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ILMAR ÖPIK, MEMBER OF THE ESTONIAN ACADEMY OF SCIENCES

This OIL SHALE special issue is dedicated to **Ilmar Öpik**, a professor of Tallinn Technical University, a researcher of Estonian oil shale as fuel for electricity production, an environmentalist and efficient promoter in the field of Estonian energy policy management.

Ilmar Öpik was born in Tallinn. He was the first child of Paul Öpik, a navy officer, and his wife Ella, a schoolmistress. Paul Öpik (1888–1967) had graduated from Riga Polytechnic Institute in 1913 where he had studied at the Faculty of Business Administration. Paul Öpik became a leading financier in Estonia: from 1923 – the head of the Treasury, from 1925 – the director of the Bank of Estonia, and in 1928–1940 the president of the Long Loan Bank. The father's brothers astronomer Ernst Öpik (1893–1985) and geologist Armin Öpik (1898–1983), were well-known scientists.

Ilmar Öpik attended Tallinn Real School (1929–1931) and after that Gustav Adolf Gymnasium (1931–1935).

In 1935, Ilmar Öpik graduated from Gustav Adolf Gymnasium *cum laude*.

Ilmar Öpik studied in the Faculty of Engineering at Tartu University (1935–1936) and in the Faculty of Civil and Mechanical Engineering at Tallinn Technical University (1936–1940). He belonged to the academic students' society *Liivika* and was twice elected a member of the Tallinn Students' Board. Ilmar Öpik graduated from Tallinn Technical University in 1940 *cum laude*.

From 1937 till 1941, still a student at the Technical University, Ilmar Öpik worked at the design department of the Franz Krull Machine-Building Factory in Tallinn under the guidance of Prof. P. M. Scheloumov. In these years Ilmar Öpik participated in designing the Glen Davis Shale Oil Plant in Australia and the Maardu Phosphorite Concentration Plant in Estonia.

Ilmar Öpik was a great sportsfan as schoolboy already. He always was a devoted yachtsman.

In January 1941 Ilmar Öpik commenced to take his postgraduate course at the Department of Mechanical Engineering of Tallinn Technical University under the supervision of Prof. H. Einberg and Prof. J. Kopvillem.

The outbreak of World War II in the early summer of 1941 cut off his postgraduate studies. Ilmar Öpik was called up and sent to the Sverdlovsk Region (Russia) in the ranks of the Labour Battalion. Later he worked in the same region as a design engineer of thermal power plants for Bogoslavsky Aluminum Plant, Solikamsk Magnesium Plant, and Egorchino Thermal Power Plant.

Having returned to Estonia, Ilmar Öpik continued his engineering work in the field of the reconstruction of the oil shale industry (1944–1946). He participated in the reconstruction of the oil shale mines and oil shale processing plants. He also took part in the construction of the new thermal power plant burning oil shale in Kiviõli.

In 1946 Ilmar Öpik became an Assistant Professor of the Thermal Engineering Department at Tallinn Technical University and in 1957 – the Head of the same department. The main courses he lectured on heat transfer, fuels and combustors, and steam boilers. He educated a great number of thermal power engineers. His approach was analytical, leaving the solution to the students to find out. He was a supervisor of several graduates and post-graduates.

Since 1968 Ilmar Öpik was connected with the Estonian Academy of Sciences, at the beginning as an Academician-Secretary of the Division of Physics, Mathematics and Engineering, and in 1977–1987 as Vice-President. He retired in 1987.

Ilmar Öpik defended his thesis for the degree of Candidate of Technical Sciences “On the Sintering of Fly Ash Deposits on the Heating Surfaces by Utilizing Estonian Oil Shale” at Tallinn Technical University in 1953. In 1963, he received the degree of Doctor of Technical Sciences defending his thesis “The Influence of Inorganic Matter of Oil Shale on the Conditions of Boiler Operation” at Moscow Power Engineering Institute.

Ilmar Öpik was a member of the Estonian Academy of Sciences (1967), and a Foreign Member of the Finnish Academy of Technology (1992).

In 1960, Ilmar Öpik founded the Research Laboratory of Heat Engineering at Tallinn Technical University.

Since 1984 Ilmar Öpik was the Editor-in-Chief and since 1996 the Editor-in-Chief *emeritus* of the international scientific journal OIL SHALE, and a member of the editorial boards of “Proceedings of the Estonian Academy of Sciences”, and “Transactions of the All-Union Universities. Power Engineering”. He was also active as an expert of the All-Union Higher Evaluation Committee of the former U.S.S.R.

