Solar Energy Overview

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Agenda

Overview

Current market conditions and energy trends

Renewable energies

Types of solar

Economic impact of solar

Goals

By the end of this presentation you should be able to;

- define passive and active solar,
- understand the definitions for the three types of solar systems - air, water and electric,
- know the best applications for the types of solar systems.

Overview

The need for energy is constant and rising. Traditional sources are costly and require long lead times to build.

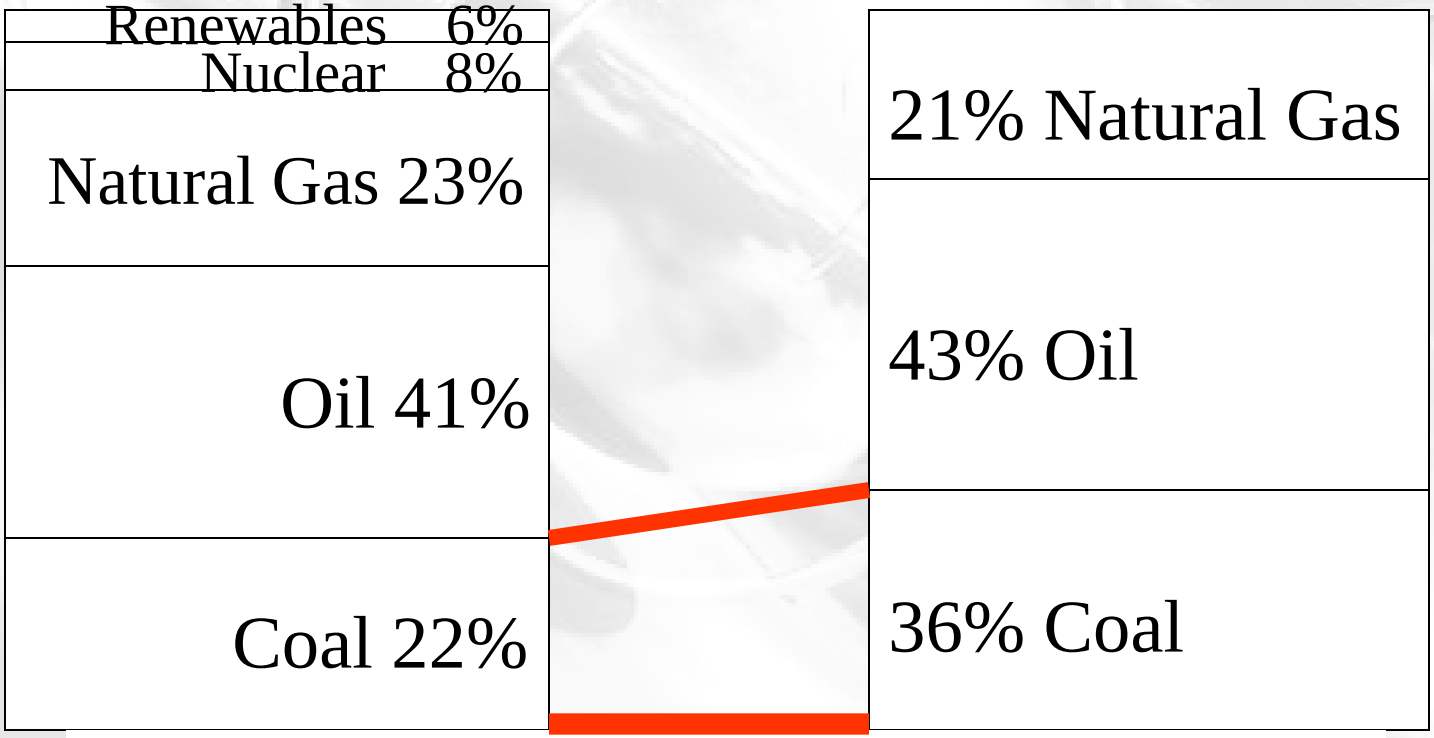
Renewable (solar/wind/biomass) energy sources can be implemented rapidly and can contribute to the grid from multiple locations (distributed generation).

