N Jacobsens Elektriske Verksted (NJEV) was established by Johannes Nicolai Jacobsen on April 21, 1891. The first successful developments were fire-telegraphs and fire-alarms. Electricity meters, room thermostats, crystal radio sets, and protective units for power utilities were also very soon useful products, in addition to different types of medical equipment.

The 1970’s were especially challenging for NJEV, and in 1972 the whole company moved from Gøteborggata in Oslo to Hokksund 60km west of Oslo. In 1974 NJEV was taken over by Norwesco, and in 1977 NJEV was taken over by Aktuell AS, that established Jacobsen Elektro AS (JEL) and transferred all activities and products from NJEV to JEL.

For several years after 1992 the Norwegian electrical power utility market was inactive, because the Norwegian utilities were re-organized and quite often traded off. This caused problems selling the JEL products in Norway. Johan Svendsen was hired to assist PEC in Tønsberg to solve the JEL problems. It was however very difficult to restructure the company and its productions. New investors were at that time more interested in electronics than the high voltage power equipment and consultancies. So in 1993 Johan Svendsen chose to take over as owner and manager for JEL.

During the last 40 years JEL has developed advanced power system protection and control equipment, electricity meters, room thermostats, and 11kV to 420kV disconnectors. To have new assignments for JEL, it was decided to build power stations and high-voltage substations all over the world. At the first trip abroad in 1994 Botswana, Zimbabwe, Mocambique and South-Africa were visited, and soon large contracts were approved in Africa. Since then JEL has installed high-voltage equipment in 20 countries in Africa, Far-East and Europe. The main activities in the company are done by experienced engineers with knowledge in advanced solutions and suitable expenses. Good financial solutions have been important factors when working in developing countries all over the world.

In Norway, JEL has 125 years of experience. A highly competent consulting department was established in 1985 to handle power system protection and control for all types of power utilities and high-powered industries. Today the design and building of large power stations, substations and transmission systems are the main activities.

Jacobsen Elektro AS is part of the Jacobsen Elektro group:

- Jacobsen Elektro Holding AS: Main holding company
- Jacobsen Elektro AS: Building all types of power generation and transmission, and a main consultant on power system protection and control.
- Jelco AS: Owns and operates international power stations
- Jarlsø AS: Supplier and builder of telecom poles and infrastructures.
- Jelcem AS: Supplier of high quality concrete for African construction sites.
- JEL Oil & Gas AS: Oil production and transport - under development


Johan Svendsen was born on February 20, 1951 and has since 1993 been the owner of Jacobsen Elektro AS. He discovered soon that the main reasons to the JEL problems was the reorganization of the Norwegian power utilities. He decided that Jacobsen elektro should start selling and delivering large power production and transmission sites in Africa and Asia. The consultancy department has become one of the largest and most competent expert groups in Europe on protection and control of power systems.
Company founder JOHANNES NICOLAY JACOBSEN was born on March 6. 1864, and died on August 9. 1906.

When Oslo received the first phone central, the supplier - Bell Phone Company - built a local workshop. There the young technician, Nicolay Jacobsen was employed. Later on, he studied in Germany, and was for a couple of years working by Siemens & Halske in Berlin.

After his return to Oslo, the local phone company employed him, but soon he decided to establish his own workshop on April 21. 1891. It now celebrates its 50-years continued existence, and still keep his name.

The company owner Jacobsen was a recognized capacity in his area of competence, and he also participated in complicated scientific activities for professor Birkeland. Jacobsen did experiments that later on lead to the world famous Birkeland-Eyde arc furnaces. Jacobsen's reputation also resulted in his public scholarships enabling him to visit professional exhibitions abroad.

One of the most public men in Oslo, the fire chief B. Dybwad gave by Jacobsen’s death a good impression of his contemporary perception of the company owner Nicolay Jacobsen: We must admire that Jacobsen has managed to reach so far, and we are sorry, that he so early had to leave his work, that engaged his interest day and night. He said himself that it often was impossible for him to sleep, because he always had to think about his intricate apparats. Overstrained by his work, he ended by Easter at a painful sickbed, and had from that time to give up all work.

For those who worked together with him, his early demise feels like a great bereavement and loss, which is difficult to replace. You could give him any type of assignment in his business, and he understood how to solve it in the best and most practical way. Thereto came a rare modesty and graciousness, seriousness and right mind.