Being a versatile scientist, Ilmar Öpik focused his attention on different research trends. His special interest, however, was always connected with the utilization of Estonian oil shale.

As a result of Ilmar Öpik's research, the theory of the formation of bound ash deposits on the boiler heating surfaces when fired with fuels rich in calcium and alkali metal (Estonian oil shale, Kansk-Achinsk brown coals, and others) was created. This theory of the formation of ash deposits on the steam boiler heating surfaces most originally relates mechanical phenomena to chemical processes. He was one of the first researchers to draw attention to the fact that the fouling intensity of the boiler heating surfaces is simultaneously connected with the physical and chemical properties of the mineral matter of the fuel. It enabled to draw a number of conclusions relevant to the design of modern steam boiler heating surfaces depending on the qualitative and quantitative characteristics of the fuel. The results of these research were taken into account in designing the oil shale boilers for Baltic and Estonian power plants in Estonia as well as for the Nazarovo power plant in Siberia.

At Tallinn Technical University, Ilmar Öpik was a pioneer of research into the high-temperature corrosion of the alloys used for boiler heating surface tubes. He was the first to prove a correlation between the intensity of the wear of the boiler heating surface tubes and the high-temperature corrosion activity of the ash forming during conversion processes of fuel mineral matter in combustor. Consequently, it is possible to influence the corrosion activity of the fuel ash knowing the behavior of the mineral matter. Also, in the middle of the sixties he laid a new foundation for the experimental study on the high-temperature corrosion intensity of alloys under the influence of ash and ambient gas taking into account the behavior of ash during the corrosion process. This experimental methodology for investigation of the high-temperature corrosion intensity of alloys is still in use.

The primary aim of this kind of investigations was to design new steam boilers for burning solid fuels with complicated individual properties of the mineral matter.

Besides classical studies on the utilization of Estonian oil shale in power plants, Ilmar Öpik paid much attention to the problems connected with thermal processing of Estonian oil shale and utilization of ash after the combustion and thermal processing. Economic valuation of the utilization of Estonian oil shale was the subject of his research, too.

Ilmar Öpik investigated also the risk factor in the application of new technologies, and possible multiplication of the unit capacity.



In the Energy Centre, a Museum of Energetics in Tallinn, 2000



Ilmar Öpik and Arvo Ots at a session of the Estonian Academy of Sciences, 1998

One specific feature of his activities was solving practical problems in a close connection with theoretical aspects.

On top of the research directly related to his professionalism, Ilmar Öpik was always interested in oceanography and the exploration of the Baltic Sea. He participated in several maritime expeditions. He was the head of the design group of the research liner *Livonia* in 1982–1984 and a member of the Baltic Sea working group for ICES.

His last publications belong to the field of power economy and policy.

Ilmar Öpik published about 150 works.

Ilmar Öpik was an expert of the Ministry of Economic Affairs of Estonia, a member of the Directory of State Stock Company *Kiviter*, and the head of the State Price Committee of Electricity Prices.

Ilmar Öpik was awarded: the State Technical Science Prize of the U.S.S.R. (1983), the K. E. von Baer Medal (1984) and P. Kogerman Medal given by the Estonian Academy of Sciences (1991), the Merit Medal of the Finnish Academy of Technology, and the Order of National Coat of the Arms 3rd Class (1996), national science prize for long productive work (1996), Independence Day prize of gratitude of the Open Estonia Foundation (2000).

Ilmar Öpik died on July 29, 2001. His death was a great loss to Estonian scientific and engineering community. Ilmar Öpik's activities were directly related to power engineering sciences and teaching at Tallinn Technical University. He was a man with extraordinary ability to combine complicated scientific problems with ingenious engineering solutions.

