A Tribute to the Memory of

# Axel F. Enström

(1875–1948)

Gunnar Wetterberg, Historian

**Royal Swedish Academy of Engineering Sciences**

A Tribute to the Memory of

# Axel F. Enström

1875–1948

Presented at the 2019 Annual Meeting of the
Royal Swedish Academy of Engineering Sciences

Gunnar Wetterberg,
Historian

The Royal Swedish Academy of Engineering Sciences (IVA) is an independent, learned society that promotes the engineering and economic sciences and the development of industry for the benefit of Swedish society. In cooperation with the business and academic communities, the Academy initiates and proposes measures designed to strengthen Sweden's industrial skills base and competitiveness. For further information, please visit IVA's website at www.iva.se.

Published by the Royal Swedish Academy of Engineering Sciences (IVA),
Gunnar Wetterberg, Historian

IVA, P.O. Box 5073, SE-102 42 Stockholm, Sweden
Phone: +46 8 791 29 00
E-mail: info@iva.se
Website: www.iva.se

IVA-M 505 • ISSN 1102-8254 • ISBN 978-91-7082-987-1
Editor: Johanna Theander, IVA
Layout and production: Hans Melcherson, Grafisk Form, Stockholm, Sweden
Printed by EO Grafiska, Stockholm, Sweden, 2019

Royal Swedish Academy of Engineering Sciences

Each year the Royal Swedish Academy of Engineering Sciences (IVA) produces a booklet commemorating a person whose scientific, engineering, economic or industrial achievements were of significant benefit to the society of his or her day. The person to be recognised in the booklet must have been born at least 100 years ago. The commemorative booklet is published in conjunction with the Academy´s Annual Meeting.

The person being acknowledged this year is Axel F. Enström, an electrical engineer and at the center of the great electrification revolution of the late 19th century. Enström was the founder of the Royal Swedish Academy of Engineering Sciences (IVA) and was known as a man with a passion for engineering sciences and an extensive network which he put to good use when founding IVA in 1919. We wish to extend our sincere thanks to Historian Gunnar Wetterberg for the time and effort he has dedicated to this year's commemorative booklet.

Tuula Teeri

President of the Academy

Camilla Modéer

Chairman of the Medals Committee

# Contents

# A time of transition

When did industrialisation start in Sweden? Some say it started with the opening of the Tunadal steam sawmill in 1849, others date it back to the construction of the main railway line in 1856, or more vaguely in the 1860s or 1870s. It is perhaps more reasonable to assume that modern industry started to emerge in the 1890s.

Many mechanical workshops had been established during the preceding decades, but they were seldom more than expanded village blacksmith's shops. They made their own nuts and bolts and often produced on individual orders or made their own products one piece at a time. Their market was their own neighbourhood and they offered a wide range of items. The Atlas workshops started manufacturing railway carriages but when orders dwindled, supplemented their income by making garden sticks.



Just before the turn of the century a very different type of industry started to emerge. It was an age of innovation when companies were founded based on one or a couple of groundbreaking inventions. Semifinished goods from suppliers were used increasingly and companies started to mass produce their wares. The domestic market soon became overcrowded with goods and, after just a few years, companies like Separator, SKF and Aga were exporting most of their products.

A number of factors made modern industrialisation possible. In the 1860s Sweden had joined the growing free trade system in Europe which opened up new markets for

manufacturers. The railway's main and branch lines improved transportation of goods and linked production chains over much longer distances than before. The patent system protected new inventions but also made information about them more readily available. The modern banking system pioneered by *Stockholms Enskilda Bank* financed new enterprises and business expansion.

The new industries required greater accuracy and precision. Measurements needed to be right when complex products were being mass manufactured with externally produced input commodities. It was no longer enough to rely on the minds of company founders and the skills of craftsmen. These enterprises came to be described as 'brainwaves' (*snilleföretag*). Their products tended to be so specialised that the domestic market was too small to carry them. They were therefore geared to exports right from the start. They needed experts for planning, calculation and verification. The emergence of modern industries also marked the breakthrough of engineering sciences.



But engineers were not only needed for industry. National and local government authorities were under an entirely new type of pressure: railways, water and sewage infrastructure, and education and training were all needed in order for industry to function. Beyond the new private enterprises, engineers were equally in demand among the state-run companies, in the bureaucracies in charge of planning and to train even more engineers.

# Young Enström

The old agrarian society was breaking up in the 1800s. In the wake of the agricultural land reform known as *"enskiftet"* (each farmstead received all its land in one allotment), crop rotation, ditch digging and mechanisation were introduced into farming. The dramatic increase in agricultural productivity in the 19th century released labour and created prosperity.

Great flows of people were moving from rural areas to cities. In this time of transition new industries emerged offering jobs that few people could even have imagined a few decades earlier. These new industries provided opportunities for people to change their lives. Schools and higher education were expanded to satisfy people's thirst for knowledge and the need for a skilled workforce. Industrialisation paved the way for social mobility and gave young people opportunities that their parents had never even dared to dream about.



The Enström family exemplified this new trend. Axel's father Johan Fredrik was born in 1840. He belonged to a family of artisans in Stockholm. He worked as a journeyman at an instrument maker. His craft was in an area that had grown alongside the growth of the upper middle class. There were several piano factories in the city and Axel's father moved around among them. Axel's mother Anna was from a family of sailors from the island of Gotland one of many who were attracted by the growing city. The very first records kept by the church showed that half of all Stockholm residents were born

elsewhere. After parish ties were initially broken, the inflow increased significantly.

Axel Fredrik was born on 21 August 1875. His brother John (who became head clerk when IVA was established) arrived three years later and his sister Ellen followed in 1886. Axel had a "good head on his shoulders" but the family was not well off. He made his way through the education system, which was still fairly unregulated, often assisted by teachers with a desire to help him along. He attended an elementary school called *Fröknarna Stockmans småbarnsskola* and continued on to *Jakobs folkskola*. Later on he attended a school founded by instrument maker and purveyor to the court, Mattias Kraft which offered "free tuition for poor middle-class children" and then to secondary school at *Jakobs femklassiga läroverk*.

The family could not afford to pay for him to finish his secondary school education at a regular school, but a couple of his teachers helped Axel get into *Stockholms Realgymnasium,* an upper secondary school known as a "student factory", where those of lesser means could graduate faster (and therefore more cheaply). In spring 1891 the sixteen-year old boy graduated with excellent grades. Enström was strong in the science subjects, but languages also came easy to him. German was the dominant foreign language in Swedish education at the time, but Enström added English to his course load. Both languages would serve him well in his future career.

That autumn Axel was accepted at the Royal Institute of Technology (KTH). In his second year he enrolled in the university's school of mechanical engineering, which in his third year added an electrical engineering department. This would eventually become the largest department at KTH. Since he was not yet of age, he was not eligible as chairman of *Teknologföreningens första sektion,* (the Chapter of the Swedish

Association of Graduate Engineers organizing the students) but he was an active member of this student society and became editor of the student newspaper *"Blandaren"*. He graduated in 1894 passing all of his 21 subjects, gaining distinction in 14 of them.

His contemporaries at his upper secondary school *(Stockholms Realgymnasium)* and KTH included Gösta Malm, who would remain one of his closest friends the rest of his life. After Enström's death Malm described his friend when he was young:
*The thirteen-year old school boy, a giant in all dimensions, soon stood out among the 300-strong band of small boys and adolescents of all ages up to the men in the top class.*



*Enström at [KTH] was now no longer a tall, husky boy but had developed into a strong and charismatic young man – both in stature and in the way he carried and expressed himself. Although he was relatively young, people listened to what he had to say.*

Lars Blume, M.Eng. helped Malm with his recollections of Enström: *Although he was the youngest he seemed to be the most mature of all of us and I suspect that he considered us silly little boys. We were drawn towards sports such as gymnastics, skate-sailing and bandy, and we even ran sprints behind the university, but Axel E. was not interested in such pursuits. Nor was he interested in our political or other discussions "beyond the subject". He did, however, participate in the so-called "Art Coterie", which even organised an exhibition of works of art by the students themselves. I remember that he was eager for a student art magazine, which* Blandaren (student *magazine) resented according to a paragraph written on the topic. In the 1894 edition of*

Blandaren *Axel is mentioned in a satirical song and is also depicted as the great, good-natured Jumbo, always with a black cigar between his lips*.

