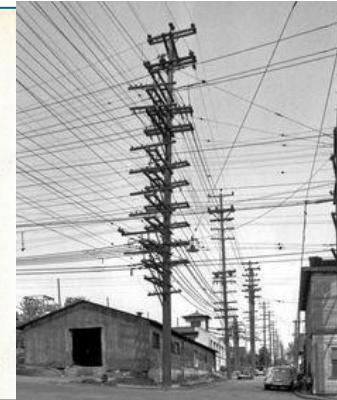
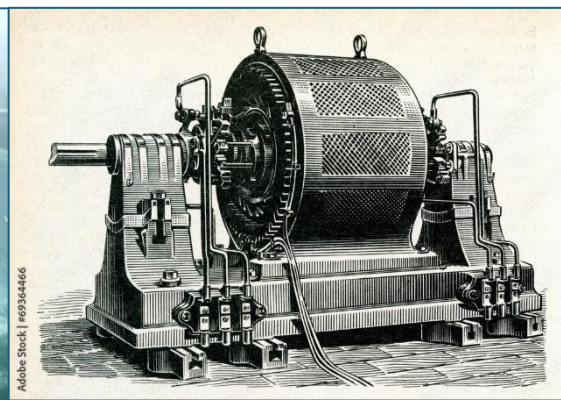
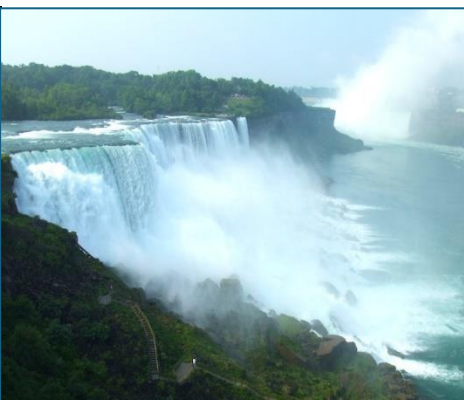


HISTORY PANEL ISSUE

*Discussion on topics for the 6th SEERC
Conference in Croatia 2028*

Krešimir Bakič, Honorary member of CIGRE
Priština, Kosovo, 13th May 2026





Homeland of the continuing electricity



1st KICKOFF MEETING OF THE HISTORY in ATHENS, on 23 January 2020 at HEDNO – the Greek DSO Headquarter, presented by 8 SEERC members who established permanent RWG HER (History of Electricity in Region).

Scope, deliverables and proposed time schedule of the Group :

Each SEERC member could delegate one or more RWG HER members.
Meetings of RWGs could be organized during TAC meetings or SEERC conferences. *First CIGRE history panel is* designed to be in June 2020 during the 3rd European Regional CIGRE Conference, in Vienna, Austria.

Unfortunately, due to the Covid, conference in Vienna was postponed on June 1, 2022, in Vienna.

Scope :

1. Collecting data on history records from regional member states (beginning of electrification, key history events important for electrification, penetration of certain technologies to power engineering, interconnections, unknown details regarding construction of crucial power plants, etc.)
2. Investigation of system issues in region, rising of regional cooperation, history of institutional arrangements in power sector,
3. Interesting stories about certain distinguished personalities and/or significant achievements in the electric power system,
4. Promoting important electric power engineers and scientists of each member state,
5. Cooperation with similar WGs in other CIGRE regions and wider (IEEE)

Deliverables :

- A. *Participation at special CIGRE workshops, panels at SEERC conferences, symposia and similar events,*
- B. *Publication of periodical reports on accomplished work and special editions (focused on selected period, or technological breakthrough in a SEERC member country)*

WORKING SECTIONS: (four periods **by time)**

- 1. **Early electrification1880 up to the establishing of Cigre (1921)**
- 2. **Time of creation of systems ... 1921 up to 1951..roles of Cigre**
- 3. **Interconnections time ... 1951 up to 2000**
- 4. **Electrification after opening the energy markets over the world (after 2000)**