Prof. Arvo OTS,
Member of the Estonian
Academy of Sciences

BIOGRAPHICAL DATA

- 1917, June 17 Born in Tallinn to the family of a naval officer and a school teacher
- 1925–1935 Studies in Tallinn at H. Kubu private school (1925–1929), Tallinn Real School (1929–1931), Gustav Adolf Gymnasium (1931–1935)
- 1935–1936 Studies at Tartu University
- 1936–1940 Studies at Tallinn Technical Institute (renamed Tallinn Technical University in 1938), a member of the academic students' club *Liivika*, twice elected a member of the Tallinn Students' Board
- 1937–1941 Simultaneously to studies work at the design department of Franz Krull Engineering Plant under the guidance of Prof. P. Scheloumov
Participation in designing Glen Davis Shale Oil Plant in Australia and Maardu Phosporite Concentration Plant in Estonia
- 1940 Graduation from Tallinn Technical University with *cum laude* diploma of mechanical engineer
- 1941 Beginning of post-graduate course at the Department of Mechanical Engineering at Tallinn Technical University (renamed Tallinn Polytechnical Institute in April 30, 1941) under the supervision of Prof. H. Einberg
- 1941–1942 Mobilized to Soviet Army, sent to Sverdlovsk Region (Russia) in the ranks of the Labour Battalion, later of the Reserve Rifle Squad
- 1942–1944 Engineer in Sverdlovsk *Uralteploelektroprojekt* Design Institute (Russia), a substitute for chief engineer of a design team at construction of power plants
- 1944–1946 Work at reconstruction of Estonian oil shale industry, the head of the Department of Power Engineering and Mechanics of the Ministry of Oil Shale and Chemical Industry of the Estonian S.S.R.
- 1946–1968 Work at Tallinn Polytechnical Institute taking part in designing, constructing and testing of oil-shale-fired power plants (Kiviõli, Kohtla-Järve, Ahtme, Sillamäe, Baltic and Estonian thermal power plants, and a 500 MW energy block in Nazarovo (Russia))



Fishing with his son Andres, the 1950s

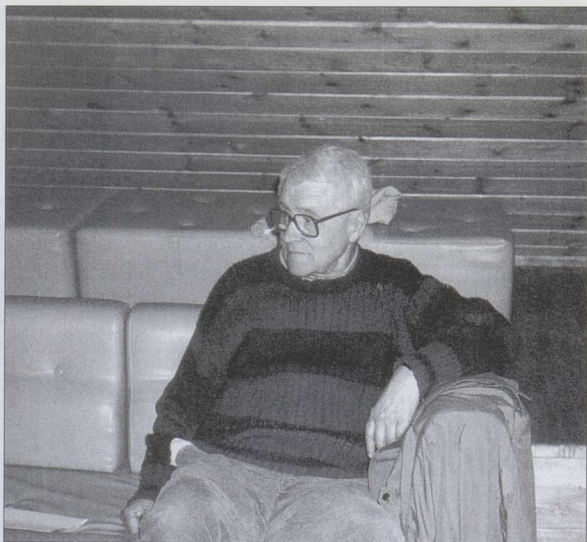


Andres Öpik and Peep Varju, 2001



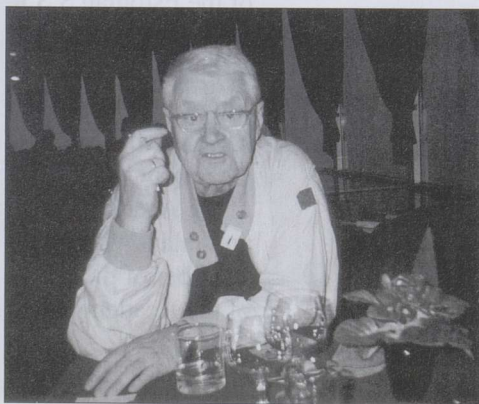
The dean of the Faculty of Chemistry of Tallinn Technical University prof. Andres Öpik (born 1947) inaugurating P. Kogerman's commemorative exhibition in 2001. From left: prof. J. Soone, prof. *emer.* V. Mikkal, dr. J. Petuhhov, prof A. Keevallik prof. A. Öpik

