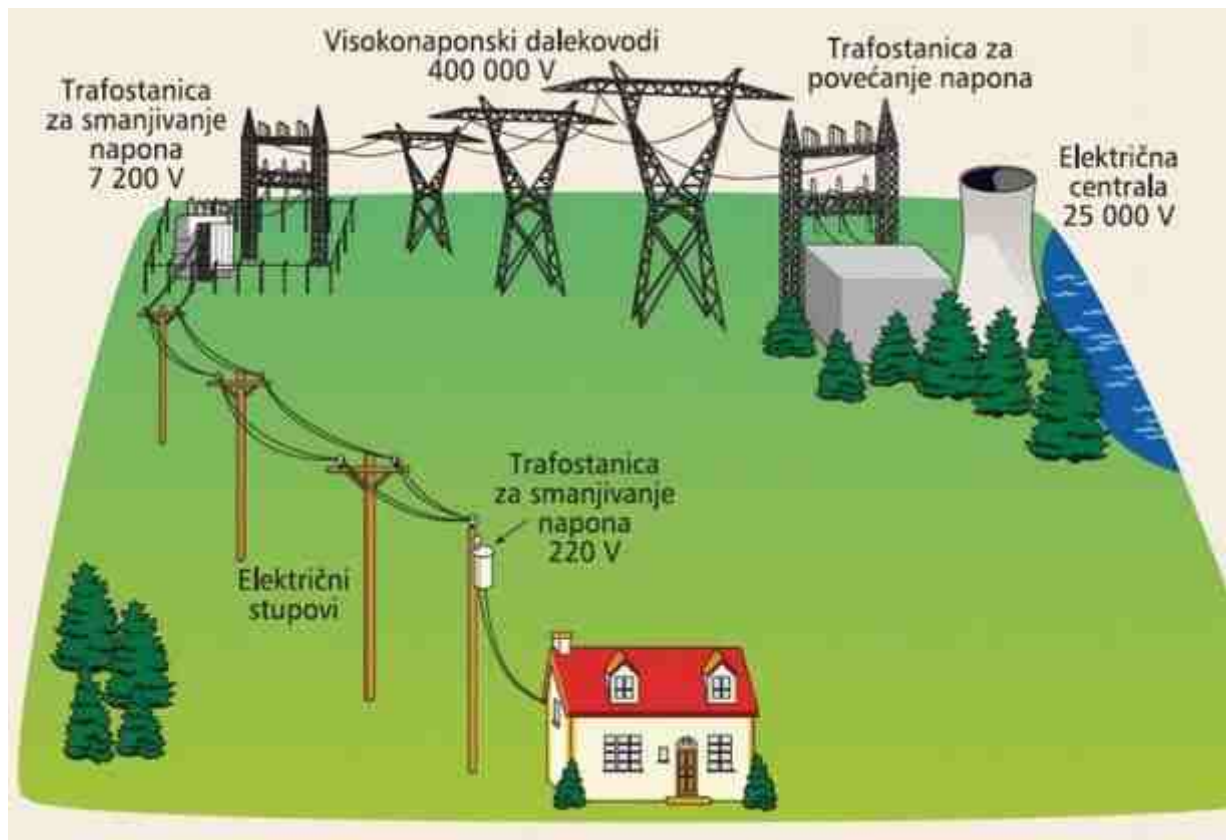


ELEKTRO-ENERGETSKI SUSTAV

- najveći je od svih tehničkih sustava. Obuhvaća: proizvodnju(1), prijenos(2), pretvorbu(3), raspodjelu(4) i potrošnju(5) električne energije.

Hrvatska godišnje proizvede oko 14 TWh

Kraljevina Švedska oko 140 TWh





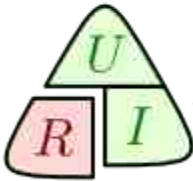
ELEKTRANA	1.TRAFOSTANICA KOD ELEKTRANE	2.TRAFOSTANICA PRED NASELJEM	3.TRAFOSTANICA PRED KUĆOM
5 000 V	na 400 000 V	na 7 200 V	na 230 V

Gubitci pri prijenosu električne energije ovise o jakosti struje (I – 'intenzitet').

Jača struja = veći gubitci; Slabija struja = manji gubitci

Jakost se može smanjiti transformatorom koji **smanji struju**, a **poveća napon** i tako se smanje gubitci pri prijenosu.