WORKING SECTIONS: (historic achievements**)**

- 1. **Elements of electric power system**
- 2. **Power plants developmens**
- 3. **Networks developments**
- 4. **Electricity education developments**
- 5. **System issues**

SEERC RWG HER

WORKING SECTIONS: PARTICULARITIES

- Specific stories from countries related to electrification
- Specific experiences in past with deployment of certain equipment
- Stories of very distinguished persons in our region
- Other historic importance for future electric power systems

Sections of work	1880 -1921 Early electrification	1921-1951 Systems creation	1951 – 2000 Globalization of eps/interconnections	2000 – 2020 market issues
Elements (TR, OHL, Cables, Power electronics)	Beginning of conductors, insulators			New conductors
Power plants (sources)				PV history
Networks (construction, HVDC, 6-phase systems)				
Education developments				
System issues (DC, AC, Hybrid, institutional arrangements)				

First Vienna History Panel we decided to be focused to early electrification and introducing **polyphase electrical system (2-phase or 3-phase)** in the SEERC Region. (June 2022)

Title of 1st panel:

Cognitive history of AC polyphase power systems development and progress in Central Europe

1. **Austrian Case – T. Kern:** *Beginning of Power System deployment incited by and followed after the 1883 World Electricity Fair in Vienna. First AC polyphase (2 phases) hydro power plant and high voltage transmission line in Weiz*
2. **Croatia Case – G. Slipac:** *First Electric Power System 2-phase and 3- phase in Croatia*
3. **Slovenian Case – K. Bakic:** *First industrial 3-phase power plant and overhead line in Slovenia (Ljubljana, 1897)*

Second History Panel in Sarajevo (5th Seerc Conference) in 2025 was focused to History of connecting power systems to regional and continental interconnections: Overhead (globally), and under the Mediterranean sea.

Title of second panel in Sarajevo:

Creation of interconnected power grids and submarine connections

1. Italy, **Massimo Rebolini**: *History of the Mediterranean submarine interconnections*
2. Slovenia, **Kresimir Bakic**: *Short story of the creation of interconnected power network*
3. Türkiye, **Ahmet OVA**: *History of Türkiye's Electric Power Interconnections with South-East Europe and Further Projects*

Third History Panel in Cavtat, Croatia, in 2028 should be

- **History of Conductors...**
- **History of insulators...**
- **History of OHL towers...**
- **History of cables for Power transmission...**
- **History of HVDC technology...**
- **History of electrical standardization: National, International, others**
- **Nice story about important electric power persons in your country**
- **new proposals...**

Country - Volunteers for the lecture (25 min)

Discussion

Short introduction

1	Early electrification up to creation CIGRE	1881 - 1921
2	CIGRE - Beginning of the system's concepts - Frequency, voltages, insulation, generators, interconnections, conductors, switchgears	1921 - 1951
3	Time of rising interconnected systems	1951 – 1999
4.	Electrification after liberalization of the market	2000 - 2020

Early electrification – crucial events

1881 – First International Exhibition and Congress **in Paris**. Organized by French Government.

- It was first ever comprehensive international gathering of electrical technologies to take place, discussing on different topics of springing up electricity science.
- Congress was attended by most advanced world's scientists from 27 countries, e.g. *Werner Siemens, H. Helmholtz, G. R. Kirchhoff, Z. Gramme, Jablochoff, H. Fontaine, M. Deprez, Lord Kelvin, G. Ferraris, etc.*
- They recommended the **ampere, volt** and **ohm** as practical units for current, voltage and resistance, which were generally adopted by electrical engineers.
- Congress showed very advanced stage of study of the development of the **DC machines**.

1882 – Second International Exhibition and Congress **in Munich**. Demonstration of electric power transmission with DC on long-distance of 57 km, from Miesbach to Munich. The project used voltage level of 2 kV, with power transmitted 2.5 kW. The project designed by **Marcel Deprez** and **Oscar von Müller**.