In acknowledgment of his excellent and fully exemplary work, for his wake allegiance in his work, this obituary is written in admiration with thank you and good bye.
The old companies in Kristiania (Oslo) – N. Jacobsen’s Electrical Workshop

On April 21, 1891 Nicolay Jacobsen started a small workshop in Lille Grensen Street 4 in Kristiania (Oslo). With only one assistant he repaired equipment for the local phone company. The workshop quickly developed itself to the company that today is named N. Jacobsens Elektriske Verksted A/S (N. Jacobsen’s Electrical Workshop limited) placed in Gøteborggate 39 at Rodeløkka (Oslo).

In the first years the company was run as a typical instrument repair shop, where almost all work was done manually. In 1912 the personal workshop was changed into a limited company, and at the same time it became a mechanical factory. This also resulted in a change in production from mechanical to electrical equipment. In 1921 the company moved to its current location, where today around 150 workers and functionaries are employed.

The engineer Jacobsen participated in important scientific developments during the professor Birkeland’s experiments that later on resulted in the well-known Birkeland–Eyde arc furnaces for nitrogen (fertilizer) production. Jacobsen’s later participation in the exploitation of electricity is clearly shown by the reception of 25 national and international gold-medals and honorary diplomas received by the company.

Norwegian National Library - NJEV product catalogue published in 1901 with 263 pages:
http://www.nb.no/nbsok/nb/fefce8536a01fa40b68f71d9ae71a181.nbdigital?lang=no#0
Workers at the turn of the century

Workers around the turn of the century. No. 7 from the right in second row is the company founder Nicolay Jacobsen

Company staff around 1913-14
1921-1972  Factory in Gøteborggata 38, Oslo
2005 Moved to Lier

Company staff in 2016 - 125 year’s anniversary
In 1901 NJEV produced two prototypes of Birkeland’s electromagnetic cannon. The purpose was to protect Norway during the full liberation from Sweden. The Norwegians didn’t have proper access to explosives, but electricity was the new source of power. The cannon should send projectiles weighing up to 10kg. One of the guns is still exhibited in the Norwegian Technical Museum in Oslo.

Birkeland was hoping to profit from this, and Prime Minister Gunnar Knudsen was among the shareholders in «Interesseselskapet Birkeland skytevåpen» (The stakeholder company for Birkeland’s firearm).

In the Norwegian Universities function room on March 6. 1903 the cannon was demonstrated for the international weapon industry by Birkeland. The gun failed and short circuited, and a very particular electrical arc covering a large surface in the air was observed. Due to the special smell of nitrogen oxide in the air, the failure was much more interesting for Birkeland than the gun. This was the start of the development of the Birkeland-Eyde method for producing fertilizer, and the first start of Norwegian Hydro.
Hjalmar August Schiøtz (1850-1927) was the first Norwegian professor in ophthalmology. He was especially a clever developer of optical instruments, and had excellent knowledge in higher mathematics and physiologic optics. He invented several ophthalmologic instruments. The most known instruments were the ophthalmometer that he designed in cooperation with professor Javal in Paris in 1881. The tonometer was invented in 1905 in cooperation with NJEV. The tonometer was for 50 years the main instrument used to measure eye pressure.

Journal from the Norwegian Medical Association: Hjalmar Schiøtz and his tonometer: [http://tidsskriftet.no/article/263673/](http://tidsskriftet.no/article/263673/)
Schiøtz tonometer: [https://en.wikipedia.org/wiki/Schi%C3%B8tz_tonometer](https://en.wikipedia.org/wiki/Schi%C3%B8tz_tonometer)
Current Limiter and Electricity Meters

The current limiter «Vippa» was developed and manufactured by NJEV from 1913, and was supplied in more than 1 million units to most Norwegian households. The purpose was to limit the power consumption in each house to a few lightbulbs. If the house-supply was overloaded, then all the lamps would start blinking. The principle was so useful that even the Japanese engineers wanted to be told how to design the units.

In Norway 1.2 millions of these energy meters were delivered to the whole country, and the development and production of energy meters continued for more than 70 years.