Extensive research on technologies, market opportunities and financial programs has reduced the investment risk, improving returns.

2004 – US Energy Consumption and CO_2

Energy Consumption

100.41 quads BTUs



CO_2 Emissions

Source: Sierra, Jan/Feb 2007, Vol. 92, No. 1, p.32

Current Energy Trends

Mostly not good…

China could consume the world's petro in 25 yrs.

US still builds / buys the "wrong cars"

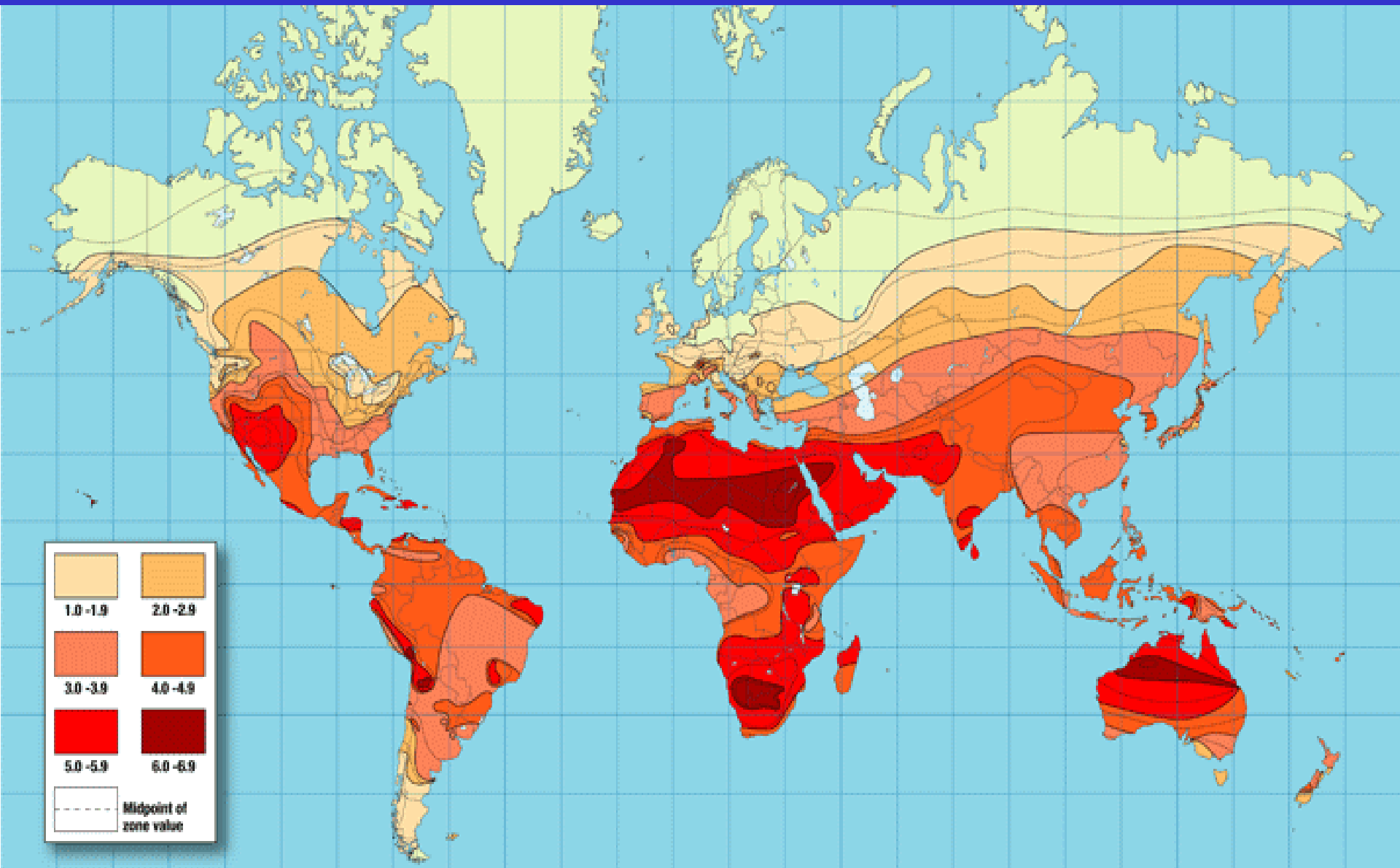
Ethanol is transitional… high cost water / corn

