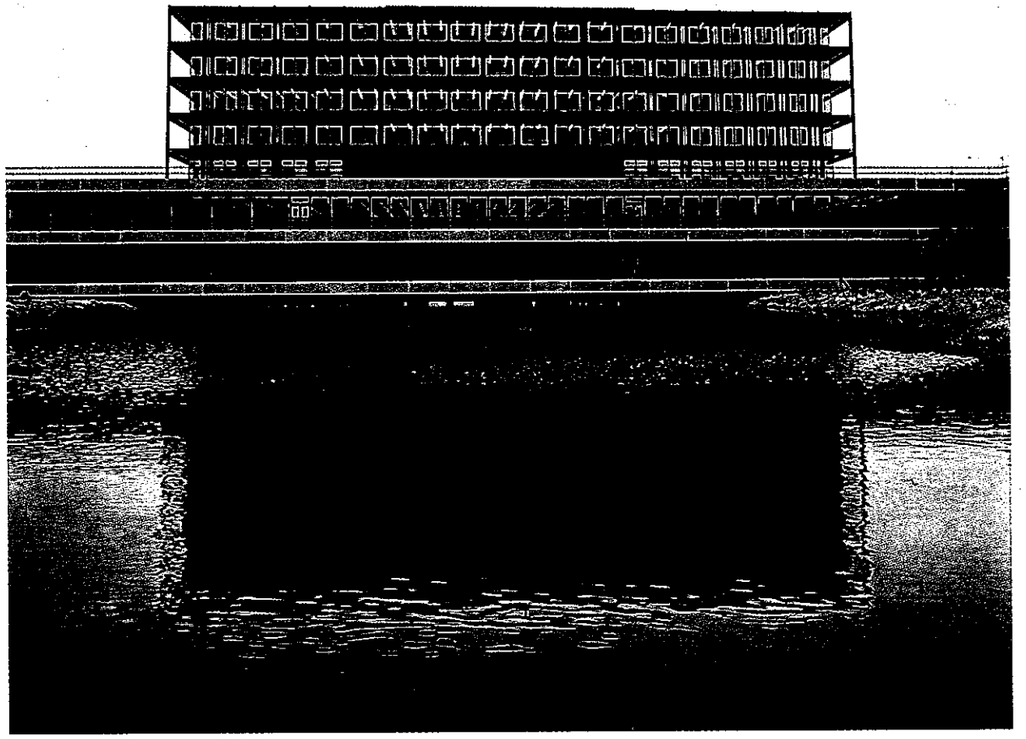
Decision to build 13.09.67
Design start 10.10.67
Start on site 01.02.68
Start installation equipment 01.03.69
First glass produced 13.09.69
Full capacity 01.01.70
Total floor area 42,000 sq.m
Total building volume 325,000 cu.m
Total cost (1970) US$ 12 mill.
excl. special equipment.

Client and project team:

Glasværkskonsortiet

06-05-01-79 P76

W.D. & H.O. Wills Limited
England



A 140,595 sq.m factory complex on a site of 56 acres for the manufacture of cigarettes and loose tobacco, together with a head office.

Production and office areas are fully air conditioned to required control levels incorporating 5,000 tons refrigeration and with air plants handling 1.2 million litres per second.

Total transformer capacity 24 MVA.

The project encompassed production and handling facilities in addition to all environmental services.

A special feature is the electronic supervisory system which monitors the air conditioning system and provides remote control of entire plant.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

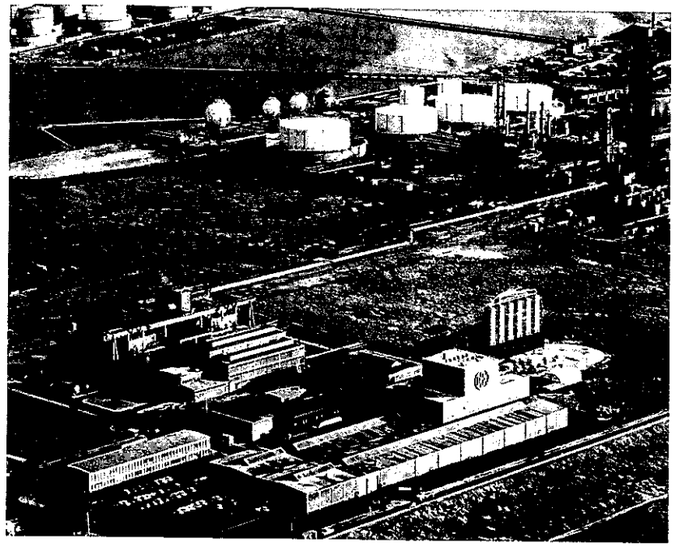
Planning, design and contract administration of H.V.A.C. services, transportation services and process services.

Architects:
Skidmore Owens & Merrill, Chicago
Yorke Rosenberg Mardall, London

Client:
Imperial Tobacco Company

06-05-03-79 P77

Industrial Projects



Danbritkem/Mærsk Kemi
High Pressure Polyethylene Factory
Denmark

The project includes process plant, blending and packing plant, warehouse, workshop, laboratory, administration building and amenity building.

The factory is based upon the I.C.I. expertise on polyethylene production, and the high pressure side is designed and documented by I.C.I.

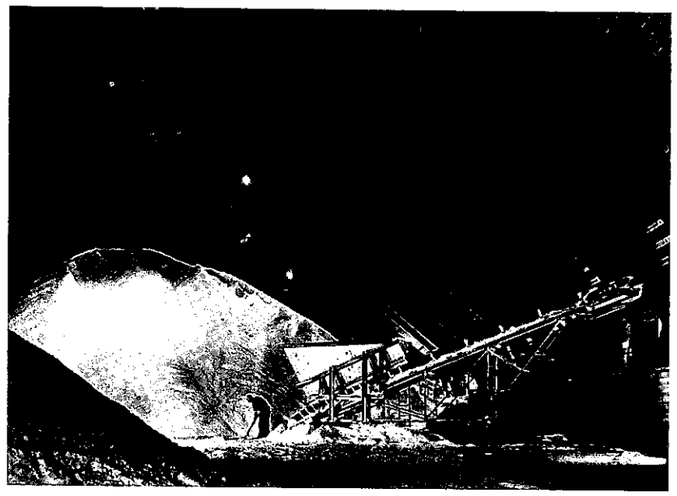
Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Responsible for the design, documentation, contract administration and supervision of civil, structural and mechanical engineering, and assisted in the procurement, contract administration and negotiation with authorities for process services and equipment.

Architects:
Preben Hansen m.a.a.
Royal Surveyor of Buildings

Client:
Danbritkem, Denmark



Danish Salt Factory
Denmark

The factory is based upon the Netherland company KNZ expertise on salt technology.

The project includes drilling in salt horst, pipe line (26 km) to factory and the factory itself with all services. Total capacity of salt is 150,000 tons per year.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Responsible for the design/documentation/contract administration of civil and structural work and of all mechanical and process services for packing and transportation.