The best trout fisher
at Valgejõe, spring 1993



In Palmse castle, 1994

October 1995



1946	Elected an assistant professor of the Thermal Engineering Department of Tallinn Polytechnical Institute
1947, February	Professional certification of an assistant professor
1953, June	Commencement of the dissertation "On Sintering of Fly-Ash Deposits on the Heating Surfaces by Utilizing Estonian Oil Shale" for the degree of Candidate of Sciences (Ph.D.) at Tallinn Polytechnical Institute
1954, March	The Ph.D. degree was confirmed
1957–1968	The head of the Thermal Engineering Department of Tallinn Polytechnical Institute
1960	Founder of the Research Laboratory of Thermal Engineering Department of Tallinn Polytechnical Institute
1962	Elected the professor of the Thermal Engineering Department of Tallinn Polytechnical Institute
1963, March	Commencement of the dissertation "The Influence of Inorganic Matter of Oil Shale on the Conditions of Boiler Operation" for the degree of Doctor of Sciences at the Moscow Institute of Power Engineering
1963, June	The doctor's degree was confirmed
1963, October	Professional certification of a professor
1967, March	Elected a corresponding member of the Academy of Sciences of the Estonian S.S.R. in the field of physics
1968–1977	Secretary-Academician of the Department of Physics, Mathematics and Engineering of the Academy of Sciences, a member of the Presidium of the Academy
1969–1975	Professor of the Thermal Engineering Department of Tallinn Polytechnical Institute
1970	The prize of Soviet Estonia for elaboration of "Scientific Basis for Utilization of Estonian Oil Shale for Power Production"
1972, April	Elected a member of the Academy of Sciences of the Estonian S.S.R. in the field of heat physics
1977–1987	Vice-President of the Academy of Sciences of the Estonian S.S.R. Member of the Bureau of the Department of Physics, Mathematics and Engineering at the Academy of Sciences Chairman of the republican council (at the Presidium of the Academy of Sciences) for studying the Baltic Sea and inland waters Member of the editorial and publishing board of the Academy of Sciences

On his 80th birthday, June 17, 1997



Lia and Ilmar Öpik

Son Andres Öpik with his wife

Congratulations from prof. A. Jähkola





At a family gathering after the official reception of the President of the Estonian Republic, 1997 (one of the favorite photos)

Prize of Gratitude from the Open Estonia Foundation
delivered in the White Hall of the *Estonia* Theatre, 2001



Arvi Hamburg, Ilmar and Lia Öpik

Ilmar Öpik and Karl Tamjärv



- 1980 State prize of the U.S.S.R. – co-author of the study
“Novel Power Plants Fired by Local Fuel – Oil Shale:
Construction and Exploitation in Estonia”
- 1982, April The honorary rank of merited scientist
of the Estonian S.S.R.
- 1984, October The K. E. von Baer Memorial Medal
- 1984–1996 Editor-in-Chief of the journal OIL SHALE
- 1987, October Adviser of the Presidium of the Academy of Sciences
of the Estonian S.S.R.
- 1987, December – Member of the Bureau of the Department of Informatics
1990, December and Technical Physics of the Academy of Sciences
of the Estonian S.S.R.
- 1990, August – Member of the Governmental Council
1992, January of the Estonian Republic
- 1991, April Member of the Estonian Oil Shale Council
- 1991, December The Paul Kogerman Memorial Medal
- 1991–1999 Member of the Oil Shale Council
at the Estonian Academy of Sciences
- 1992, June Elected a Foreign Member of the Finnish Academy
of Technology
- 1993 Member of the State Price Committee
of Oil Shale and Electricity Prices
- 1994–1998 The head of the same committee
- 1993–1994 Adviser of the Ministry of Economic Affairs
of the Estonian Republic
- 1996 The national science prize for long productive work
- 1996 Order of National Coat of the Arms 3rd Class
- 1997 Professor *emeritus*
- 1998–1999 Member of the governmental expert commission for
evaluating economical problems of oil shale mining and
utilization, and for making proposals to the Government
- 1999 Expert of the governmental commission
on oil shale energetics
- 1999–2001 Member of the Energy Council
at the Estonian Academy of Sciences
- 2000 Independence Day prize of gratitude
of the Open Estonian Foundation
- 2001, July 29 Died in Tallinn

OIL SHALE ENERGY AND SOME ALTERNATIVES IN ESTONIA



At home on his 84th birthday, June 17, 2001

production capacities that design re-
sults in a relatively high oil shale price. Underground production – mines –
are especially influenced by overdesign. The latter as well as closing of mines
before the exhaustion of their resources are considered a result of increased en-
vironmental policy, which when fixing the taxation rate of mines has not con-
sidered the relatively stronger impact of surface mines on the environment as
compared with underground mining.

- Oil shale enrichment losses are great, 15–20% of oil shale kerogen gets
lost during processing.
- Oil shale transport by railway, which is overloaded by transit of oil prod-
ucts, is expensive.
- Net efficiency of outdated basic power equipment – 200 MW condensa-
tion blocks – is extremely low (27–30%).
- Ineffective utilization of oil shales is accompanied by pollution of the
environment with enrichment tailings, ash, sulfur and nitrogen oxides,
carbon dioxide, etc.