(Ohmov zakon)

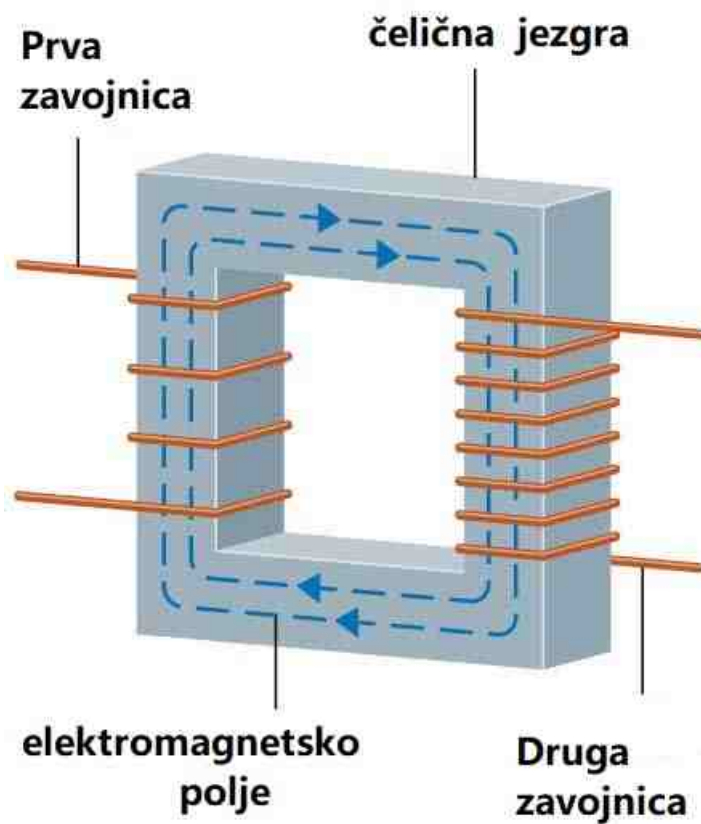
$$R = \frac{U}{I} \quad \frac{U}{R} = I$$

$$U = R \cdot I$$





Transformatori rade samo na izmjeničnu struju !

Uvijek imaju po dvije zavojnice:



Krajem 19. stoljeća:



IZMJENIČNA ili ISTOSMJERNA ELEKTRIČNA ENERGIJA ?

THE CURRENT WAR

THE TALE OF AN EARLY TECH RIVALRY

DC

DIRECT CURRENT

The flow of electricity is in one direction only. The system operates at the same voltage level throughout and is not as efficient for high-voltage, long distance transmission.

Direct current runs through:

- Battery-Powered Devices
- Fuel and Solar Cells
- Light Emitting Diodes

"[TESLA'S] IDEAS ARE SPLENDID, BUT THEY ARE UTTERLY IMPRACTICAL."

- THOMAS EDISON

THOMAS EDISON VS. **NIKOLA TESLA**

You would have never found two geniuses so spiteful of each other beyond turn-of-the-century inventors Nikola Tesla and Thomas Edison. They worked together—and hated each other. Let's compare their life, achievements, and embittered battles.

AC

ALTERNATING CURRENT

Electric charge periodically reverses direction and is transmitted to customers by a transformer that could handle much higher voltages.

Alternating current runs through:

- Car Motors
- Radio Signals
- Appliances

"IF EDISON HAD A NEEDLE TO FIND IN A HAYSTACK, HE WOULD PROCEED AT ONCE... UNTIL HE FOUND THE OBJECT OF HIS SEARCH. I WAS A SORRY WITNESS OF SUCH DOINGS, KNOWING THAT A LITTLE THEORY AND CALCULATION WOULD HAVE SAVED HIM 90 PERCENT OF HIS LABOR."

- NIKOLA TESLA

WAR OF CURRENTS OFFICIALLY SETTLED

In 2007, Con Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882. It changed to only provide alternating current.

FALLING OUT

Edison promised Tesla a generous reward if he could smooth out his direct current system. The young engineer took on the assignment and ended up saving Edison more than \$100,000 (millions of dollars by today's standards). When Tesla asked for his rightful compensation, Edison declined to pay him. Tesla resigned shortly after, and the elder inventor spent the rest of his life campaigning to discredit his counterpart.

EDISON FRIES AN ELEPHANT

In order to prove the dangers of Tesla's alternating current, Thomas Edison staged a highly publicized electrocution of the three-ton elephant known as "Topsy." She died instantly after being shocked with a 6,600-volt AC charge.