Architect:
Preben Hansen m.a.a.
Royal Surveyor of Buildings

Client:
Dansk Salt A/S, Denmark

Commercial Projects

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00-94-06-79

The CIC member firms have acted as consultants on the projects referred to, in own capacity or in cooperation with other firms

Further information regarding scope of professional services and names of other consultants connected with the specific projects may be obtanied at CIC

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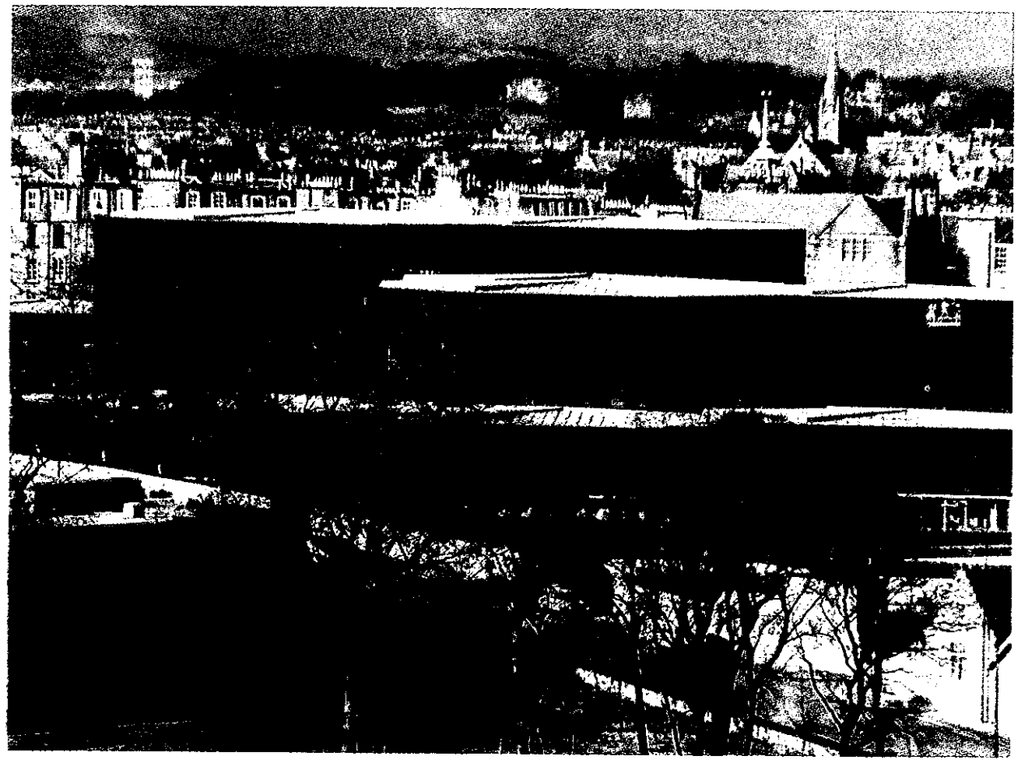
06-06-01-79 P88

Scottish Widows Fund and Life Assurance Society Edinburgh



The scheme for the head office achieves balance between the complex requirements of an expanding business and the design limitations imposed on the use of a site, situated in an area of considerable beauty. The project represents one of the largest and most significant buildings undertaken in Scotland.

Completion date April, 1976.

The building provides 26,000 sq.m of accommodation and is a honeycomb formation with 12 interlinking hexagonal modules.

The building, which is fully air conditioned, provides spacious office accommodation on office landscape principles for up to 1,700 staff members.

A system of mechanically ventilated double glazing was developed to control variations in temperature on the perimeter areas. The main areas are served by a variable air volume (VAV) air conditioning system.

Internal lighting is contained in continuous recessed trunking as an integral part of the finished ceilings, extract air being exhausted through lightfitting troffers into ceiling void.

The computer suite air conditioning is independent of the other systems. The suite essentially comprises two areas, the computer room and the administrative area, each with a separate air conditioning system.

Air is supplied to the computer room at a rate of 30 air changes per hour through a perforated ceiling, and is extracted through the floor into a void below. A positive pressure is maintained in the room to prevent the in-flow of contaminated air to the computers. The design conditions are 21°C± 1°C with 50 % R.H. ± 5%.

Air is supplied to the administrative area by a recirculating plant at the rate of eight air changes per hour through slot diffusers, and extracted through the lighting fittings and windows.

Computerised control system

The computerised control system with the central control console has been installed to control all air conditioning, water services, ligthing electrical switch gear and fire security equipment.

At any time the entire status of the plant can be checked on a print-out. There are a number of other special features, but the primary purpose of the equipment is to reduce maintenance to a minimum and optimise economy in operation.

The system is built around a communication loop principle. A management by exception concept ensures that the computer operator only receives information on matters requiring immediate attention, unless he specifically requests other data.

All operational routines such as monitoring, controlling and operator communication are compiled as instructions in software, giving flexibility without hardware changes in the event of additions to or change of use of buildings or building services.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Planning, design, documentation and contract administration of all building services.

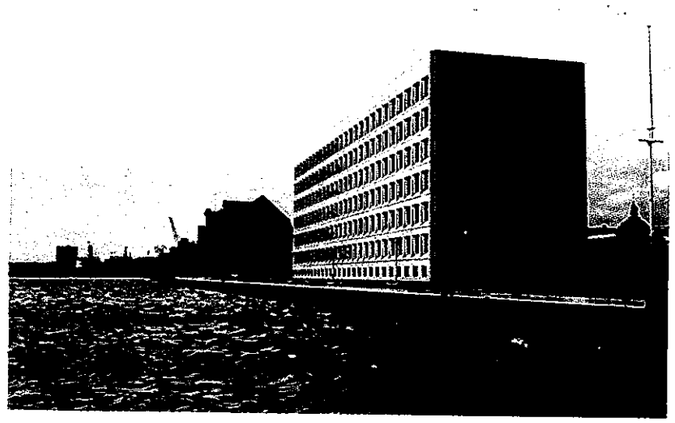
Architect:
Sir Basil Spence Gloves & Ferguson.

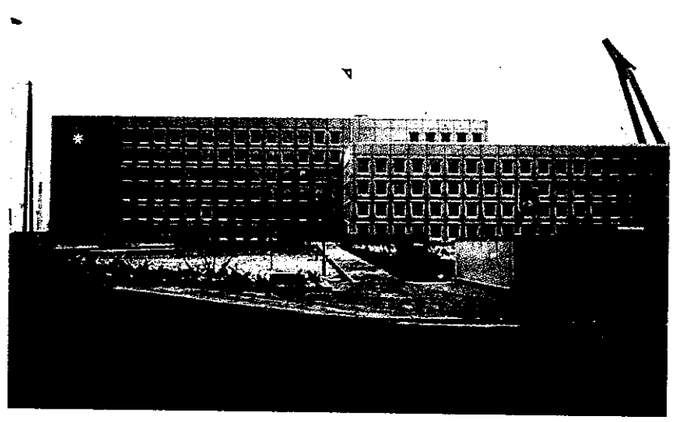
Client:
Scottish Widows Fund and Life Assurance Society.

06-06-02-79 P89

A. P. Møller Administration Building Denmark

The building is located at the Copenhagen Harbour side.





New administration building for the A.P. Møller Organization
A 6-storey, 20,000 sq.m administration building, providing office accommodation for up to 800 staff members.

The building is fully air conditioned by means of two big 4-tube induction systems and ten minor air conditioning systems, all equipped with heat recuperation plants. The building is heated by district heating and cooled by means of two 500 kW refrigeration machines.

The cooling plant is of special interest as the cooling effect of the water from the nearby harbour is utilized optimally. The refrigeration machines are not operated until the temperature of the harbour water increases to a level where no cooling effect is directly obtainable for the air conditioning.

All technical plants in the building are supervised and controlled by a supervisory control centre. It should be noted that air conditioning plants are disconnected after hours and only connected as late as possible the following day by means of an optimizing starting programme.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Consulting engineers for the mechanical, electrical and structural engineering scheme, and responsible for commissioning/hand over procedures.