Students of limited means back then could rarely afford to spend all of their time on their studies. The summer after leaving upper secondary school Enström got a job as a tutor in an affluent family and continued tutoring for them in 1892. He spent the summers of 1893 and 1894 getting practical experience at *Elektriska Pröfningsanstalten* (the Electrical Testing Company). He also provided remedial instruction to struggling students during the academic year and in 1894–1895 he worked as an assistant teacher in physics, mathematics and chemistry at his old "student factory", *Stockholms Realgymnasium*.



According to Enström's biographers he would have liked to have pursued a career in academia. KTH was still more of a vocational institution than an academic one at that time. Enstrom therefore received his Bachelor's degree at Uppsala University and then applied to study under Svante Arrhenius at Stockholm University, where in 1898 he completed his licentiate dissertation "On the Discharge Capability of Cathode Rays on Electrically Charged Bodies". Over the next few years he supported himself by teaching at KTH and other universities, but could not afford to work on his doctoral dissertation. He applied for positions as associate professor in physics and as professor in electrotechnology – both at KTH – but the positions were given to others.

Instead he took on more and more assignments as a consulting electrical engineer, from the beginning of 1903 in his capacity as a partner of the *Elektriska Pröfningsanstalten*.

# The role of the engineer in question

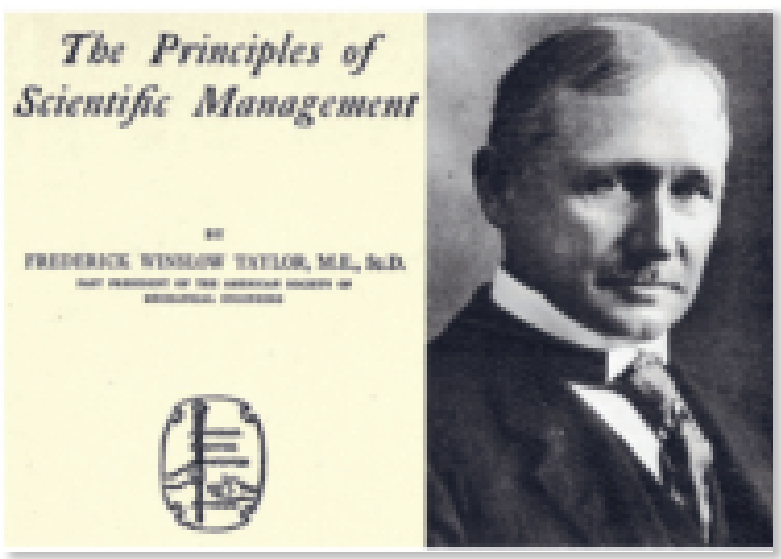
At the beginning of 1900s there were around 2,000 individuals with a higher education in engineering in Sweden. *Teknologiska Institutet* i Stockholm which later became the Royal Institute of Technology (KTH) was founded in 1827 and *Chalmerska slöjdskolan* in Gothenburg in 1829 (now Chalmers University of Technology). Engineering students were a small group and most of them knew each other. They assembled as members of *Svenska Teknologföreningen*, a fraternity of engineering students, the forerunner of which was founded in 1861. It was a student union from the start, but had been split into two sections – one for students and one for professional engineers. It acquired great influence as an expert body which the government consulted on technical matters, and it represented the views of engineers on how society and industry should be developed.



The question was, however, what role the engineers themselves should play. Among the engineers two different views were forming. One view was focused on the role of engineers in industry, emphasising alignment with owners and responsibility for promoting business. The other view emphasised the engineers' knowledge and saw engineers as having a role in safeguarding factual and impartial decision-making. Roughly speaking, many of the engineers working in industry were in the first group, while the latter was represented by those who were engaged in the public sector and education.

This struggle within the Swedish Association of Graduate Engineers was in part about what the criteria should be to become a member and about the dominance of Stockholm, but it was most clearly expressed in discussions about what engineering students should learn at university. Axel F. Enström, who was chairman of the Association 1906–1907, was the main proponent of deeper scientific analysis, while the "practitioners" wanted more economics and management on the curriculum. A strong proponent of the latter point of view was Captain Erland Nordlund, former editor of the technical magazine *Teknisk Tidskrift*. He was appointed as Director General when *Industriförbundet* (The Federation of Swedish Industries) was founded in 1910.

KTH's curriculum was the topic of several lively debates at meetings of *Teknologföreningen,* but eventually the opposing sides reached agreement. Enström convinced the doubters by explaining the need for scientifically based education in order for engineers to be able to perform more precise calculations and analysis. Nordlund for his part would become one of the most eager proponents of scientific management in the spirt of the American engineer Fredrick W. Taylor. The in-depth Taylorism studies of the various work stages and the potential to improve and change them also appealed to the scientifically oriented debaters and became an important element in the rationalisation movement that grew in the interwar years.