WAR OF CURRENTS: ELECTRICAL TRANSMISSION IDEA

DC (Direct Current) vs. AC (Alternating Current)

Incandescent light bulb, phonograph, cement making technology, motion picture camera, DC motors and electric power

1,093 NUMBER OF US PATENTS

1 NUMBER OF NOBEL PRIZES WON

1 NUMBER OF ELEPHANTS ELECTROCUTED

1931—Passed away peacefully in his New Jersey home, surrounded by friends and family

DEATH

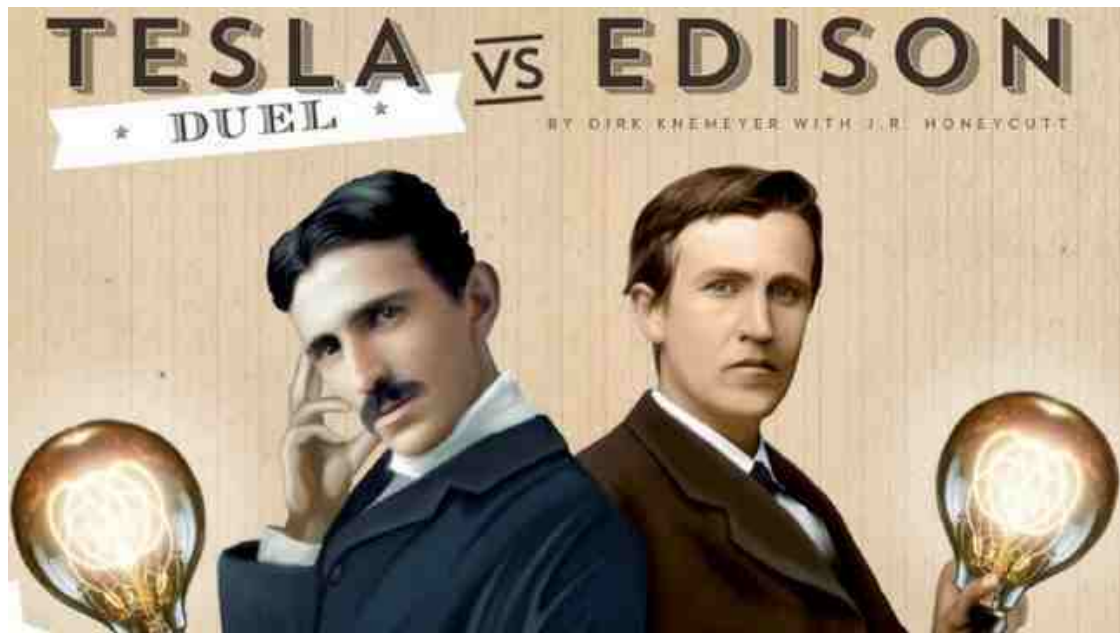
1943—Died lonely and in debt in Room 3327 at the New Yorker Hotel

NOBEL PRIZE CONTROVERSY

In 1915, both Edison and Tesla were to receive Nobel Prizes for their strides in physics, but ultimately, neither won. It is rumored to have been caused by their animosity towards each other and refusal to share the coveted award.

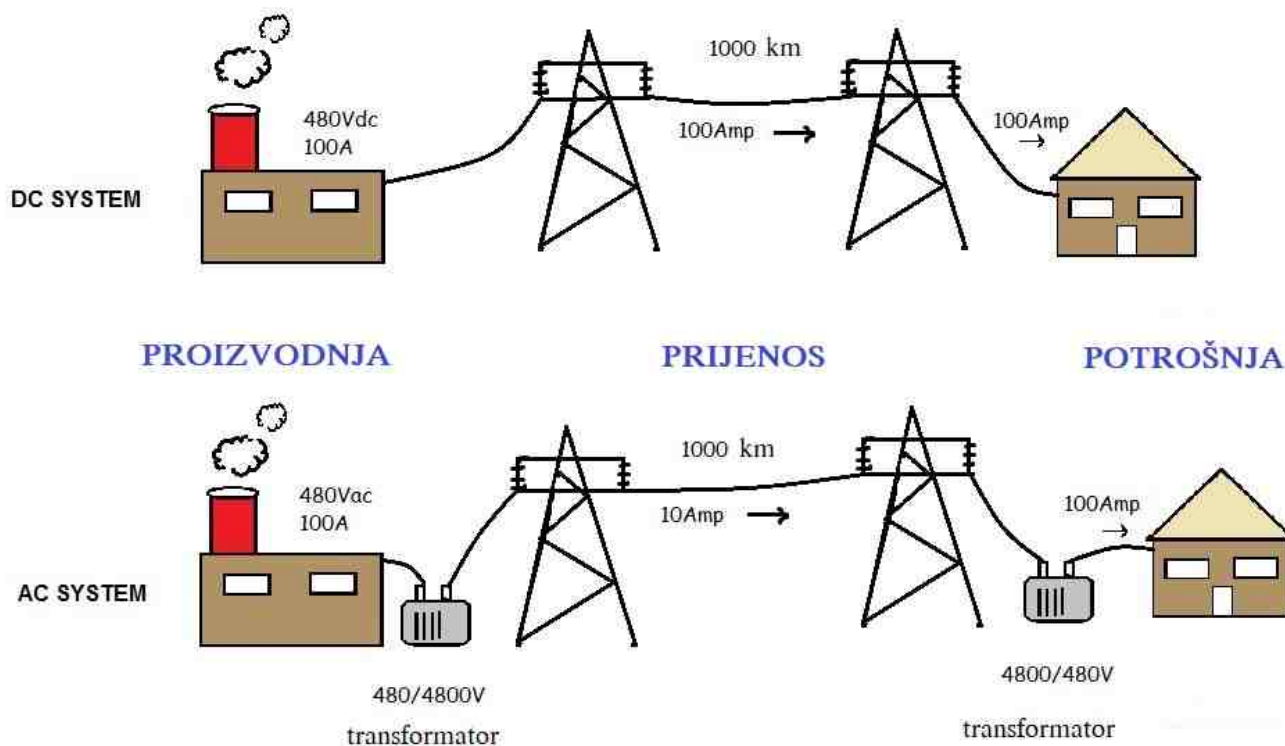
SOURCES: CHENEY, MARGARET. "TESLA: MAN OUT OF TIME." UPI. ROBERT. "TESLA: MASTER OF LIGHTNING." THOMAS.EDISON.COM | PBS.ORG | WEB.MIT.EDU | WIRED.COM