Architect:
Ole Hagen, architect m.a.a.

Client:
The A.P. Møller Organization

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06-06-03-79

Office Buildings

Gentofte Centre, Gentofte, Denmark
2,000 sq.m office landscape, shops, basement parking etc.

BP Oil-Company, Aalborg, Denmark
Administration building for BP, situated at the harbour of Aalborg.

Radiometer, Copenhagen
Administration building in connection with manufacture and sale of electrical and electronic equipment, incl. several stages of extensions.

Kalk & Mørtelværkerne, Copenhagen
Pavilet building made of prefabricated wooden panels.

Roche A/S, Avedøre Holme, Denmark
2,000 sq.m administration and storage building with cool room for pharmaceutical products.

Passagen, Roskilde, Denmark
Shops, offices and basement parking.

Hjallerup Savings Bank, Denmark
Approx 1,000 sq.m service and administration building.

Sanistål, Aalborg, Denmark
Design of mechanical, electrical and structural engineering for office building for Lange & Unmack (Sanistål), a 2-storey building of approx 1,600 sq.m.

Thisted Co-operative Bank, Thisted, Denmark
2-storey building with basement, total area about 1,500 sq.m, situated at the harbour of Thisted.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Civil/structural and/or services design and documentation.

Public Buildings and Cultural Institutions

P109

00-94-08-79

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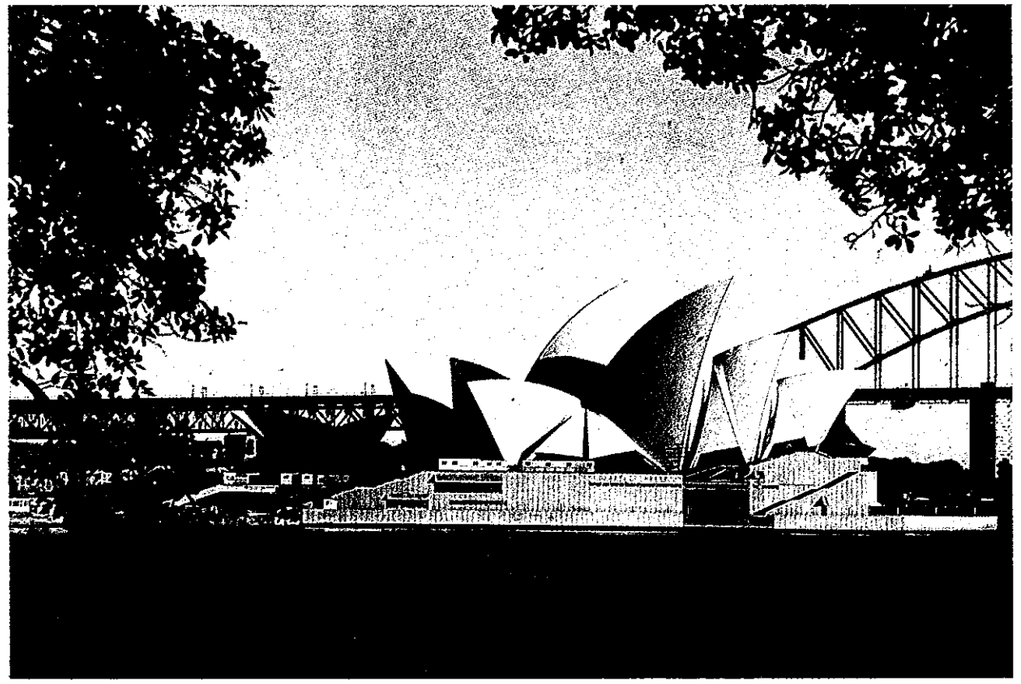
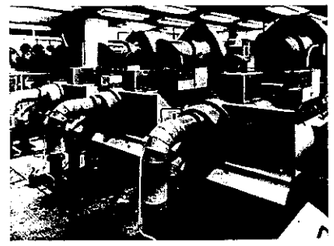
06-08-01-79 P114

Sydney Opera House
Australia





The centrifugal compressors utilizing the Sydney Harbour water as heat sink.

The construction of this famous Opera House was completed in 1972. Already in 1955 the international architectural competition was announced, and in January 1957 the first prize was awarded the Danish architect Jørn Utzon. Since then Steensen & Varming has been responsible for the design of all mechanical engineering services for the Opera House.

The Opera House covers four and a half acres of ground and consists of three main halls. It provides facilities for opera, every form of music from symphony concerts, solo recitals to pop groups, organ and jazz bands, ballet, drama, movies, lectures, assemblies, exhibitions, art shows.

The largest of the halls, the Concert Hall, seats 2,700, the Opera Theatre holds 1,530 and the Drama Theatre, 550.

The Opera House also contains Music Room, Recital/Reception Rooms, Rehearsal/Recording Hall, Exhibition Area, Main Restaurant and Cafeteria.

Beneath the seating in the Opera Theatre is a suite of five large and five smaller rehearsal areas plus 50 dressing rooms – just some of the 900 halls and rooms within the complex.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Design, documentation, contract administration and detailed site supervision of all mechanical, hydraulic and fire protection services incl. controls/supervisory system.

Selected services data and key figures:

The size and complexity of the Opera House air conditioning system is illustrated by the following figures:

120 fans distribute 600,000 cfm (270 cu.m/sec) of air through appr. 35 km of ducts to about 3,000 outlets/diffusers.

The air conditioning system is heated/cooled by a heat pump system, utilizing the Sydney harbour water as heat sink with 3 centrifugal compressors each 500 t. of refr. capacity. A total of 40 air conditioning systems arranged in 23 plant rooms are supplied with chilled and hot water from the heat pump system.

Architects:

Stage 1 + 2: Jørn Utzon, architect m.a.a.
Stage 3: Hall, Todd, Littlemore, architects.

Client:

Ministry of Public Works, N.S.W.

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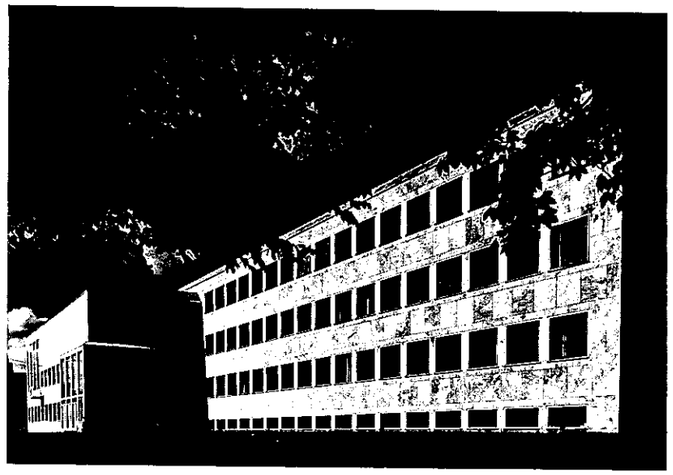
Public Administration Buildings

Fredensborg-Humlebæk municipality, Denmark
The building is the first stage of an extension of the existing city hall likely to take place.

The heating plant is of special interest as the chimney has been led through the old water tower, no longer being used for its original purpose.



Tårnby city hall, Denmark
Built in two stages. The whole city hall is fully air conditioned with cooling and humidification. A plant for heat recuperation is incorporated in the ventilation plant.

Fredericia city hall, Denmark
Council hall, offices etc.

Roskilde city hall, Denmark
Administration building for the County Council of Roskilde. The building is air conditioned with cooling and humidification.

Vallensbæk municipality, Denmark
Standard Pavilet office house built of prefabricated wooden panels.