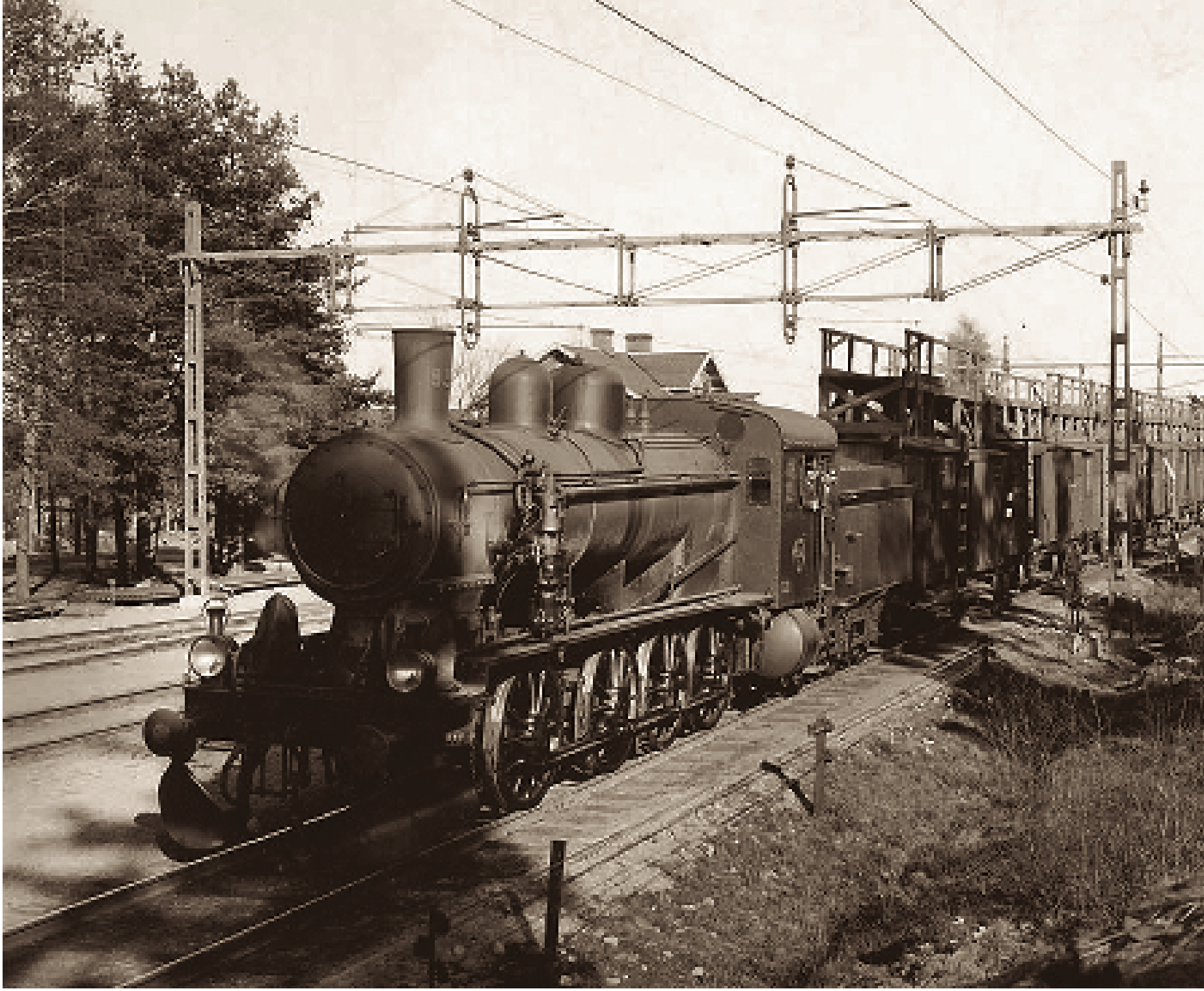


# At the centre of the electrification revolution

Axel F. Enström was one of the first batch of students to graduate from the Royal Institute of Technology's new School of Electrical Engineering in 1894. His decision to become an electrical engineer put him at the centre of the great electrification revolution. Electricity is a perfect example in engineering history of technology with broad areas of application, having a sweeping effect on the economy and recreating the entire social structure. The steam engine and the internal combustion engine are other revolutionary technologies. Information technology and biotechnology can be considered equivalent examples today.



Today, with electricity as an obvious aspect of our lives, it is easy to underestimate how much this breakthrough meant. It impacted research and development, production, power transmission, and the machines that would use this new power source. It laid the foundation for new companies; ASEA being the most important example. It put considerable strain on the financial system, when companies and public agencies were required to make substantial investments in the new technology. Timber yards at sawmills were electrified, the new buildings housing the Riksdag (Swedish Parliament) and the central bank on Helgeandsholmen island in Stockholm were illuminated by electricity. The new technology was a blessing in people's lives everywhere.



*A coal-fired steam engine is used to set up electrical aerial lines for the western main line between Stockholm and Gothenburg.*

But who would do the work? The costs were so high that it was important to estimate the potential profitability of the various projects. The new technology was dangerous; electricity could not just be installed anywhere. In many areas skilled workers were needed to implement electrification. It required precision, and safety became an important argument for those who wanted to improve higher education in engineering.

Electrical engineers were at the cutting edge of the new future. Enström and a team of his colleagues would play a dominant role in Sweden's industrial and economic development in the decades to come. Back when he was at upper secondary school Enström met Gösta Malm, the future Director General of Vattenfall, the state-owned Swedish power company at the centre of public electrification. A few years after Enström graduated from KTH he attended a conference in the USA together with Malm's counterpart in the private sector, Sigfrid Edström, who Marcus Wallenberg Sr. had recruited to the struggling ASEA from the *Göteborgs Spårvägar* (Gothenburg Tram System). Edström would be one of the leading figures in Swedish industry for several decades to come, including in his capacity as Chairman of the Swedish Employers Association, *Svenska Arbetsgivareföreningen* (SAF). Both Malm and Edström later served as Chairman of IVA.



As a consulting engineer at the consultancy *Elektriska Pröfningsanstalten,* Enström came into contact with a number of new developments of technology. It is easy to overlook the significance of consultancies in the development of technology. Normally large companies and public authorities are in focus. But when lack of competence prevents new fields to evolve, all users can share the meagre expertise avail-

able thanks to these consultancies. The consulting engineers act as pollinators of the new technology; the knowledge they gain during one assignment can often be useful in their second or third one.

Enström was involved across a broad front – from the most practical areas to increasingly comprehensive analysis. In 1897 he worked as an assistant to the county's inspector for the electrical installations at the great Stockholm Exhibition, and in 1901 he was promoted to inspector himself. Formally he retained this title until 1939, although the inspections he carried out were few and far between.

*Elektriska Pröfningsanstalten* helped companies and public administrations to plan and monitor new plants and installations. Enström was assigned to work for Grängesberg, Fagersta, the Holmen Paper Mill, the city of Skellefteå (Finnforsen Power Plant) and the city of Norrköping. His assignment in Norrköping was to design a plant that would supply the town with gas, electricity, district heating and coke, while also making use of the chemical by-products from the gas works. The longer term plan was to distribute power to most of Östergötland, southern Södermanland and north-eastern Småland. World War I interfered, but most of the plans for Norrköping were implemented eventually. While working in Norrköping Enström became increasingly fascinated by the potential of thermal energy.

Enström's work that would over time be of the greatest significance was his work on government commissions. Back in 1901 he was commissioned as an expert by the National Board of Trade *(Kommerskollegiet)*, which at the time had overall responsibility for the Government's industrial policy and the Swedish Patent and Registration Office, when new electrical inventions were to be scrutinised. The following year he

was appointed to work on a special committee for a proposed bill on electrical installations. As an expert working for the Riksdag he came into contact with several influential members. He would continue to develop this network over the years.

Enström was also widening his horizons. Back in the summer of 1898 he had taken a trip to Germany where he visited university laboratories in Darmstadt, Munich and Heidelberg. This inspired the young Swede when he became head of the physical lab at the Royal Institute of Technology (KTH) 1899–1902.



*The World Fair in Saint Louis, 1904.*

But there was still research to be done. In 1903 Enström and mining engineer Gunnar Dillner, head of the department of metallurgy at *Materialprovningsanstalten* (Institute of Materials Testing) received a grant from the British Iron and Steel Institute to study how silicon and aluminium alloys could be used to produce dynamo steel sheets. Their thesis was awarded the institute's Carnegie Medal in 1905.

In 1906 Enström received funding from the National Board of Trade and the Swedish daily newspaper Svenska Dagbladet to travel to the USA and attend the World's Fair in St. Louis. At the Fair the first international electrotechnical congress was held and Enström represented Sweden alongside his physics professor and Nobel Laureate Svante Arrhenius as well as Sigfrid Edström, who had joined ASEA the previous year. At the congress the International Electrotechnical Commission (IEC) was formed to develop international standardisation in electricity. The organisation's head office was in London and national committees were established in the member countries. Enström was involved from the start in the Swedish committee and was elected President of the IEC for the years 1930–1935. During his years at *Elektriska Pröfningsanstalten* Enström had taken a number of trips to Europe to study power plants and other electrical installations.

# The big energy crisis

It was a well-known fact that enormous amounts of energy would be needed to take advantage and benefit of the industrial revolution. The most important source of energy at the time was coal which dominated the entire Swedish import system at the beginning of the 20th century. There were concerns that the coal shortage would prevent industrial development in countries with insufficient domestic resources. Sweden tried to optimise extraction from its mines at Höganäs and Billesholm, but the resources did not go far enough.



Hopes were high that hydropower and electricity would fill the void. Sweden's first Electricity Act entered into force in 1903, but it did not regulate prices. The Riksdag therefore asked the Government in 1907 to look into "how satisfactory guarantees of contractual possession of electric energy could, through legislation or otherwise, be provided to purchasers of such energy". The Riksdag report also addressed the issue of how to determine the price of electric power.

It took a while before the Government took action, but in 1911 it formed an electric power committee. The committee, which continued its work until 1914, included members of the Riksdag and individuals with legal, economic and technical expertise. The majority rejected the price regulation proposal, but a couple of committee members warned that electricity monopolies could push prices up. One expert warned

that people in rural areas who consumed little electricity would suffer the most. World War I delayed the bill process, but in 1920 Nils Edén's liberal-social democratic coalition presented a bill to protect consumer access to electric energy. The Government resigned a little more than a week after it had adopted the bill but the Riksdag still voted in favour of it. There would be no price regulation.

Enström was asked to join the electric power committee. Fellow committee members describe how he did not have much to say during the meetings, but that he did conduct a major review of the Swedish power supply. He emphasised how difficult it had been to assess the development up to that point and that it would be even harder to predict the future. It would therefore be a mistake to allow financial legislation to hinder development. His warning was a contributing factor in the committee not going along with the Government.



