Making Green by Going Green - The Workshop

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What Does Green Mean?

Definition of sustainability:

(Brundtland Commission of the United Nations, 1987)

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

In *your* organization, what does "green" mean?

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Sustainable Energy

"Sustainable energy is the provision of energy that meets the needs of the present without compromising the ability of future generations to meet their needs."

Wikipedia

"As a practical matter, sustainable energy has to be cost-effective."

Jim Burpee

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So . . . What is Energy?

"Energy is a quantity that is often understood as the ability a physical system has to do work on other physical systems."

Wikipedia

Practically speaking, "Energy is the stuff that makes stuff work."

Jim Burpee

Source: Wikipedia

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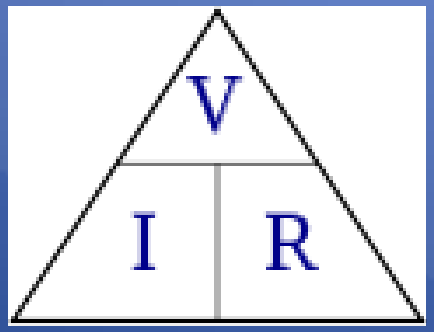
Electrical Energy

- Volts (V)

  Volts = Amps X Ohms
- Amps (I)

  Amps = Volts/Ohms
- Ohms (R)

  Ohms = Volts/Amps



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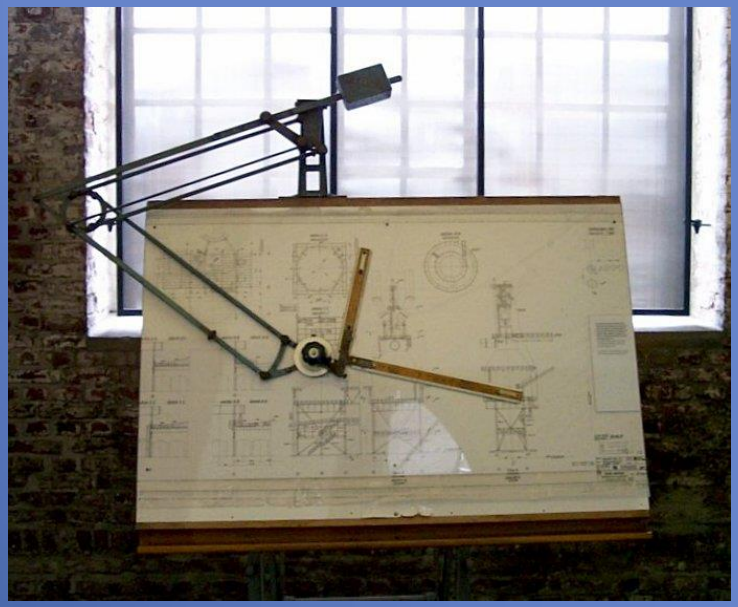
Electrical Power