Birkerød fiscal office building, Denmark
Standard R & S office building in prefabricated concrete.

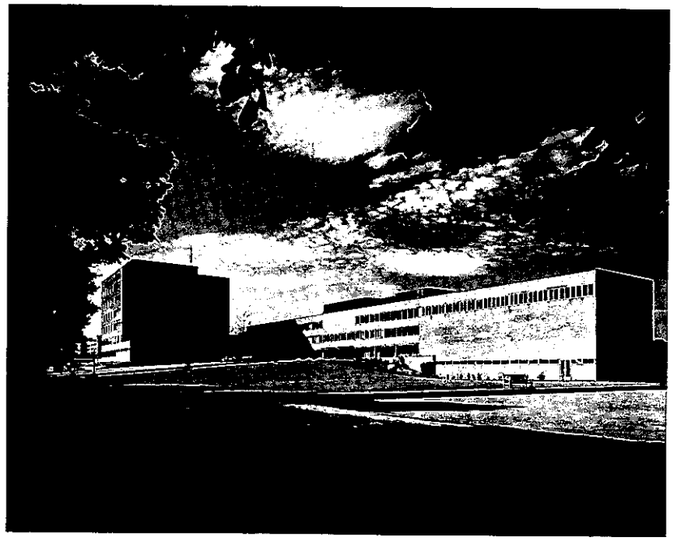
Paris NATO headquarters, France
Project control and project management.

Frederiksværk municipality, Denmark
Rebuilding of former administration building into municipality offices.

Søllerød city hall, Denmark
City hall of Søllerød municipality, situated in Holte.

Århus city hall, Århus, Denmark
Multi-storey building with famous bell tower.

Edinburgh Police Headquarters, Scotland
20,000 sq.m building complex.



Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Civil, structural and/or services design and documentation.

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Educational Facilities

00-94-09-79 P126

The CIC member firms have acted as consultants on the projects referred to, in own capacity or in cooperation with other firms

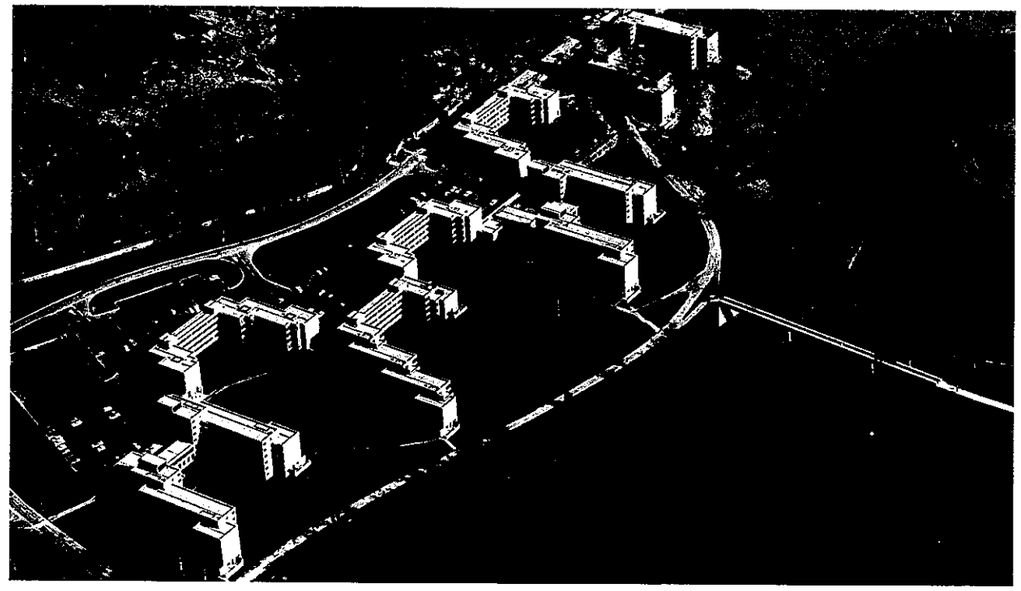
Further information regarding scope of professional services and names of other consultants connected with the specific projects may be obtanied at CIC

CIC

List of universities where contribution to planning and/or design has been provided by **Steensen & Varming International, Consulting engineers and planners.**

Project		Architect
Denmark		
University of Copenhagen	Library	K. Varming.
	Arctic Greenhouse	K. Gottlob.
	Institute of Experimental Medicine and Surgery	K. Gottlob.
	Biological Institute	K. Gottlob.
	Animal lab. for Transplantation and Immunebiology	Eva & Nils Koppel.
	H. C. Ørsted Institute (chemistry, physics, mathematics)	Eva & Nils Koppel.
	Niels Bohr Institute (nuclear research)	Preben Hansen.
	The Royal Danish School of Pharmacy	Preben Hansen.
	Panum Institute (medical faculty)	Koppel, Koppel & Edstrand.
University of Aarhus	Institute of Mathematics and Physics	C. F. Møller.
	Biological Institute	C. F. Møller.
	Computer Centre	C. F. Møller.
	Botanical Institute	Kjær & Richter.
	Institute of Geology	J. and K. Schmidt, H. Nybo Andersen.
University of Aalborg	Computer Centre	J. Blegvad.

Universities



List of universities where contribution to planning and/or design has been provided by **Steensen & Varming International, Consulting engineers and planners.**

Project		Architect
Scotland		
University of Glasgow	Institute of Virology and Genetics	Sir Basil Spencer, Glover & Ferguson
University of Edinburgh	Art Faculty Building	Robert Matthew Johnson-Marshall and Partners
	Department of Zoology	Architectural Research Unit
	Library	Sir Basil Spence, Glover & Ferguson
	Student Centre	Morris & Steedman
University of Stirling	Complete new University	Robert Matthew Johnson-Marshall & Partners
University of Aberdeen	School of Agriculture	Robert Matthew Johnson-Marshall & Partners
University of Dundee	Student Residences	Napper, Errington, Collerton, Barnett, Allot
Italy		
Universita degli Studi della Calabria	3 villages with residences and other facilities for students and staff	Tarquini Mårtensson & Mikael Tarp Jensen.
Swaziland		
University of Botswana and Swaziland	Department of Geology	Krohn & Hartvig Rasmussen and Design Studio.
	Department of Extramural Studies	Krohn & Hartvig Rasmussen and Design Studio.
	Kitchen and Refectory (Ext.)	Krohn & Hartvig Rasmussen and Design Studio.
	Auditorium	Krohn & Hartvig Rasmussen and Design Studio.
Singapore		
University of Singapore	Dental Faculty	YRM + MSJ and S.A.A.
Australia		
University of Sydney	Sports and Recreation Centre	P. Hall & J. Anderson.
	Faculty of Architecture	Professor R. N. Johnson and Fowell, Mansfield, Jarvis & Mclurcan.

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Universities

List of universities where contribution to planning and/or design has been provided by **Steensen & Varming International, Consulting engineers and planners.**

Project		Architect
England		
University of Oxford	Engineering building.	Murray Ward and Partners
	New Engineering and Biochemistry Building	Murray Ward and Partners.
	St. Catherine's College	Arne Jacobsen.
University of Cambridge	Fitzwilliam House	Denys Lasdun and Partners.
Liverpool University	Students' Union	Bridgewater & Shepheard.
Birmingham University	Faculty of Commerce and Social Science	Howel Killick Partridge and Amis.
University of Sussex	Falmer House	Sir Basil Spence.
	Physics Building	Bonnington & Collins.
	Arts Building	Bonnington & Collins.
Leicester University	Engineering Laboratory	Stirling & Gowan.
Ireland		
University of Cork	Science Building	Boyd Barratt.
	University College	Boyd Barratt.
University of Dublin	Science Building	Downes, Meehan and Robson.
	University College	Michael Scott.
University of Ulster	New University	Robert Matthew Johnson-Marshall & Partners.