He worked in cooperation with two other engineers on the committee who would be part of his future network. In January 1911 Waldemar Borgquist had served as head of the electrotechnical division of *Kungliga Vattenfallsstyrelsen* and would later be appointed Director General of this state-owned power company, later on called Vattenfall. Sven Lübeck was an even more important figure. He was in charge of and an owner of the Swedish Hydraulic Engineering Company, *Väg- och vattenbyggnadsbyrån* (VBB), and a man Enström had also encountered in various projects for the Electrical Testing Consultancy. Lübeck belonged to the same prominent group of engineers as many of Enstrom's other acquaintances, but he also had political strings to his bow. He was elected into the lower chamber of the Riksdag in 1915, became

Managing Director of Krångede kraftverk (Krångede Power Plant) in 1917, County Governor of Gävleborg County in 1922, Minister for Communication in 1923 and Minister for Social Affairs in 1928.

World War I broke out before the committee had issued its report. The war brought the energy issue to a head, with increasing blockades affecting neutral Sweden's ability to import fuel in particular. Other energy sources had to be found. Forest felling increased and wood replaced coal in many contexts. Coal mining in north-western Skåne was intensified and peat harvesting became widespread, with wooden tracks laid from rail lines out across the bogs to make the process more efficient.

Above all the war gave a powerful boost to the transformation of the energy system. The fuel shortage made electrification more economically viable than before – both in the expansion of hydropower, and the production of electric engines and industrial machinery. Electrification was accelerated, in particular in rural Sweden. Farmers did well in the "goulash economy" (private sector). Meanwhile paraffin oil for lamps and combustion engines became expensive and hard to come by. Electricity distribution associations were formed around the country to help improve the situation. The electrified farms' share of arable acreage increased from 5 percent in 1917 to 30 percent in 1920.

The energy supply was one of the main economic issues of the time and would make its mark on much of Axel F. Enström's career.

# IVA is established

At this time the National Board of Trade took care of much of the Government's work in matters relating to industry. The Board had been created in 1651 to promote trade, shipping and manufacturing. In the 1800s its existence was strongly called into question, but in 1891 it was reorganised. The purpose of this civil service department was to support and promote these sectors, but it was also given overall responsibility for the Government's regulation of emerging industries.

In the summer of 1916 Enström was employed as an additional expert on matters relating to mining management and industry and became head of the Board of Trade's industrial department. At the same time he was appointed to the National Industrial Commission, one of the emergency commissions that were formed to handle the supply problems during World War I. The Commission was headed by Enström's school friend Gösta Malm, who at the time was Managing Director of the Skånska Cementgjuteriet and was named

*Gösta Malm*

County Governor of Norrbotten County in 1917. The fuel supply was one of the most important issues for the Industrial Commission to address. These problems and efforts to find new methods to solve them made a deep impression on Enström.

By this time Enström's colleague Sven Lübeck had become a member of the Riksdag. He was probably one of the driving forces behind the motion "on measures for long-term support for a systematic national power and fuel policy", which right-wing political leader Arvid Lindman and 64 other members of the Riksdag put before the lower chamber on 22 January 1916. In historical texts Lindman is often referred to as "the Admiral", but he was above all an industrialist and politician. The idea was that a systematic approach would be achieved "by, for example, creating a kind of permanent scientific-practical institution connected to the National Board of Trade".



The bill was sent out for consideration before the Riksdag had addressed it. One of the authorities carrying the most weight was the National Board of Trade, and Axel F. Enström was put in charge of preparing its response on the bill proposal. After reviewing the proposed bill, the Board invited 20 or so industrialists, researchers and engineers to deliberate on it on 3 November 1917. Enström wrote a memorandum as a basis for discussion: *"Promemoria regarding the organisation and coordination of the technical-industrial research"*. The Board approved the creation of a power and fuel institute, but the guest experts were invited to express an opinion on a more far-reaching notion: "While considering how these issues should be able to be dealt with and how work in the various science and technology research areas should be organised, proposals have emerged within the Board of Trade on establishing a *Swedish engineering sciences academy"*.

The proposed academy would "be the state agency in charge of engineering sciences research in the country and for coordinating the current dispersed endeavours". Although it was a "state agency" it would receive financial support and donations from industry. Enström compared it to the Royal Swedish Academy of Agriculture and Forestry which "including the subsidiary research institute" had greatly benefitted Swedish agriculture.

The academy would be divided into a number of divisions responsible for the various engineering fields. A number of research institutes would be organised under the umbrella of the academy, starting with the proposed fuel and power institute. It would support "spontaneous guest researchers in engineering sciences; a system on the analogy of the [Royal] Academy of Sciences". There was no international equivalent, although Enström referred to international examples of support for engineering sciences research.



The deliberations had an encouraging outcome, and the Board of Trade immediately appointed an "academy committee" consisting of some of the delegates from the meeting: Birger Carlson from Stockholms Superfosfat (the chemical industry was an important research stakeholder), Enström's predecessor at the Board of Trade, Gunnar Dillner, who was then Managing Director at Gränges and LKAB, Professor Tore Lindmark from KTH, Johan Gustaf Richert from Vattenbyggnadsbyrån and the Royal Swedish Academy of Sciences and C.A. Rossander from Elektriska Pröfningsanstalten, Enström's former workplace. Director S.E. Österberg was the committee secretary. On 16 March 1918 the Board of Trade decided to write to the King and propose that the Government establish the academy. Meanwhile the committee started to raise funds

for a foundation for the academy. They were aiming for one or two million kronor. Enström sent out 377 subscription lists to potential donors that included industrial enterprises and individuals.

Within liberal politician Nils Edén's left coalition the report landed on the desk of the Minister for Finance Fredrik V. Thorsson, a shoemaker from Ystad who had become one of the most respected social democratic leaders, and his State Secretary Rickard Sandler. When Hjalmar Branting retired as Prime Minister at the beginning of 1925 (he died in February), most people thought that Thorsson would take over, but he was diagnosed with stomach cancer and died that May. Instead Sandler was appointed in this role. Sandler was one of the sharpest minds in the social democratic party. He had served as Minister for Trade since 1924 and became later Minister for Foreign Affairs after Per Albin Hansson took over as head of the party and Prime Minister.



Although the academy proposal had emerged in engineering and industrial circles it was accepted by Thorsson and Sandler. When the Cabinet on 11 March 1919 voted to present the bill on establishing the academy, Minister Thorsson said:

> *People have increasingly come to understand the importance of engineering sciences research in supporting industrial production and in rationalising the use of existing power, fuel and natural resources. In the war years in particular there has been a greater general understanding of the importance that should be attached to a lasting interaction between scientific research and practical endeavours...*
>
> *The proposal presented by the National Board of Trade on an engineering sciences*

*academy involves gathering the scattered forces who are working throughout our county in the field of engineering sciences research. I believe that the National Board of Trade's proposal is worth all consideration. There should be no doubt in anyone's mind that such an institution is to be considered a significant factor in advancing our industrial strength in the future, and that experience has shown that similar organisations established in other countries have been of great benefit to production during the war and can be expected to be of even greater benefit in future peacetime production. Last but not least, it should be noted in this regard that the current efforts to shorten working hours will benefit effectively from every measure the purpose of which is to achieve improvements, short-cuts and savings in production. It is clear to me that this proposal is of significance from this general social perspective as well...*

*I believe that one of the criteria for establishing the academy is that the requisite funds are made available from private sources ...*



The wording here says a lot about how social democratic ideas had developed. Just a couple of years previously the party was divided in a bitter showdown between reformists and revolutionaries. Now, however, Thorsson and Sandler were taking a clear stance to rationalise capitalism, not crush it. The reference to working hours was not made by accident – in addition to the democratic breakthrough, the 8-hour day was the Edén government's most important reform. The fact that the proposed academy was framed in this context helped to ensure broad support for it right from the start.