Digital museum - Vippa: http://digitaltmuseum.no/011025092185?query=vippa&pos=17
Digital museum - Vippa: http://digitaltmuseum.no/011025092178?query=vippa&pos=16
Telephones and Telephone Centres

Morsead - Telegraph:  http://www.morsemad.com/norske.htm
Antikkmannen – Old NJEV telephone:  http://www.antikkmannen.net/787467487i=80256863
Radio Receivers

From 1923 to 1931 NJEV developed and produced a large amount of crystal radio-sets with headphones called «Smaaen» («The Little One»). From 1931 to 1936 the main radio receiver with radio tubes called «folkemottakeren» developed.

Nord Norsk Radiomuseum: [http://www.nnrm.net/Teknisk%20info/NRK%20Folkemottaker.htm](http://www.nnrm.net/Teknisk%20info/NRK%20Folkemottaker.htm)
Digital museum: [http://digitaltmuseum.no/011024249550](http://digitaltmuseum.no/011024249550)
Norsk teknisk museum, Digital museum - Jel radio receivers: [http://digitaltmuseum.no/011024249550](http://digitaltmuseum.no/011024249550)
NRK.no radioapparater: [http://www.nrk.no/informasjon/nrks_historie/det_hvite_hus/236246.html](http://www.nrk.no/informasjon/nrks_historie/det_hvite_hus/236246.html)
Traffic Control Systems and Speed Monitoring

In 1947 NJEV delivered the Electro-Matic Traffic Control system for Trafalgar Square in London. Similar systems were installed in many Norwegian towns, to replace the manual police controls. In the mid 1950's NJEV also developed Speed monitoring systems, to enable the police measuring cars speeding on the roads.
In 1981 JEL took the development and production of high-voltage disconnectors and earthing switches for 11kV to 420kV from Elmek (National Elektro). The breakers were especially solid and durable, and had a normal operational lifetime of 40 years. After factory service the breakers lifetime would increase with additional 40 years. Modern equipment has usual lifetime of 20-30 years, so the JEL breakers were very advanced. In 2001 the production was transferred to EB elektro.

**HV disconnectors from JEL, and purchased circuit breakers built together in Hokksund**

EB elektro products - [http://www.eb-elektro.no/no/segmenter/distribusjonsnett/skillebrytere](http://www.eb-elektro.no/no/segmenter/distribusjonsnett/skillebrytere)
Protective relays for high-voltage power systems

Since 1934 NJEV (later JEL) developed and produced protective relays for electrical high-voltage power lines, power stations, substations and transmission systems. Rolf Widerøe was very active in the development of new impedance-protection measuring principles in the early years. Until 1985 the JEL protective relays were still so advanced that they were the standardized solutions protecting almost all Norwegian power lines from 66kV to 420kV. And the JEL technology was for decades one of the best worldwide solutions.

In 1998 generation no. 7 of the protective relays was developed. This time as a fully digital solution. In the early days the main protective relay weighed over 200 kg, and is shown in the lab in the picture below. Today the RefleX protective relay weigh less than 4 kg, and perform the same functions with much higher safety and reliability.

First generation of impedance protection - 1934

Protection laboratory in 1953 with advanced impedance relays type RZϕ3x4 used on the largest power lines.
J S Sørensen, R S Torkildsen, L B Kolrud, Bjarne Nilsen, Miss. Henriksen

Generasjon 7 of protective relays – developed 1998 / 2011

Rolf Widerøe development engineer: https://en.wikipedia.org/wiki/Rolf_Wider%C3%B8e
JEL protective relays: http://www.jel.no/losninger/kraftnett/vern-og-kontrollanlegg/modelvelger/?lang=nb
In 1935 a group of power system protection experts was established, at NJEV, working on all Norwegian power utilities and high-powered industrial sites. The group was expanded in 1985 to protection/control planning, installation and maintenance. During the last years the engineers have also planned, built and tested complete power stations and high-voltage substations from 11kV to 420kV in Norway and abroad mainly in Asia and Africa.

1985 JEL started a consulting department for planning and maintenance of main power system protection and control. Today they work on all international types of equipment from all manufacturers, and the department is one of the largest groups of protection and control engineers in Europe.

Early Software Development

In 1987 most computer applicants were using fixed screens, connected to the main computers in the office basements. Using mobile laptop computers, spreadsheets and other software gave new possibilities for the protection engineers who travelled between more than 400 different power utilities and factories in Norway.