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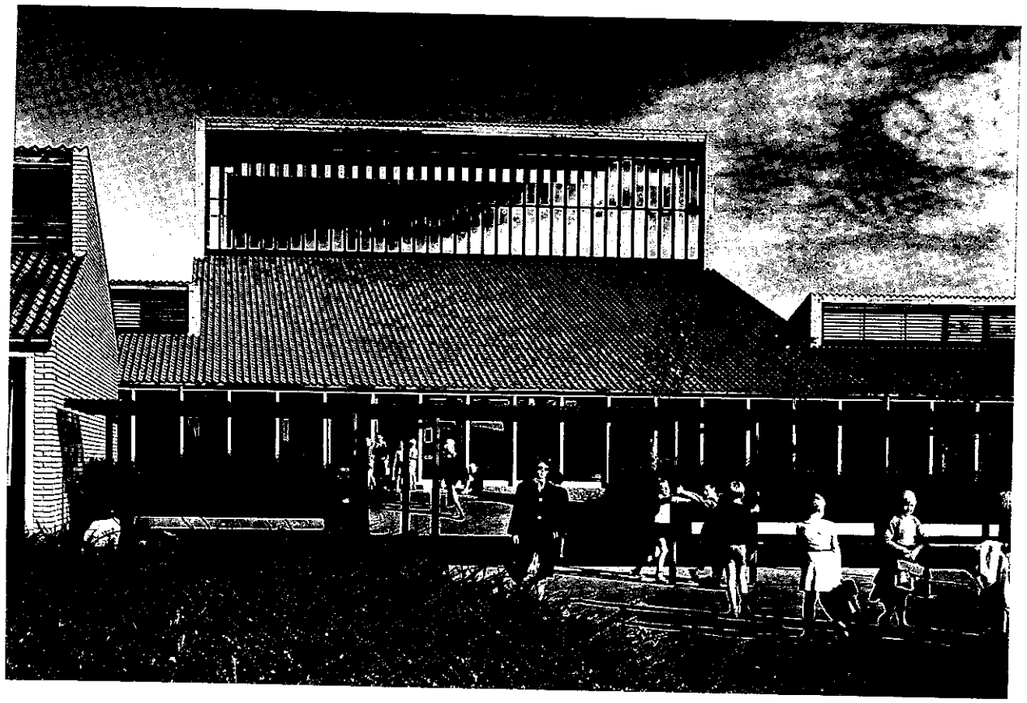
Schools



List of schools where contribution to planning and/or design has been provided by **Steensen & Varming International, Consulting engineers and planners.**

Schools and High Schools

Project	Architects
Buddinge School	Eva & Nils Koppel
Gladsaxe High School	Eva & Nils Koppel
Egegårds School	Gert Edstrand, Eva & Nils Koppel
Kildegårds High School	Arne Hoff-Møller
Vallensbæk School	Bygningsinspektoratets arkitektkontor
Sct. Jørgens School	Brüel, Bornebusch & Selchau and Henning Larsen
Østervang School	Gerda & Jørgen Hartmann-Petersen
Lynghøj School	Palle Jacobsen
Hvalsø School	Prof. Poul Kjærgaard
Havdrup School	Prof. Poul Kjærgaard
Aarslev School	Halldor Gunnløgsson & Jørn Nielsen
Gundsø Pavillon School	Preben Andersen
Marie Kruse's School	Ole Hagen
Kvaglund School	Prof. Poul Kjærgaard

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Schools

List of schools where contribution to planning and/or design has been provided by **Steensen & Varming International, Consulting engineers and planners.**

Schools and High Schools

Project	Architects
Greve High School	Skaarup & Jespersen
Dåstrup School	Skaarup & Jespersen
Lindegård School	Skaarup & Jespersen
Tinglev School	Nicolaisen & Braarup
Klostermarks School	Henning Larsen
Ejegod School	Skaarup & Jespersen
Værebro School	Ejlers & Graversen
Farum School	A5-Vandkunsten
Roskilde County school	Skaarup & Jespersen
Nurses' Training School, Herlev	Bornebusch & Selchau
Abattoir School, Roskilde	Preben Hansen
School for Pharmaceutical Chemists	Skaarup & Jespersen
Teachers' College, Emdrup	Eske Kristensen
Rønshoved College	Paul Maroti & P.O. Pedersen

Research Institutions

00-94-10-79 P137

The CIC member firms have acted as consultants on the projects referred to, in own capacity or in cooperation with other firms

Further information regarding scope of professional services and names of other consultants connected with the specific projects may be obtanied at CIC

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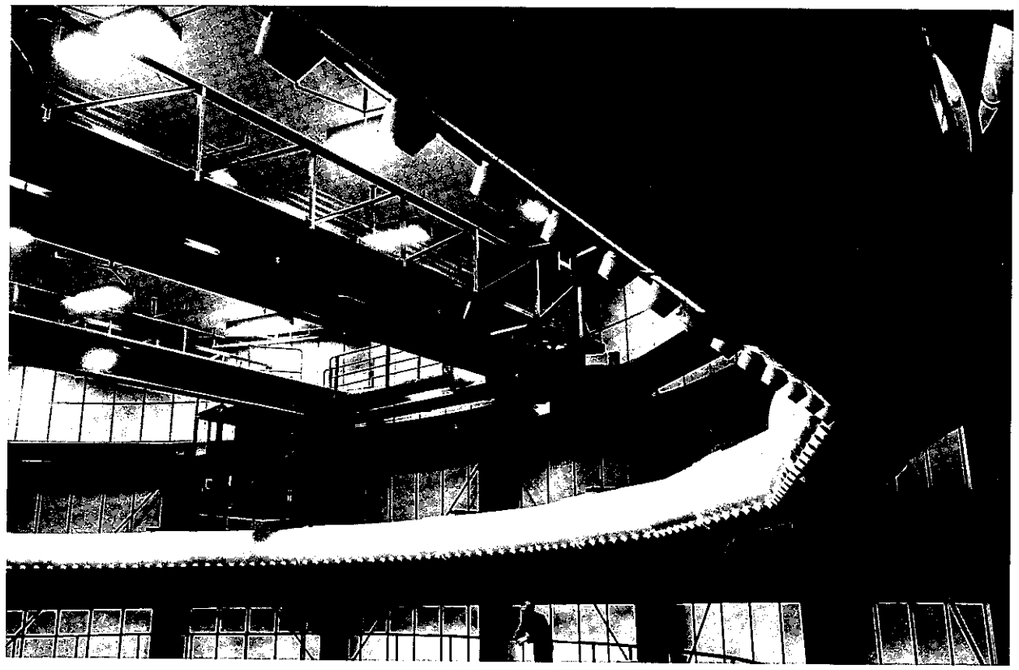
06-10-01-79

Nuclear Research Establishment
Risø



The research facilities for the Danish Atomic Energy Commission comprise approximately 60,000 sq.m, built in the following stages:

Auditorium, laboratories, workshops, canteen, administration building, reactors DR1 and DR2, waste water treatment plant, water works and private dwellings, in total 40,000 sq.m.

Reactor DR3, approximately 3,000 sq.m.

Electron Accelerator, 1,500 sq.m.

Hot cells for investigation of higly radioactive materials, approximately 7,000 sq.m.