Thorsson attended the first Annual Meeting of the Academy in 1920 and was awarded a commemorative medal on the occasion of the its 10th anniversary in 1929.

After the Riksdag approved the proposal, the Government established the Academy's statutes on 19 June 1919, appointed the first academy members on 29 August and on 24 October the same year approved the election of the Chairman and Vice Chairman as well as the appointment of the President.

Meanwhile Enström and his friends were busy raising the funds needed. The National Board of Trade set up a temporary agency to manage the fundraising efforts. A total of SEK 1.8 million was raised. Dillners Grängesberg and Ernst Sievert from *Kabelverket* (cable factory) each donated SEK 100,000, the Höganäs-Billesholm coal mines SEK 75,000 and 20 or so companies each donated SEK 50,000 including L. M. Ericsson, Separator, Stockholms Superfosfat, AGA, Uddeholm, SKF, Stora Kopparberg and ASEA



Enström had secured premises for the Academy even before all of the decisions had been made. By taking over the shares in the real estate company *Fastighetsaktiebolaget Riddaren,* the Academy secured Grev Turegatan 14 and was able to move and occupy the first floor right after it was established.

There had been a manège on this site since 1872. In 1896 the company that owned the manège embarked on an adventure when it built Stockholms Tattersall, a grand indoor riding complex. It was inspired by the equestrian centre that Richard Tattersall

*Dressage in the upper and (and smaller)*
*of the riding halls in the building.*

founded in London. The building facing the street was given its current facade and housed shops, a restaurant and a banquet hall. The building across the courtyard was destroyed by a major fire in 1913, which also damaged the top floor of the street-side building.

There is no real information about how the purchase actually took place, but the history books hint that Enström and his friends secured the building for a good price. It is possible that they were able to benefit from the post-WWI depression when banks and financial institutions were hard pressed by their commitments during the war and needed to quickly realise their assets. At any rate, the building has served IVA well over the years and is now one of the most important venues for meetings and important conversations.

# Institutes and laboratories ...

It was to a great extent Axel F. Enström's academy. He had been given the title of Kommerseråd (Head of Division) of the National Board of Trade at the beginning of 1919. Although that would remain his title for the rest of his life, he was formally named President of the Academy (including the title of Professor) on 24 October 1919. He made his mark on the work carried out over the next few decades. Although it was often a case of him implementing the ideas of others, it is one thing to throw out an idea; putting it into practice is somethings else entirely.



The Academy's members became its most valuable asset. IVA received a government grant for its administrative activities and for special assignments, but it was the knowledge and networks of its members upon which the Academy's activities were based. Right from the start the Academy became an important body to which the Government referred proposals and reports for consideration. The various divisions within the Academy, with their expert knowledge, considered various issues and individual members provided their opinion. It was Enström himself, however, who often had the last word.

Everything did not turn out just as he had imagined. The Academy's resources to fund research would never be particularly substantial. When the need for engineering sciences research became increasingly urgent towards the end of the 1930s, Enström and his successor Edy Velander were able to participate in investigatory work, but IVA

was not entrusted with the task of continuing it. Instead a research council for engineering sciences was formed – the first in what would become a comprehensive national research council structure.

IVA would, however, provide a venue for a significant amount of research and development work in the interwar years. The Academy hosted a number of practical institutes which often lacked a building of their own in which to work. This was nothing new – the Royal Swedish Academy of Sciences and the Royal Swedish Academy of Agriculture and Forestry also hosted much of the research in their respective areas.

The Government provided the institutes with grants which were applied for and channelled through the Academy, although the institutes raised most of their funds themselves through various assignments. Vigorous activity was taking place at the Academy. In the 1930s around a hundred reports were published by the institutes in IVA's own journal alone.



The first initiatives were closely aligned with Enström's own background in power and fuel. The first research institute to launch an initiative was the Electric Heating Institute *(Elektrovärmeinstitutet)* in 1923. The driving force behind it was Waldemar Borgquist, Director General of the national administration for power plants. Enström and Borgquist persuaded a number of power companies and associated industries to act as guarantors for the institute, but the basic idea was for the institute to be self-sufficient.

Electrical engineer Otto Stålhane was appointed to head the institute. He was a metallurgist who had designed furnaces and boilers. Most of the activity at the electric heating institute was based on paid assignments and Stålhane was able to present


*The IVA stove that cut wood consumption in half is launched in an advertising campaign aimed at Swedish housewives. Although the stove is licensed to around ten manufacturers, it is not a commercial success.*

an impressive balance sheet. During the years 1923–1933 the institute conducted around 500 studies, design projects and laboratory tests, but it also had time to pursue its own projects and make its own discoveries.

The most spectacular project was the IVA stove. During the interwar years, although wood was still the resource largely used in society for heating, the stoves were not particularly effective. In 1926/27 the Academy supported studies at *Statens Skolköksseminarium* (Home Economics Institution) on fuel economy in newer stove models "under the leadership of Miss Ellen Enström", Axel's sister.

The result must have been underwhelming because Stålhane and Enström took matters into their own hands. In January 1930 Stålhane received his first grant from the Academy to develop a wood-fired stove with hobs and radically improved heating economy. In IVA's 1931/32 Annual Report Enström announced that the stove was finished and on the market. The quality of it may have been substandard because a Finnish importer called W. Rosenlew & Co complained bitterly in a letter to Enström, refusing to accept any more of them. The project did, however, draw attention to the inefficiency of wood heating and this would become an important issue during the blockades of World War II.

Stålhane also became involved with steam boilers. After they were the topic of discussion at the Academy at a steam and power technology conference, an institute to focus on steam heat, *Ångvärmeinstitutet,* was formed in 1931. The new institute was modelled after the Electric Heating Institute. The experts began by studying fuel, feed water and steam technology, followed by measurement technology, analysis methods and studying materials.

The history books hint at the fact that these invention activities were not without its problems. Questions raised included: When IVA's laboratories and institutes developed new equipment and methods, who would keep the profits? How should competing with existing companies, some of which were the Academy's benefactors, be handled? The solution came during the depression of the 1930s when the flow of grants and funding for IVA dwindled. The Electric Heating Institute became a separate entity, moved out from Grev Turegatan and continued to operate privately under the leadership of Otto Stålhane.



In the period between the establishment of Stålhane's two institutes, Enström and IVA took over the Charcoal Laboratory *(Kolningslaboratoriet).* This came about when *Jernkontoret* (the Swedish Steel Producers Association) in 1902 formed a committee to study charcoal production. Charcoal was still one of the most important raw materials at Sweden's mills and factories. Engineer Hilding Bergström served as secretary on the committee and was put in charge when the Charcoal Production Laboratory was created in 1906. The lab was transferred to IVA in 1929. Beyond coal and charcoal, the lab worked for many years on the production of liquid engine fuel from wood, peat, tar and liquid resin. During World War II the lab got a boost when charcoal was used to

produce wood gas, and tar and tar oil which were refined into liquid fuel and lubricating oil. In this context the lab developed a “chimney stack” and simple and easy-to-use stack ovens.

The same year that IVA took over the Charcoal Production Lab, a Cement and Concrete Laboratory was created. In charge of it were the young engineers Donovan Werner and Stig Giertz-Hedström. They experimented with special cement for water infrastructure construction and casting with high water content. They also developed methods to test concrete pipes and other products. The laboratory also developed a vibration method to use in casting concrete. This resulted in a separate company called AB Vibrobetong.




*The fuelling station at Hotellplatsen in Gothenburg offers coal for wood-gas fuelled cars. Wood-gas fuel was sold at no fewer than 750 locations around the country. At the beginning of the war coal was the most common fuel in use, although the number of wood generators subsequently increased.*

# ... committees and commissions

Advances in research and development were not only being made in the Academy's own laboratories. While the researchers who were employed worked at the institutes, Academy members were gathering in temporary groups to solve technical problems. Enström listened to various proposals, kept up with international developments and often took the initiative to appoint a committee or form a working group.