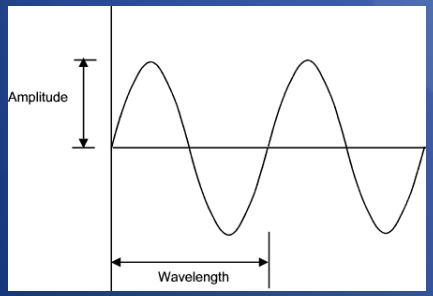
- Watts

  Watts = Volts X Amps

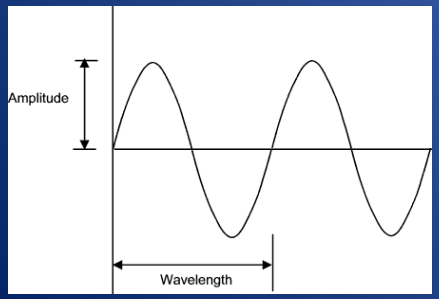
- KVA x PF (Power Factor) = KW



Volts



Amps



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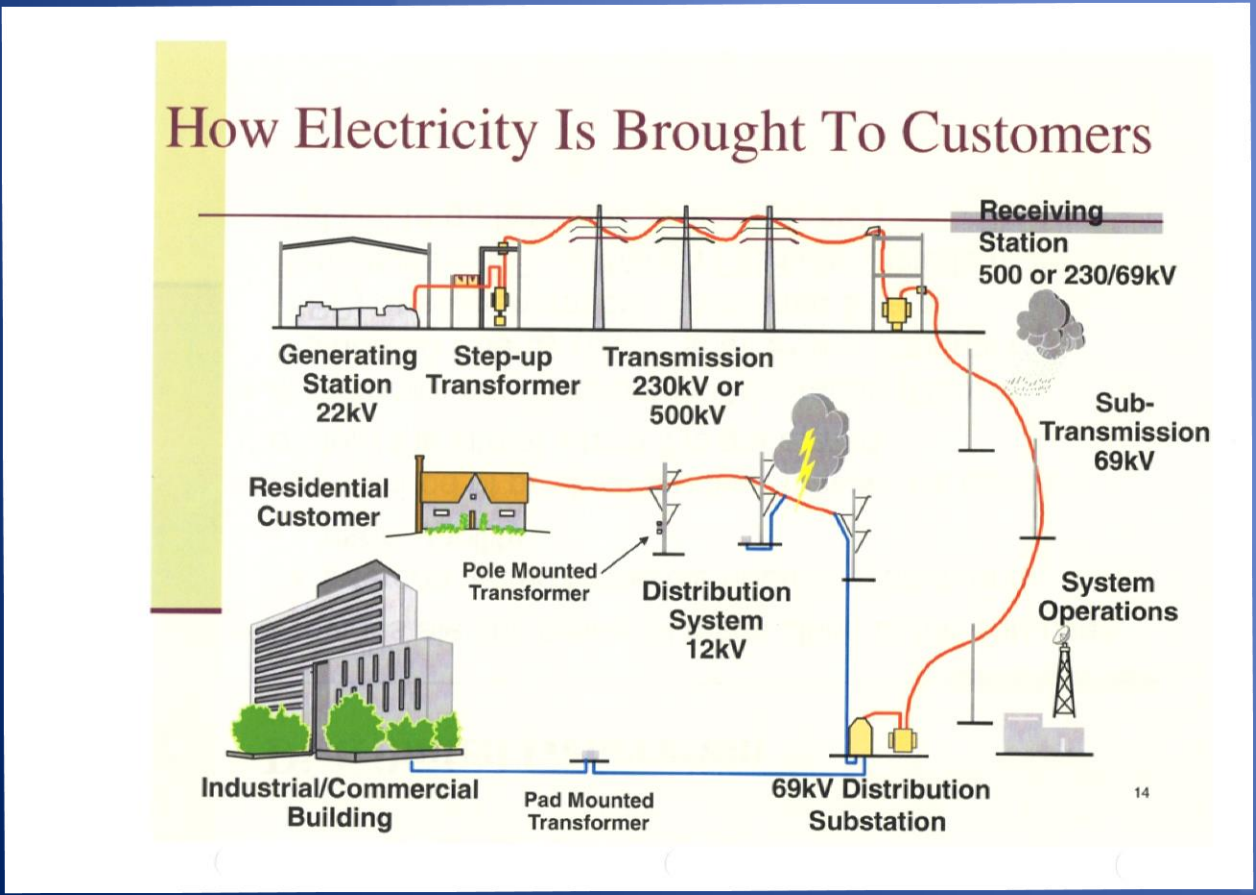
Electrical Power Distribution



Building Power Distribution

- Meters & Sub-Meters
- Distribution Panels

Power Consumption vs. Power Production

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Power Producing Devices

Power Consuming Devices

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Bringing Sustainable Energy to The Practice of Sustainable Architecture

Energy Conservation

- HVAC
- Lighting
- Pumps & Motors
- Sensors & Controls
- Building Envelope
- Commissioning

Energy Production

- Solar Photovoltaic
- Solar Thermal
- Wind
- Hydro
- Geothermal
- Combined Heat & Power

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Energy Conservation

- HVAC
  - Pros: Lower operating costs, consider ducting, IDEC, Reduce redundancy
  - Cons: Initial cost, rework cost, engineering costs
- Lighting
  - Pros: Reduced watt usage, longer bulb life, reduced maintenance
  - Cons: More expensive, light levels, light spectrum variances
- Pumps & Motors
  - Pros: Reduce operating costs, increase motor/pump life, reduced maintenance
  - Cons: Replacement costs, engineering costs
- Sensors & Controls
  - Pros: Automated runtime, reduced personnel, reduced maintenance
  - Cons: Mfg mismatch, system only as good as the operator, maintenance personal
- Building Envelope
  - Pros: Reduce heat/cooling load, reduce heat island effect, better interior comfort
  - Cons: Upfront design considerations, cost, maintenance
- Commissioning (assuring continuing optimal system performance)

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Energy Production

- **Solar Photovoltaic**
  - Pros: Free power once the system is paid for, very low maintenance, environmentally friendly
  - Cons: Expensive, large install area, inverter life cycle costs, daytime operation only, shade issues
- **Solar Thermal**
  - Pros: Free power once the system is paid for, environmentally friendly, can be used for A/C
  - Cons: Expensive, large install area, maintenance costs, best application is for heating
- **Wind**
  - Pros: Free power once the system is paid for, environmentally friendly, scalable
  - Cons: Expensive, maintenance, only operates in the wind, over-revving, radar shadowing, birds
- **Hydro**
  - Pros: Free power once the system is paid for, environmentally friendly?
  - Cons: Expensive, not usually fish friendly, probably not going to design one
- **Geothermal**
  - Pros: Excellent temperature source/sink, free heat
  - Cons: Install costs, maintenance, soil condition considerations
- **Combined Heat & Power**
  - Pros: High efficiency, provides both electrical and heating, cost
  - Cons: Should design for thermal load, maintenance costs, cost

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