Extension of electronics and physics laboratories, accelerator and agricultural facilities, approximately 6,000 sq.m solid waste storage.

Production facility for fuel elements.

Due to the complex installation of the reactors Steensen & Varming established a special erection group which prepared all shop drawings and carried out construction management.

Many other special tasks were in the hands of Steensen & Varming, among these were:
Reactors DR1, DR2, DR3:
Project management
Coordination of foreign and Danish design
Negotiations with authorities
Construction management
Supervision of reactor erection

Containment:
Philosophy
Sealed building control
Interlock systems
Leakage testing

Building structure:
Reactor and building foundations
Steel structure
Shielding
Cranes

Safety precautions:
Control and alarm systems
Emergency exits and procedures
Fire protection
Decontamination systems
Effluent control
Health physics

Services:
Clean condition procedure
Heavy water systems
Helium systems
Air systems
Water treatment
Ventilation systems with air barriers
Cooling water systems
Heat pump system

Miscellaneous:
Active handling facilities
Fuel element storage

Hot cell facility:
Facility for heavy remote handling of radioactive reactor components

Solid waste storage:
Facility for irradiated materials

Liquid waste treatment:
Facility for contaminated effluents

Accelerator:
Linear electron accelerator

Laboratories:
Facilities for chemistry, electronics, physics, metallurgy, health physics

Farming research:
Centre for agricultural and horticultural experiments

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Design, documentation and contract administration of civil, structural and mechanical engineering.
Project management and construction management for the reactors.

Architect:
Preben Hansen m.a.a.
Royal Surveyor of Buildings

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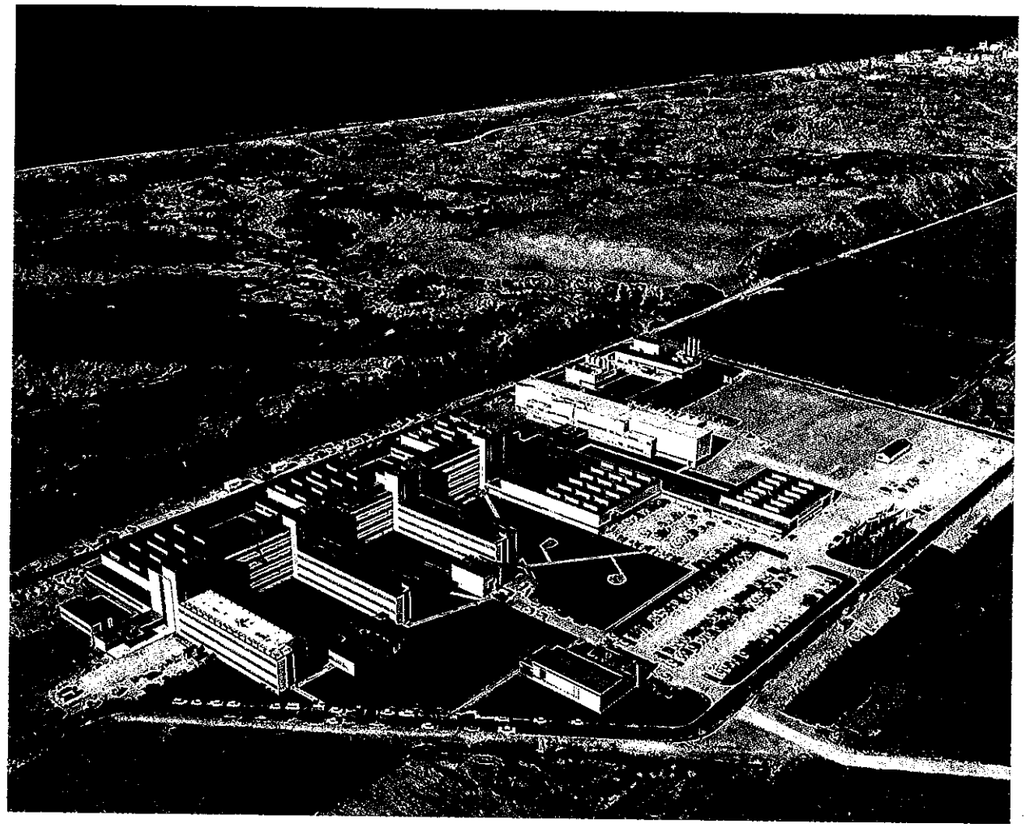
06-10-02-79

European Space Technology
The Netherlands



The European Space Agency (ESA) with headquarters in Paris, has at its disposal a number of establishments, the largest of which is the European Space Research and Technology Centre (ESTEC) near Noordwijk in the Netherlands. ESTEC is responsible for applied research work on space technology and for studying and developing payloads for sounding rockets and satellites.

The test hall for the environmental testing division contains large test chambers and vibrators for simulation of environment in space and conditions during launching.

Design work started in February, 1964.

The test hall for the environmental testing division was the first building to be completed, and research work started in this hall in the autumn of 1965. The workshop was operational towards the end of 1966, and all buildings were completed by July, 1967.

Due to the various functions of the building, two types of construction have been used. The research laboratories and offices are reinforced concrete buildings with prefabricated facade elements and U-shaped columns along the centre line while the slabs are cast in-situ. The production and testing areas have always been considered very special areas requiring maximum flexibility. These areas therefore consist of halls with steel frames covered with insulated prefabricated concrete roof elements and walls of insulating asbestos cement sheeting.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Project management, design, documentation and contract administration of civil, structural and mechanical engineering.

Architect:
Preben Hansen m.a.a.
Royal Surveyor of Buildings

Client:
European Space Agency (ESA)
(formerly European Space Research Organisation – ESRO)

06-10-03-79 P140

Eurochemic, Belgium

Eurochemic, Mol
The European Company for the Chemical Processing of Irradiated Fuels (Eurochemic) is a joint undertaking constituted under the auspices of the O.E.C.D.

The scope is to carry out any research or industrial activity connected with the reprocessing of irradiated fuels, the use of the residual uranium recovered, and the valuation of the plutonium formed in the reactors and of other by-products.

For this purpose the company built a reprocessing plant and a research laboratory.

The research laboratory, designed for work with fissile and highly radioactive materials contains: Hot wing. The decontamination rooms and a workshop are also situated here.

Hot cells:
Two hot cells for remote handling of radioactive or contaminated materials, mainly for chemical work at an activity level: 1 MeV gamma sources of up to 2,000 curies.

Chemical Engineering Hall:
For large scale experimental process operation on pilot plants.

Completed:
1961

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Design and documentation of civil, structural and mechanical engineering related to hot cells facilities.

Architects:
Suter & Suter, Basle, Switzerland

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06-10-04-79

Nuclear Research Projects

IAEA, Seibersdorf, Austria
Nuclear research laboratories for International Atomic Energy Agency, IAEA.