The Academy had an aerotechnical committee as early as 1924. IVA received a special government grant for this committee which, among other things, studied how to construct floats so that aircraft could land on ice. The committee realised, however, that this research required more resources than IVA could provide and in 1933 it started to demand a "proper aerodynamic research and testing institute". A couple of years later the Academy wrote to the Government on this matter and *Flygtekniska försöksanstalten* (the Aeronautical Research Institute) was subsequently created.



The Swedish Welding Commission *(Svetskommissionen)* still exists today. It was tasked with "conducting studies and investigations and taking other action to promote rational technical development of the practice of welding". Within this commission, researchers and industrialists agreed on nomenclature, norms, training and rules. Similarly, the Corrosion Committee *(Korrosionsnämnden)*, was founded after IVA had arranged a "Corrosion Day" in 1932 based on a German model. Producers and consumers of anti-rust agents gathered at the event. The Corrosion Committee

*IVA's research station was built with government funding and on land made available on Drottning Kristinas väg next to the Royal Institute of Technology (KTH). The two buildings were called a "research hotel" in the press and the area was renamed "the new science city". An industry research institute and a testing institute were also located here.*

issued a handbook on the use of anti-rust paint, arranged extensive field trips and allowed the National Testing Institute *(Statens provningsanstalt)* and industry labs to conduct tests. Enström served as chairman for both committees and Axel Härlin was secretary for many years.

Axel F. Enström was interested in measurement technology. He considered this an urgent topic to pursue and believed that the collective solutions would benefit all engineers in Sweden. But he also realised that a splintered approach involving multiple separate solutions would be an obstacle to progress. This was an example of the types of initiatives the Academy was created to pursue. Enström arranged a series of lectures, seminars and displays on the topic of measurement methods and instruments. At the urging of IVA a Measurement Technology Institute was created in 1936. A couple of years later an X-ray control division was added which would eventually become a separate entity called *Tekniska Röntgencentralen*.



Over the years the Academy would provide a home for many more committees, boards and commissions – close to 70 in the 1930s alone. The Energy and Fuel Commission and the Fuel Technology Committee sharpened the focus on energy issues. Based on experiences from World War I's blockades, Enström fought to keep the wood gas committee going, which proved to be a wise decision when World War II broke out. The Lift and Crane Committee and the Refrigeration Committee helped to introduce new technologies and the Forest Transport Committee took up the cudgels early on for heavy vehicles in the forest industry.

# Tekniska museet

In 1911, in connection with the 250th anniversary of Christopher Polhem's birth, there was talk in the *Svenska Teknologföreningen* (Swedish Association of Graduate Engineers) about establishing a museum of technology using surplus items from the anniversary collection. However, there was barely enough money to pay a Polhem biographer and so the project came to nothing.

It was brought up again at the Gothenburg Exhibition in 1923. An artillery officer called Torsten Althin had been collecting historical technical items for a number of years. In the leading technology magazine *(Teknisk Tidskrift),* IVA member Edvard Hubendick proposed to document industrial history in Stockholm.



Enström had also visited the exhibition and had appointed Althin in charge of the museum project. At the beginning of 1924 they started to gather items which were initially displayed in the building on Grev Turegatan. Enström and Althin visited various companies and at the beginning of the 1930s they had scraped together a building fund of SEK 450,000, equivalent to around SEK 15 million today – an impressive sum, but far from enough to build a museum.

The problem was solved in 1933 when the Knut and Alice Wallenberg Foundation donated SEK 2 million to construct the museum building. The Government helped by making available a site on which barracks had previous housed the Royal Life Regiment Dragoons. IVA thereby beat the Royal Swedish Academy of Sciences, which had

talked about establishing a museum of “exact scientific history”, based on a collection of instruments that it had assembled over centuries.

The museum opened in 1936 and Axel F. Enström would become Chairman of the Museum Foundation.



*The white facade of the functionalism-style entrance in 1936, the year it was officially opened. On the right: Torsten Althin places miniature aeroplanes in a model of the machine room at Tekniska museet in 1934.*

# Network

The birth of IVA was based on the active engagement of the large network of engineers and industrialists, one of whom was Enström. The impetus came from this network through Sven Lübeck and the Lindman proposal for a power and fuel institute, but the network also made it possible to deal with pitfalls along the way. Successful fundraising was essential in order to receive Government support, but there was also the matter of other bodies competing for consideration as well.

There was already an academy that covered some common ground, namely the Royal Swedish Academy of Sciences (KVA). Enström therefore invited Johan Gustaf Richert from *Vattenbyggnadsbyrån* (the Swedish Hydraulic Engineering Company) to the first deliberations about the academy and to join the National Board of Trade's academy committee. Aside from his involvement in his own consulting firm, Richert had been a professor in civil engineering at KTH 1903–1909 and was inducted into KVA in 1911.



This was a wise move. The Government referred the National Board of Trade's report for review by KVA. The older academy approved the proposal, "as fitting, as an important way to benefit our country and provide it with the opportunity to successfully participate in the significant competition in industry, which after the end of the World War, is certainly even greater than before, and will prove essential for our economic and cultural development".

Attached to this response was a special statement from inventor Gustaf Gröndal and sanitation technology expert Klas Sondén. According to the Board of Trade's proposal the academy would only involve itself with fields of science "which could be said to have a directly lucrative purpose", but Gröndal and Sondén expressed the opinion that it should also address sanitation technology, economic and legal matters, all of which were of importance in engineering activity. The Board of Trade agreed with this and, in its response to the review report, proposed the creation of a special division for "support sciences". Richert, Gröndal and Sondén would all be inducted into the newly formed Academy, and Gröndal and Sondén joined the division for Basic and Interdisciplinary Engineering Sciences.



In the new Academy's orbit were also *Teknologföreningen* (Swedish Association of Graduate Engineers) and *Industriförbundet* (Federation of Swedish Industries), both of which were interested in engineering sciences research. The former had tried to support researchers but had not managed to mobilise any significant resources for the purpose. *Industriförbundet* had originated during the time when the role of the engineer was a topic for discussion, but in 1916 Axel Hultkrantz had taken over as Director General from Erland Nordlund. Hultkrantz came from the Swedish Army Quartermaster Corps (which he would return to as Quartermaster-General in 1926).

At the first meeting of the National Board of Trade, Hultkrantz was doubtful about the Government's role as nanny for the new academy. He stressed that "the industrial community would very much like to see practical benefits" and expressed his opinion that the more the government was involved, the less the industrial community would

pay attention to it. He therefore doubted that the project would receive the support of industry.

However, before the Board of Trade wrote to the Government, Enström was given the opportunity to report on the project for a special committee of the *Industriförbundet* board. He described the role that private funding would play so that the Academy could act more independently than if it relied fully on government funding. As a result *Industriförbundet* "expressed its support for the creation of a Swedish Academy of Engineering Sciences declared that it would support it in a suitable


*The first page of the inductee certificate that all members received.*

manner". When IVA was established, Gustaf Ekman, Chairman of *Industriförbundet,* was elected as its first Chairman and Johan Gustaf Richert as Vice Chairman.

Axel F. Enström described the plans at the Annual Meeting of the *Teknologföreningen*. When the first members of the Academy were nominated the Association was richly represented. Of the 64 members inducted in the first year of operation, 60 were members of the Association and 40 of those had held elected positions. The majority – 36 members – had studied at the Royal Institute of Technology (KTH). Only four had graduated from Chalmers University of Technology. Eight had studied at lower-level technical education institutions. Several of the board members of *Industriförbundet* were inducted into IVA as well. This must have lowered the tension that Axel Hultkrantz had warned about.



The Academy also took the opportunity to appoint honorary members in order to maintain important contacts. The first honorary member in 1919 was the Crown Prince, subsequently King Gustav (VI) Adolf, the Director General of the National Board of Trade K.A. Fryxell and his predecessor, metallurgist and member of the Riksdag Richard Åkerman. The following year the Academy named as honorary members Nobel Laureate Svante Arrhenius, Dr. Frans Kempe CEO of Mo och Domsjö AB, Jonas C:son Kjellberg, who was Chairman of Skandinaviska Kreditaktiebolaget (Scandinavian Credit Company, later renamed Scandinavian Bank) and Managing Director for its Stockholm branch, CEO Marcus Wallenberg and the grand old man of the chemistry of cellulose, Professor Emeritus Peter Klason.