1883 – 3rd International Exhibition and Congress **in Vienna** had enormous impact to all states in Region. More than 50% exhibited electric lamps were incandescent and many other electrical use (boat, train, tram...). On 17 Sep was set up scientific commission leaded by Prof. **Josef Stefan** (Vienna) to study of electrical measurements and conducting scientific research at the Exhibition.

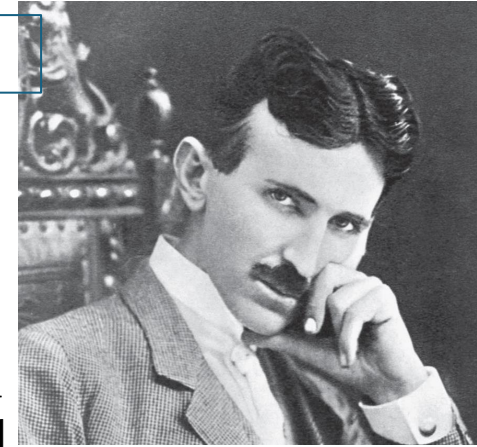
1884 – 4th International Exhibition and Congress **in Turin**. Prof. **Galileo Ferraris** made a single-phase AC transmission of 20 kW, 2000V on 40 km distance, but without a motor. The efficiency of this long-distance transmission was 89%. The open question was the AC motor for polyphase electrical system.

Period from 1882 to 1892 was the most innovatory period in history, which enabled later the development of massive electricity use.

Early electrification – crucial events - 2

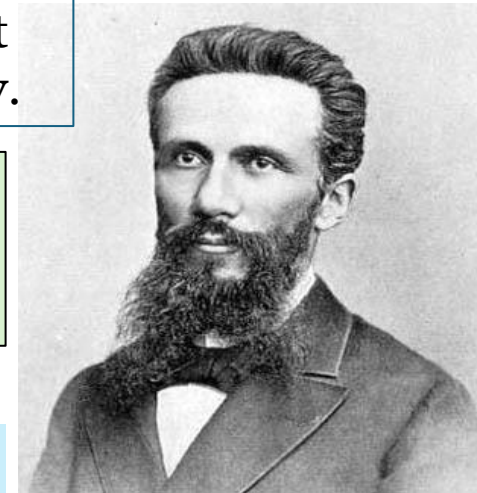
First ideas of an operation of electrical systems, using **polyphase AC systems** were in 1882.

First attempt of this approach belongs to the inventor **Nikola Tesla**, who worked in Budapest, in 1882, where he watching Danube River bathing in the sun from Budim Fisherman's bastion and recognized the waves on water were flowing synchronously with sunshine glitters atop of each wave. 26 years old Tesla suddenly got an idea about similarities of transmitting power of Danube water with power in electrical machines by electro-magnetic waves. He was obsessed with the idea of **multi-wave systems** and the thought of making it. Later, he developed model in his mind and in 1884 just before left to USA presented the model of **2-phase synchronous** generator and motor connected with 4 conductors, in Strasbourg.



Nikola Tesla (1856 – 1943)

In 1885, **Galileo Ferraris** presented construction and tests with 2-phase induction motor, but his interpretation was that this motor isn't efficient as we can read from **Dolivo-Dobrovolsky**.