Battery technology is 50 years old

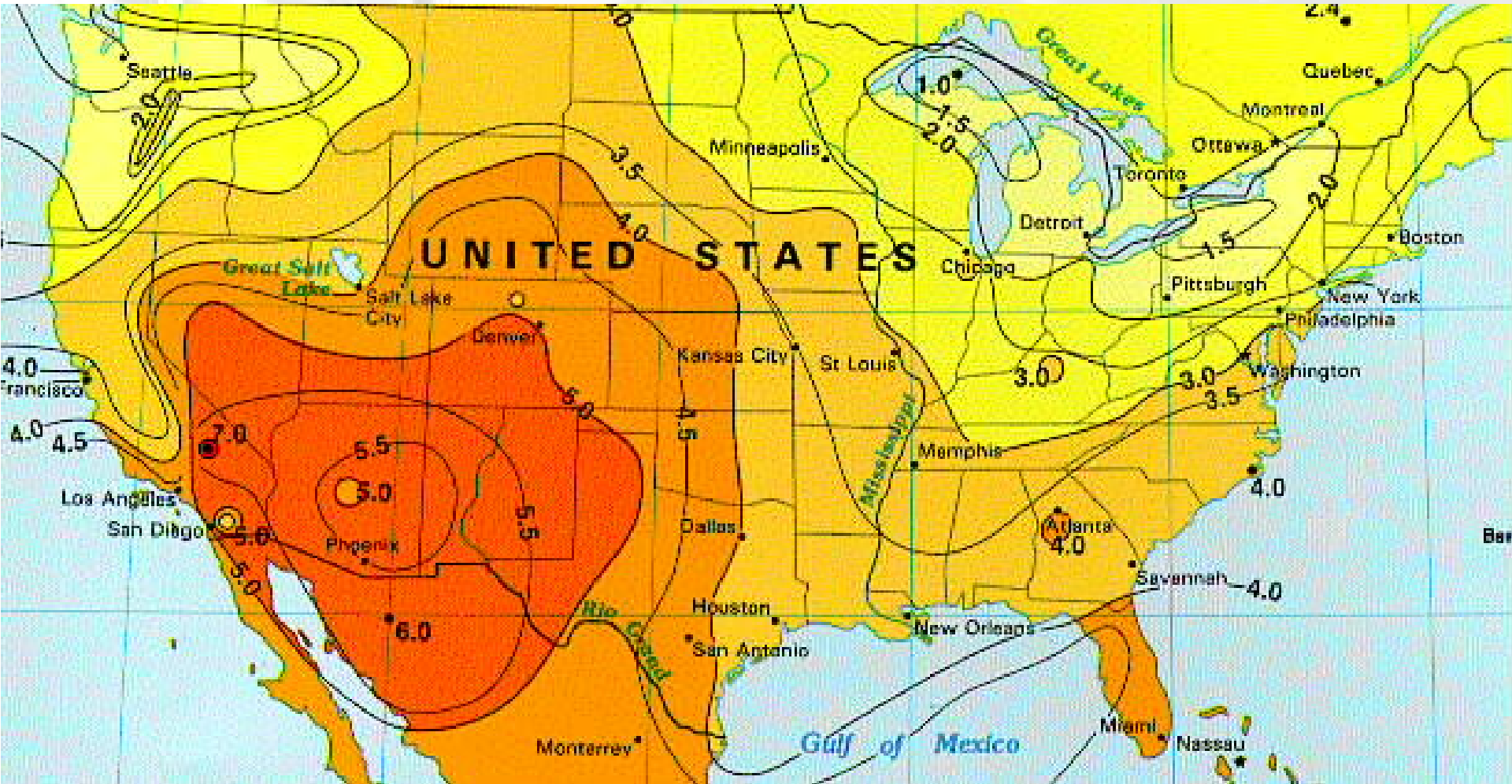
Main problem – we have no options

Insufficient research funding… poor strategies

Global Solar Radiation



Insolation: The rate of delivery of solar radiation per unit of horizontal surface. Nebraska averages 3.5 to 4 vs. 5.5 to 6 for Arizona. The measurement is in kWh/m2/day. Nebraska is ninth best nationally.



Renewable Energies

*Nebraska imports 89% of its total energy use

Hydropower (1% of Nebraska's energy source)

Solar – 9th nationally

Wind – 3rd nationally

Biomass – methane recovery

Geothermal – mostly heat pumps