# Enström and the economists

One particular aspect of Enström's work was his attempts to make economic forecasts. When he was working with the Electric Power Committee before World War I he was tasked with studying the development of coal prices. The purpose of the study was to gather information to assess Sweden's hydropower assets. In the process Enström thought that he could distinguish recurring cyclical variations in price development.

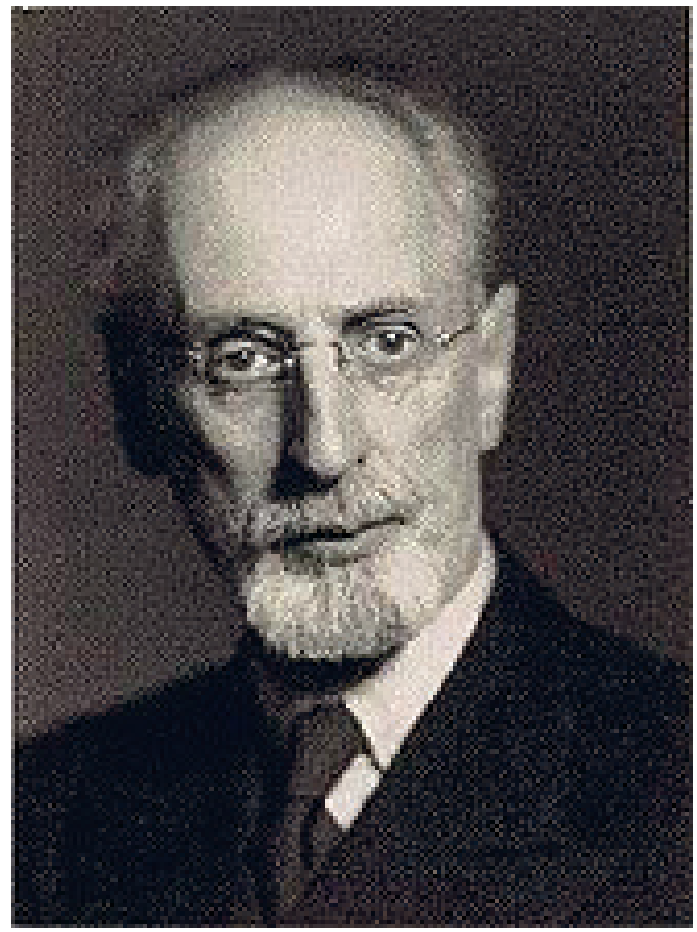
This fascinated him. For more than 30 years he constantly returned to this topic. He searched for information from near and far on these cycles in all areas of economics and nature. When he turned 60 his IVA acquaintances raised SEK 36,000 (equivalent to just over SEK 1.1 million today) to help him to continue studying economic cycles.



Enström set his sights high. He wanted to explain what was behind the cycles and also use their regularity to predict the future. For a while he tried to see if they were linked to the periodicity of sunspots – his hypothesis seems to have been influenced by harvest outcomes, which in turn had repercussions in various areas. Later on he believed that it was more about statistical conformity, "statistical standard amounts". He also thought that certain stages of the cycles could be related to armed conflict. He would interpret the signs of an impending world war earlier than many others.

Enström tested his ideas in a number of articles in the *Teknisk Tidskrift* magazine,

but any economists that read and showed any interest had a frosty response to his speculations. Enström was grasping at straws. In Joseph Schumpeter's "Business Cycles" (1939) he was pleased to find a diagram that illustrated something similar to his own conclusions from 1914. But this important book never came out in print and in his estate inventory, this "Manuscript of a financial thesis (unfinished)" is valued at one krona.



*Eli Heckscher*



At the urging of KVA, IVA had created a seventh division for "support sciences" (Basic and Interdisciplinary Sciences) which included economics. After the Government had selected IVA's first 40 members in 1919 these individuals proceeded to nominate an additional 24 in a second round. One of them was Eli Heckscher, a professor of economics and statistics at the Stockholm School of Economics. But it would take until 1940, after Enström had actually stepped down as President, before IVA created Division IX to focus on economic sciences and management.

# Blessings of engineering sciences

Axel F. Enström focused much of his attention on the international contacts of Swedish engineers. IVA was the first Academy of Engineering Sciences in the world, but as others followed they were interested in an exchange of ideas. He embarked on study trips to learn about engineering sciences research in other countries, especially in Germany. He does, however, seem to have managed to keep his distance from the naive statements on the Nazi new order that others could fall victim to. Texts that Enström left behind after his death include a letter from IVA member John Roos af Hjelmsäter, Director General of *Statens provningsanstalt* (National Testing Institute), asking for help to "transfer" Professor Fritz Frank, "who cannot stay in Germany much longer". Enström's notes say: "answer by phone".



In 1929 Enström travelled to the World Power Conference in Tokyo where he would be appointed Chairman of the International Electrotechnical Commission for the years 1930–1935. In his address to the conference he not only happily reported how advances in engineering sciences would improve people's lives, but also how interactions with machines would make people more intelligent than previous generations. His idea was that machines would make such great demands on people's powers of observation and thoroughness that they would raise the intellectual capacity of their users. If he had lived in the 1980s, when the social scientist from New Zealand



*On 28 June 1933 the Crown Prince opens the World Power Conference at the Concert Hall in Stockholm. The 800 delegates, with their wives, from 37 countries arriving by an extra train from Copenhagen made big front page news in the Dagens Nyheter newspaper. They were treated to a bus tour of Stockholm before taking their seats in the grand hall. At the centre of the podium sits the host and President of the Conference, Axel F. Enström. In 1929 he attended the World Power Conference in Tokyo where he was appointed Chairman of the International Electrotechnical Commission for the years 1930–1935. In his speech, the Crown Prince expressed his view that "few things are more impressive – or more beautiful – than a well-built, powerful power station, whether it runs on fuel or hydropower.*

James R. Flynn noted how IQ levels had gradually gone up, Enström would probably have taken this as proof of his hypothesis.

He was convinced of the blessings of engineering sciences research and he was keen to communicate this to a wider audience. The papers he left behind included correspondence with *Radiotjänst* (Sweden's Public Radio Service) about technology for the general public, but the most lasting impression he left behind was from his summary of the progress in technology – both in Sweden and elsewhere in the world, which he turned into a recurring feature of IVA's Annual Meetings.

Normally he would deliver this summary as the Academy's President, but in the year's 1938–1940 he did so as the IVA's Chairman. When Enström was appointed Chairman, Edy Velander took over as President. Initially Velander was only to service as a substitute in the role, but when Enström resigned as Chairman in 1940 Velander formally took up the position as President of the Academy.

*At the Annual Meeting of the Academy in 1939 Axel F. Enström delivers his final science and technology speech. The following year he becomes Chairman of the Academy which he founded 20 years earlier.*

# A few other facts

With his charisma and his position at the centre of a network of engineers, Enström would be entrusted over the years with several assignments aside from his positions at the Academy. He was either chairman or a member of a number of government commissions and committees, he was a member of the board of the Royal Institute of Technology for almost a quarter of a century and Chairman of Sweden's Standardisation Commission, which he initiated. He did not have a driving licence, but this did not prevent him from joining the board of the Royal Automobile Club (KAK). He was also Vice Chairman of the *Svenska Väginstitutet* (Swedish Road Institute). He became involved in various national defence issues, especially in relation to the air force, and was inducted into the Royal Swedish Academy of War Sciences, as well as the Royal Swedish Academy of Sciences and Royal Swedish Academy of Agriculture and Forestry.