The first spreadsheets used by JEL were based on Hewlett Packard Executive Spreadsheet, before DOS and Windows were properly established. Also the HP Executive Memomaker (text) and HP Drawing Gallery software were part of the applications. Later on the Lotus 123 spreadsheet was applied for protection documentation for over 25 years. The last years the system has been transferred to Excel spreadsheets, because the Lotus software was discontinued in 2013.

The ProDoc software was developed as an advanced tool for documentation of fault-types and power system protection settings. After 30 years, ProDocX is the third generation and still based on the same principles. The system is open and contains detailed documentation of protection systems from most manufacturers.

ProDocX and JEL electric power services:  http://www.jel.no/en/electric-power-services/
HP computer museum - Executive Spreadsheet:  http://www.hpmuseum.net/display_item.php?sw=175
HP computer museum - Executive Memomaker:  http://www.hpmuseum.net/display_item.php?sw=46
Building Substations and Power Lines

In 1992 it was decided that JEL should build substations, power stations and power lines all over the world, and has now done that in more than 25 countries in Africa, Far-East and Europe. Most stations were built by the JEL project department. In Asia and Africa JEL has worked very actively with local suppliers, workers and installation crews. Extended technical training and the continuous exchange of cultural cooperation and practical working procedures has been very useful and interesting.

161kV substation, Bawku, Ghana - finished 2016

Building Power Stations

JEL has designed and built power stations in both Africa and in the Far East. The 150MW power station Kinyerezi 1 in Tanzania was delivered by JEL in 2015. Kinyerezi 2 is an extension the same size that will be built by JEL in 2016/2017.

The president is taking over the power station in Tanzania

Anniversaries for NJEV and JEL

1891-1941 50 year's anniversary - NJEV
- Annual turnover 1½ mill. Norwegian Kroner in 1941
- 125 employees
- Fire Telegraphs with fire signalling
- Current limiters
- KWh energy meters with power overspending measurements
- In 1934 the development of power system protections started.
- Medical equipment
- Single sales point of electrical lamps from A/S Norsk Elektrisk Glødelampefabrikk
- Småen and Folkemottakeren crystal radio receivers. From 1924 to 1938

1941-1966 75 year's anniversary - NJEV
- 177 employees
- KWh energy meters
- Power system protection units
- Installation, maintenance and services in Norway on protective relays.
- Traffic control signals for the main Norwegian towns.
- In 1947 NJEV delivered traffic control for Trafalgar Square, London
- Parking payment meters and radar based car-speed equipment.
- Fire signalling systems for both private houses and large buildings
- Room thermostats
- Alarms, automatics and remote control systems.
- Telephones and telegraph systems.

1966-1991 100 year's anniversary - JEL
- 56 employees
- KWh energy meters
- Systems for KWh information from users
- Substation control and remote control systems
- High power disconnectors and earth-switches from 11kV to 420kV
- Power system protection relays
- Installation, maintenance and services in Norway on protective relays.
- Largest Norwegian protection consulting environment started in Jel in 1984

1991-2016 125 year's anniversary - JEL
- Annual turnover 514 mill. Norwegian Kroner in 2015
- 65 Norwegian employees
- Building large substations and power stations.
- Most activities in Africa, Far-East and Norway
  - Power stations
  - Substations from 11kV to 420kV
  - Specify and build advanced local/remote control systems
- Power system protection experts with more than 30 years of experience
  - Advanced consultancy on protective relays of all types and from all manufacturers.
  - One of the largest groups of protection experts in Europe.
  - Extensive maintenance of all types and all manufacturers of protective relays.
  - Protection calculation and settings documented for over 30 years.
- Specification and supply of local/remote control systems.
Countries supplied by JEL during the last 25 years

During the last 25 years, JEL has delivered substations and power stations in more than 25 countries. Before then Norway was the main marked for JEL. Due to reorganization and trading of the Norwegian Power Utilities, all activities in Norway were cancelled for several years. The problem was solved by the new owner of Jel, Johan Svendsen by choosing to work Africa and Far-Asia. The results are now that JEL is selling main power stations and substations at any voltage level in mainly Africa, Asia and Europe:

Albania
Angola
Armenia
Bangladesh
Costa Rica
East-Timor
England
Equatorial Guinea
Finland
Ghana
Kosovo
Laos
Liberia
Lithuania
Mozambique
Nicaragua
Norge
Romania
Sierra Leone
Sverige
Tanzania
Uganda, Vietnam
Zambia
Zimbabwe

Jacobsen elektro AS

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