Galileo Ferraris (1847 – 1897)
Prof. at Turin University

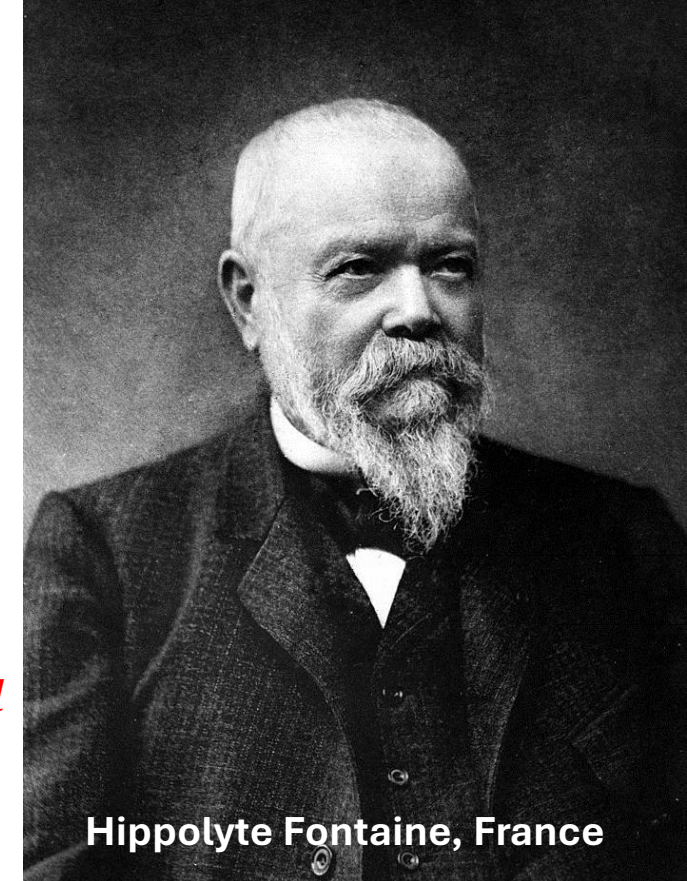
Later in 1887, Tesla applied US Patents on el. mag motor and transmission of Power, and granted all 7 patents on **May 1, 1888**. 2 weeks later Tesla had lecture at Columbus University, NYC: “**A new system of AC motors and transformers**”, before the AIEE.

Authors of the first ever 3-phase Transmission of electric power, in August 1891, in Germany, were: **Mikhail Dolivo-Dobrovolsky** (1862-1919), **Oskar von Miller** (1855-1934) and **Charles Lancelot Brown** (1863-1924)

STORY: Who invented transmission of electric power?

Frenchman **Hippolyte Fontaine** (1833-1910) was assistant engineer of the famous Belgian inventor Zenobe Gramme (note: Dynamo invented by Gramme has been the first in the world to provide a higher voltage and more stable direct current). At the **World's Fair of 1873 in Vienna**, H. Fontaine wanted to show visitors how a water pump could operate powered by an electromagnetic machine using DC electricity produced by new invented Dynamo. In the beginning water pump didn't work properly. From neighboring exhibitors than he borrowed missing copper wire (it was approx. **2 km long**), connected dynamo with DC motor nearby to the water pump, and finally the pump started working properly. **After this experiment, said Fontaine, he got an idea how mechanical power could be transmitted to distant places by electricity.** He wrote an article about it in a French newspaper.

Fontaine's idea was first used by the French factory-owners **Felix and Chretien** in **1878**, at its factory for sugar in Sermaizeu. Since the processing of sugar beet is seasonal work and except for one month in the rest of the year their steam machines usually stay unproductive. So, they decided to use its steam engines for useful work, for transfer of electrical power from factory halls to plowing fields. At a steam machine they installed dynamo to produce DC electricity and used flexible cable at a distance of 800 m (from the factory to the fields) to transmit power to the DC motor, which was specially developed for the plow plowing. **This was the transmission of electrical power into the electric plowing in France, in 1878.** That example found many imitators in France and elsewhere, in particular because of the economic efficiency. Fontaine was also one of the organizers of the First World Electrotechnical Exhibition in Paris in 1881.



Hippolyte Fontaine, France

Four types of power transmission:

- 1. Mechanical**
- 2. Electrical,**
- 3. Hydraulic,**
- 4. Pneumatic**