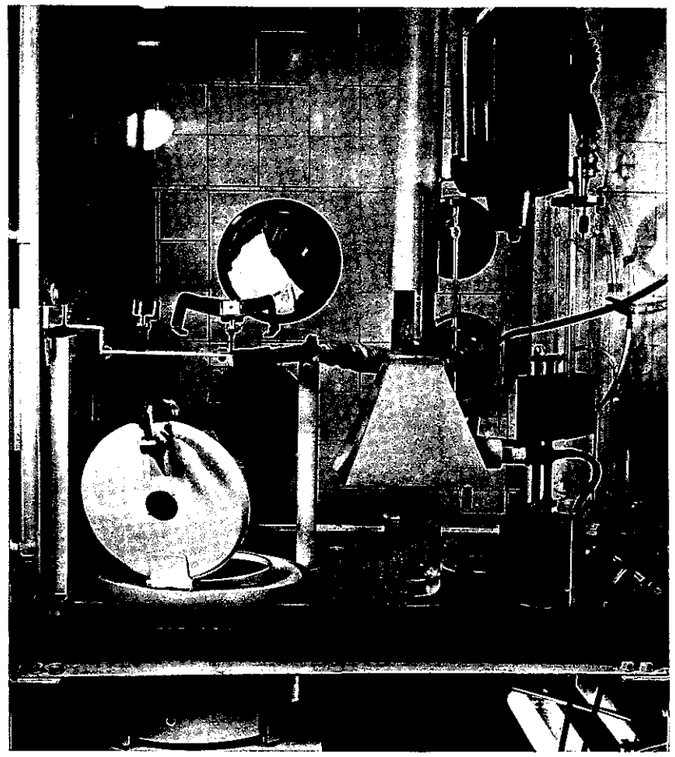
Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Design and documentation of laboratory installations and mechanical engineering including waste disposal system.

Completed:
1963

Architecs:
Grobler & Schindler



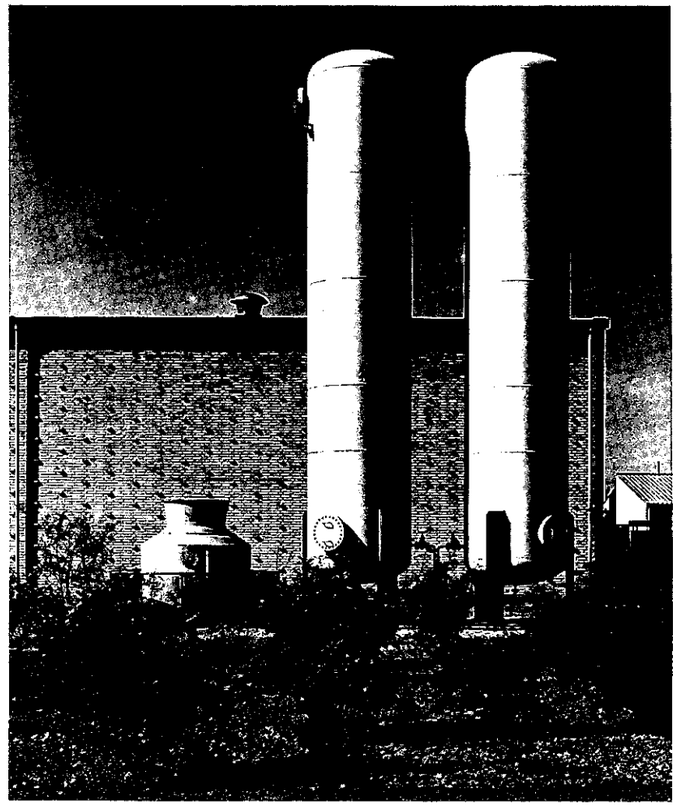
Trombay, India
Radiological laboratories with hot cells for the Indian Atomic Energy Commission.

This was completed in 1965 at the nuclear research centre near Bombay.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Coordination of design and construction management and detailed design.



Niels Bohr Institute, Denmark
The old institute is in Copenhagen but in 1961 a new department was built neighbouring the Danish Nuclear Research Establisment, Risø.

A Tandem van de Graaf accelerator and associated equipment is used for experimental research on atom nuclei.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Design, documentation and construction management of civil, structural and mechanical engineering.

Architect:
Preben Hansen m.a.a.
Royal Surveyor of Buildings

Health Care Facilities

00-94-11-79 P145

The CIC member firms have acted as consultants on the projects referred to, in own capacity or in cooperation with other firms

Further information regarding scope of professional services and names of other consultants connected with the specific projects may be obtanied at CIC

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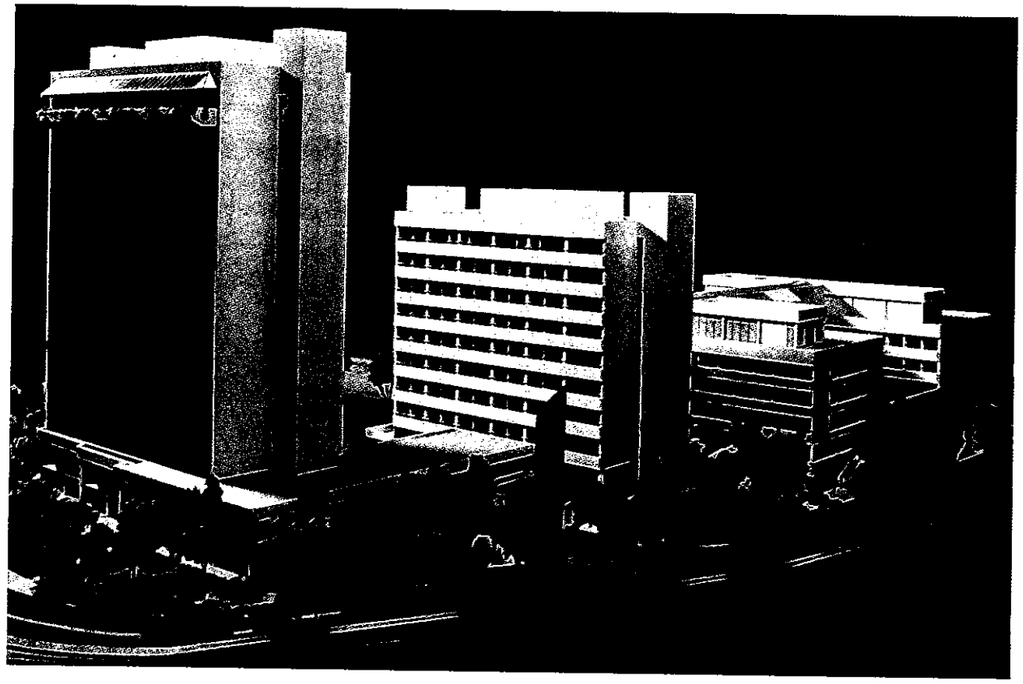
06-11-02-79 P147

Mount Elizabeth Hospital
Singapore



Mount Elizabeth Hospital is being developed as a private hospital with 240 beds related particularly to the disciplines of medicine, surgery, obstetrics/gynaecology and paediatrics. These disciplines will be supported by appropriate diagnostic and treatment departments, and administrative and support facilities.

In addition there will be a convalescent suites block for minimum care patients and relatives, operated in conjunction with the hospital proper and dependent on it for all support services. This building will also provide the potential for any future expansion of the hospital. There will be a consulting suites block with suites for medical specialists, dental and paramedical practitioners, shops, convention facilities a cafeteria-restaurant and underground car parking.

The site is on the fringe of »downtown« Singapore, and was offered for redevelopment by the Urban Redevelopment Authority. Compared to normal hospital standards there is a high site cover and plot ratio. The plot ratio and a three-storey fall across the site have influenced the form of the hospital building.

Design work started in November 1976 with hospital planning, architectural layouts and specialised hospital engineering planning, briefing and system development.

The project is anticipated to be completed in full using staged handover by late 1979.

The project consists of three buildings linked together at ground level forming a 250 bed private hospital, 148 convalescent suites block and 17 floors of specialist medical consultant suites.

Six main operating theatres, assisted delivery and two minor theatres are included with vertical laminar air flow in one of the selected main theatres.