A COLLABORATION BETWEEN GOOD AND COLUMN FIVE



IZMJENIČNA ili ISTOSMJERNA ELEKTRIČNA STRUJA?





DC SISTEM – ogromni gubitci pri prijenosu, jer se istosmjernoj struji ne može transformatorom smanjiti jakost i povisiti napon.

Zato je prihvaćen Teslin AC sistem !

Napon: u kućnoj električnoj mreži 230V,
u industriji 400V.

Opasan po život > 30V



ELEKTRO-ENERGETSKI SUSTAV, STR. 7. – 14.

- najveći je tehnički sustav. Obuhvaća i proizvodnju i prijenos i potrošnju el. energije. **str.8. – 15.**

Prijenos i distribucija: Kod visokih napona gubitci energije su manji. **str.8. i 14.**

elektrane ⇒ transformator ⇒ dalekovod ⇒ transformator ⇒ potrošač

25 kV	povisuje	110 kV	smanjuje	230 V
	napon	400 kV	napon	400 V

<https://hep.hr>

<http://dalekovod.hr/>

Zadatak: RL 15. – 16.

Ponovimo:

1. _____ je znanost o proizvodnji, prijenosu i razumnom korištenju energije.
2. Koliki je napon u kućnoj električnoj mreži?
3. Električna se energija proizvodi u _____.
4. Glavne vrste elektrana su: _____.
5. Kako se prenosi električna energija od elektrana do korisnika?
6. Koliki je napon u dalekovodima?
7. Preko 90% HE u čitavom svijetu proizvode _____ električnu struju.
8. Zbog čega dalekovodni kabel ne smije dodirivati stup dalekovoda?

Tko želi saznati više:

<https://hr.izzi.digital/DOS/71709/71722.html>

Prijenos električne energije

<https://www.youtube.com/watch?v=w7JM-hqJU94>

Kako nastaje električna energija?

<https://www.youtube.com/watch?v=dTqku2vYaNo>

Solarna elektrana

<https://www.youtube.com/watch?v=g9SWbCI3iBI>

Škola proizvodi i prodaje vlastitu električnu energiju

<https://www.youtube.com/watch?v=H2F1FUMG8Ok>

Gravitacijska svjetiljka

<https://www.youtube.com/watch?v=xgNazXdWZFc>

How is electricity generated ?

<https://www.youtube.com/watch?v=e6lpOczJ50>

Transformatori

https://edutorij.e-skole.hr/share/proxy/alfresco-noauth/edutorij/api/proxy-guest/452e1469-e362-4711-abcb-6f535c3b5254/html/7590_Transformatori.html

Fotonaponski članak

Kako napraviti bateriju od novčića

Više o HE u Hrvatskoj:

https://hr.wikipedia.org/wiki/Hidroelektrane_u_Hrvatskoj

HOOVER DAM:

<https://www.youtube.com/watch?v=n4o8NlSa4Hs>

10 NAJVEĆIH:

<https://www.youtube.com/watch?v=kgbe4h5xLoc>

TRI KLANCA bbc:

<https://www.youtube.com/watch?v=YIBiBYDHWnQ>

BRANA NA RAMI:

<https://www.youtube.com/watch?v=xqSulZZJlmY>

HŽ

<https://www.hzinfra.hr/opasnost-od-strujnog-udara/>

<http://www.spasimonocnonebo.com/> - godina astronomije