He still had time over for several commitments within the private sector as well. Even before IVA was established, he was a member of the board of *Nordiska armaturfabrikerna* (Nordic Electric Fittings Company), a post he retained until his death. It is possible that Sigfrid Edström had a hand in securing his board assignment with ASEA from 1922 to 1948, but he was also a member of the boards of Finspongs metallverk, Vaporackumulator, Elektrolux, Aga-Baltic Radio, Svenska aluminiumkompaniet, and for Försäkrings AB Fenix-Heimdall where he was also Chairman. He also served as

Chairman of the Board of Svenska Bryggareföreningen (Brewer's Association) 1925–1948.

The picture painted by Enström's friends and colleagues is of a man who was aware of his importance. Slightly reserved, quite formal, with charisma that sometimes came across as pompous, but still a sociable person who conducted much of his work by spending time with people who he felt mattered. He rarely interfered with the work of his staff but relied on the fact that those who had been assigned a task would complete it to the best of their ability. Torsten Althin, who Enström put in charge of *Tekniska museet,* recounts that during the decade that IVA provided a home for the museum, Enström only visited it once. Enström was outwardly a network person, but left to others to take care of day-to-day business.



*Prime Minister Per-Albin Hansson and Axel F. Enström at the sixty-year anniversary celebration of Svenska Bryggareföreningen (Brewer's Association).*

*At the Annual Meeting on 24 October 1939 Axel F. Enström receives the Academy's Great Gold Medal from Crown Prince Gustaf Adolf.*

*Axel F. Enström did not have any children of his own with his wife Anna who had children from a previous marriage. Enström took an interest in her family, particularly in Anna's grandchild Frederik Ydén, who became one of the first students to study engineering physics at the Royal Swedish Institute of Technology (KTH). In this photo from 1944 Axel F. Enström is seen with Frederik's mother, Emmy Ydén.*



There is another detail about him to recount. During his second summer as a tutor he worked with a boy called Nils, the son of wholesale merchant A.O. Ydén and his wife Anna on the island of Lidingö outside Stockholm. A decade later Anna was staying at a convent in Évian-les-Bains in the French region of Haute-Savoie trying to escape from her former upper class existence. A few years later she and Ydén divorced and in 1908 she married her son's tutor.

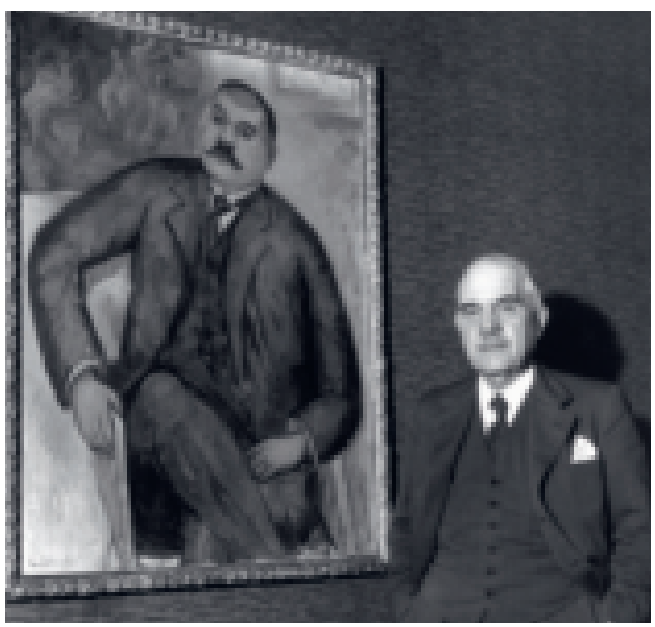
Although Axel F. Enström's marriage to a woman 16 years his senior raised a few eyebrows, the marriage seems to have been a happy one. The couple were both music-lovers and moved in artistic circles. Anna was the aunt of Sigrid Hjertén, who married a fellow artist Isaac Grünewald in 1911. We have this family connection to thank for the cover of this memoir – Grünewald's brilliant portrait of Enström from 1916.

Anna's soirées played an important role when Axel was developing IVA. At the Enström's home on Fiskargatan 9 on Södermalm in Stockholm foreign guests were welcomed and complex academic

matters were discussed. Although the couple did not have children together, Axel took an interest in Anna's grandchild Frederik Ydén, who became one of the first students at KTH's school of engineering physics.

Enströms sister Ellen and a couple of members of the Ydén family are listed as beneficiaries in the 1948 estate inventory. The estate was relatively modest – other than his personal property, it consisted of the summer cottage at Älgömaren in Saltsjöbaden, a few shares, some money on bank accounts and a couple of life insurance policies. The value of the assets in an estate are often largely underestimated, perhaps even more so in this case as the estate tax had been introduced the year before Enström passed away. SEK 71,260.33 is equivalent to no more than just over SEK 1.3 million today. Anna Enström's daughter-in-law Emmy Ydén was, however, the beneficiary of a life insurance policy that paid out just over SEK 74,000 but which was not included in the estate.

At any rate, it paints a picture of someone who did not line his pockets from his position in society – quite the reverse in fact. During his time as President of IVA Enström let his own salary remain nominally unchanged, at least for many years. He was by all accounts an honourable man, in his profession and in his private life as well.



*In 1944 when the Academy turned 25 its founder is interviewed by Dagens Nyheter and depicted standing in front of the painting by Isaac Grünewald.*

# Sources and literature


Axel F. Enström left behind documents at the *Centrum för näringslivshistoria* (business history centre)

Axel F. Enström's estate inventory

Engineer Lars Blume till Gösta Malm, Sigtuna, 26 July 1952

Althin (1958), Torsten, *Axel F. Enström. En minnesbok,* Ingeniörsvetenskapsakademien

Berner (1981), Boel, *Teknikens värld. Teknisk förändring och ingenjörsarbete i svensk industri,* Arkive thesis series 11

Cavalli-Björkman (2017), Görel, *Kvinna i avantgardet. Sigrid Hjertén. Liv och verk,* Albert Bonniers

Hansson (1981), Sven A, *Svenska Teknologföreningen – de andra femtio åren 1911–1961*, Svenska Civilingenjörsförbundet

Heden (2012), Håkan, *Energimarknadsinspektionen. En sekellång historia,* Energimarknadsinspektionen

Indebetou (1937), Govert och Hylander, Erik, *Svenska Teknologföreningen 1861–1936. Biografier,* Svenska Teknologföreningen

*Ingeniörsvetenskapsakademien 1919–1969. Artiklar publicerade i TVF under jubileumsåret 1969,* Ingeniörsvetenskapsakademiens meddelande 166

*IVA. Organ för Ingenjörsvetenskapsakademien och dess laboratorier.* Published by: Axel F. Enström

Ljungberg (1986), Gregory, *Edy Velander och Ingenjörsvetenskapsakademien – en levnadsteckning och en bild av akademien 1938–1959,* IVA-meddelande 251

Kärnfelt (red, 2018), Johan, Grandin, Karl and Jülich, Sonja, *Kunskap i rörelse. Kungl. Vetenskapsakademien och skapandet av det moderna samhället,* Makadam

Stenson (2004), Per, *Vidgade vyer. IVA:s tredje kvartssekel under Gunnar Hambraeus och Hans G. Forsberg,* Kungl. Ingenjörsvetenskapakademien

Sundin (1981), Bo, *Ingenjörsvetenskapens tidevarv. Ingenjörsvetenskapsakademin, Pappersmassekontoret, Metallografiska institutet och den teknologiska forskningen i början av 1900-talet,* Acta Universitatis Umensis/Umeå Studies in the Humanities 42

Weinberger (1996), Hans, *Nätverksentreprenören. En historia om teknisk forskning och industriellt utvecklingsarbete från den Malmska utredningen till Styrelsen för teknisk utveckling,* Avdelningen för teknik- och vetenskapshistoria, Kungl. Tekniska Högskolan

Wetterberg (2010), Gunnar, *Nils Edén,* Albert Bonniers


Royal Swedish Academy of
Engineering Sciences

IVA-M 505 • ISSN 1102-8254 • ISBN 978-91-7082-987-1