Key figures and selected services data:
Total capital cost (1977) approx. US$ 14 mill.
Chilled water plant for air conditioning
Normal 7.0 MW
Stand-by 2.1 MW
Central oxygen, vacuum, medical air, nitrous oxide and entonox systems.
Power supply transformers:
2 x 22 kW/0.433 kW, 2 MVA
1 x 22 kV/6.6 kV, 2.5 MVA
Stand-by power diesel generators.
2 x 800 kW
1 x 150 kW

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Establishment of brief and outline proposal for mechanical, electrical and transportation services followed by hand-over to local consultant for detailed design/documentation.

Hospital Planners
YRM + MSJ Pty. Ltd., Sydney, Australia

Architects:
Chan, Kui Chuan, Singapore

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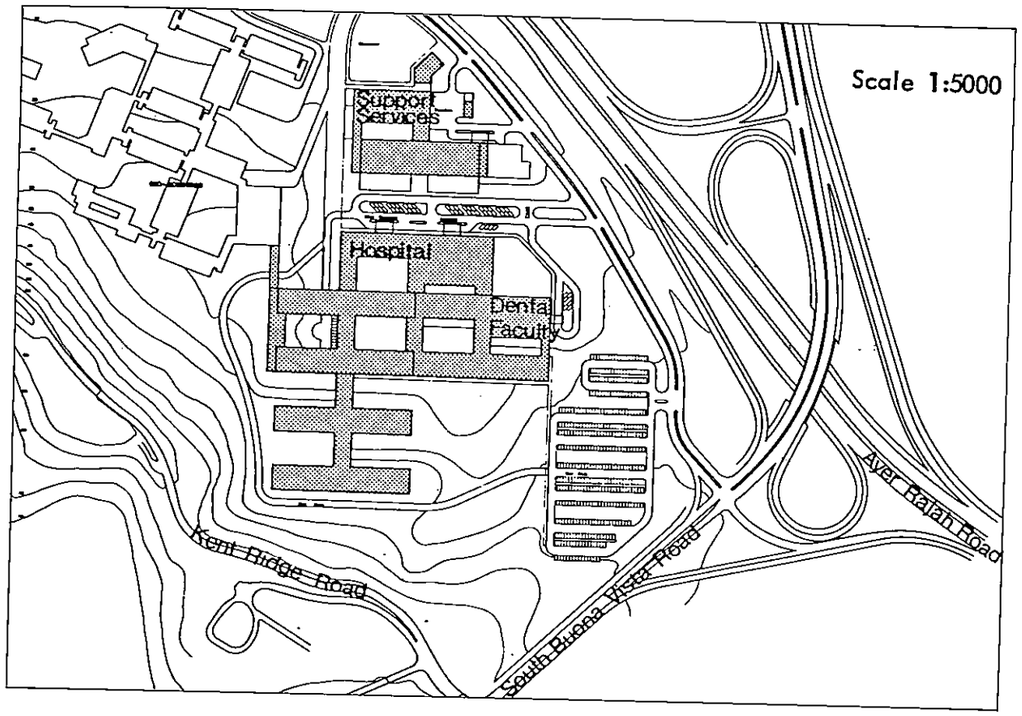
06-11-03-79

Kent Ridge Hospital
Singapore



Kent Ridge Hospital is being developed at the new University of Singapore as a general hospital with appropriate embedded areas for clinical teaching. In addition the hospital will provide accommodation for the academic departments of Pathology, Social Medicine and Public Health, Academic Offices and Research Laboratories for clinical staff, and the Dental Faculty and dental services.

The site of the project is adjacent to the Basic Bio-Science departments of the University. The Bio-Science complex will house the Faculties of Medicine and Dentistry and the Bio-Medical library, and will provide facilities for pre-clinical teaching for both Faculties.

The hospital is being developed to provide in the order of 750 gazetted beds, related particularly to the disciplines of Medicine, Surgery, Orthopaedics, Obstetrics, Gynaecology and Paediatrics.

The disciplines will be supported by appropriate diagnostic and treatment departments i.e. Accident and Emergency, Outpatients Clinics, Diagnostic Radiology, Surgical Procedures, Labour, Intensive Nursing, Rehabilitation, Clinical Laboratories, Clinical Measurement and by administration and support departments.

The hospital is predominantly naturally lit and ventilated. Openable glazing facilitates lighting and ventilation and provides patient access to the verandahs which also act as sun and rain protection.

Design started in September 1974 and the completed construction date for Stage 1 comprising 450 beds is scheduled for mid 1982. The second stage adds 250 beds and is scheduled for mid 1985.

Singapore's climate, high power costs and dependence on water supply from mostly outside the island gave the task of minimising energy consumption in a tropical climate for a highly energy demanding building.

Some of the ways in which lower energy requirements have been incorporated are:

1. Solar heated domestic hot water throughout the hospital
2. A natural water reservoir formed at the foot of the site to collect surface rainwater for use in the large cooling towers of the air conditioning plant.
3. Orientation of the building, its form, shape and shading optimised for greatest reduction in solar heat gain.
4. Narrow building pods to gain maximum natural lighting.
5. High efficiency filtration used on air conditioning plants to recycle conditioned air in non critical areas.

Tender 1980, total cost approx. US$ 42 mill.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners

Briefing/design/documentation of all engineering services.

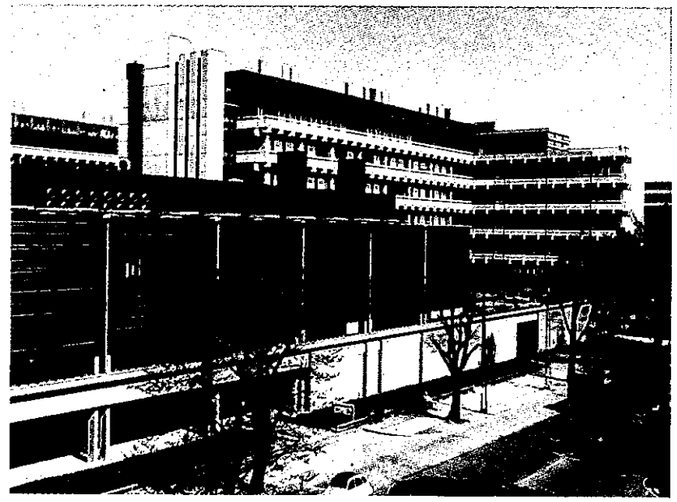
Architects
YRM + MSJ, architects, Sydney, Australia
S.A.A., architects, Singapore

Client:
Ministry of National Development, Singapore.

06-09-01-79 P127

The Panum Institute
Denmark

Phase 1 of 5 phases of the Panum Institute with teaching building, research building and building for animals for research.



Main lobby interlinking the individual buildings.

The institute contains the medical faculty of the University of Copenhagen and the Dental school, and is located on the site of the old Blegdams Hospital. The development plan of the institute was based on staged demolition of the hospital and construction of the institute.

The total floor area of the institute is approx. 135,000 sq.m distributed on student teaching, post graduate teaching, research laboratories, buildings for animal experiments and other buildings for special purposes.

Due to the amount of traditional and special engineering services and to the overall requirement of flexibility, all laboratory and special purpose buildings are arranged with interstitial floor systems, creating service voids between the floors with easy access for maintenance/repair and for modification of systems according to the changing requirements.

Scope of professional services provided by:

Steensen & Varming International Consulting engineers and planners.

Planning, system development, design, documentation and contract administration/supervision of all civil, structural and mechanical engineering.

Architects:
KKE – Eva and Nils Koppel, Gert Edstrand, architects m.a.a.

Client:
The Danish Ministry of Education, The Building Administration.