**Nebraska Energy Office Statistics—was 99% in 1984-1985 Annual Report*

Solar: Passive and Active

Passive – sun warms an object and heat migrates through natural diffusion

- Sunroom on the south side of a house warms the dark tile floor which radiates into the adjacent room

Active – requires energy to move heat from one location to another

- Solar collectors using a pump to warm water and return the fluid to a tank

Types of Solar: Thermal and Electric

Solar Thermal –

Warm Air - hollow collectors

Hot Water - copper absorbers

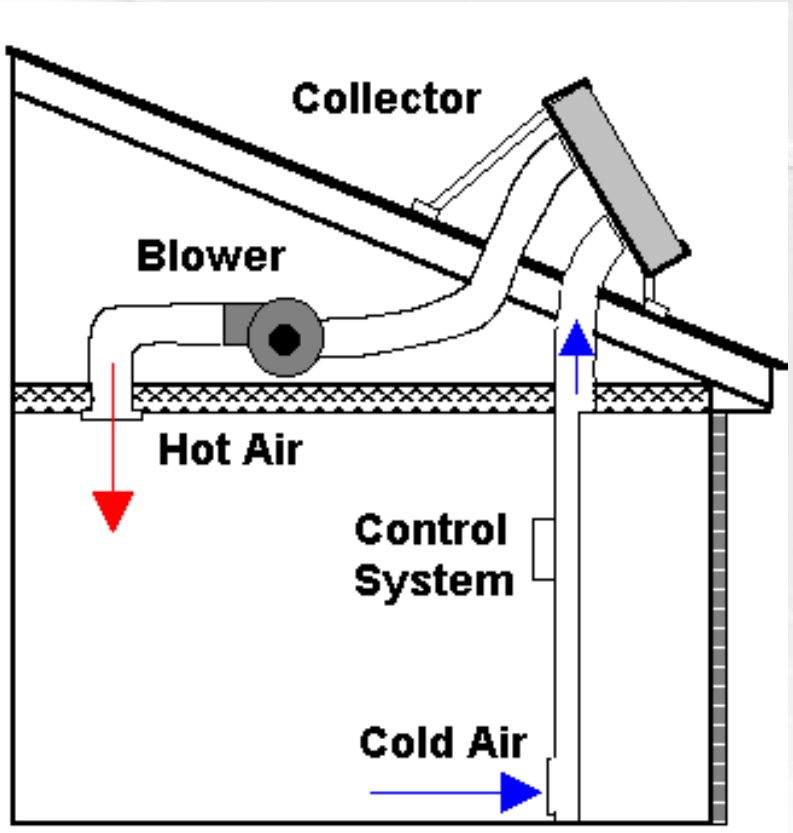
Solar Electric – silicon and polymers

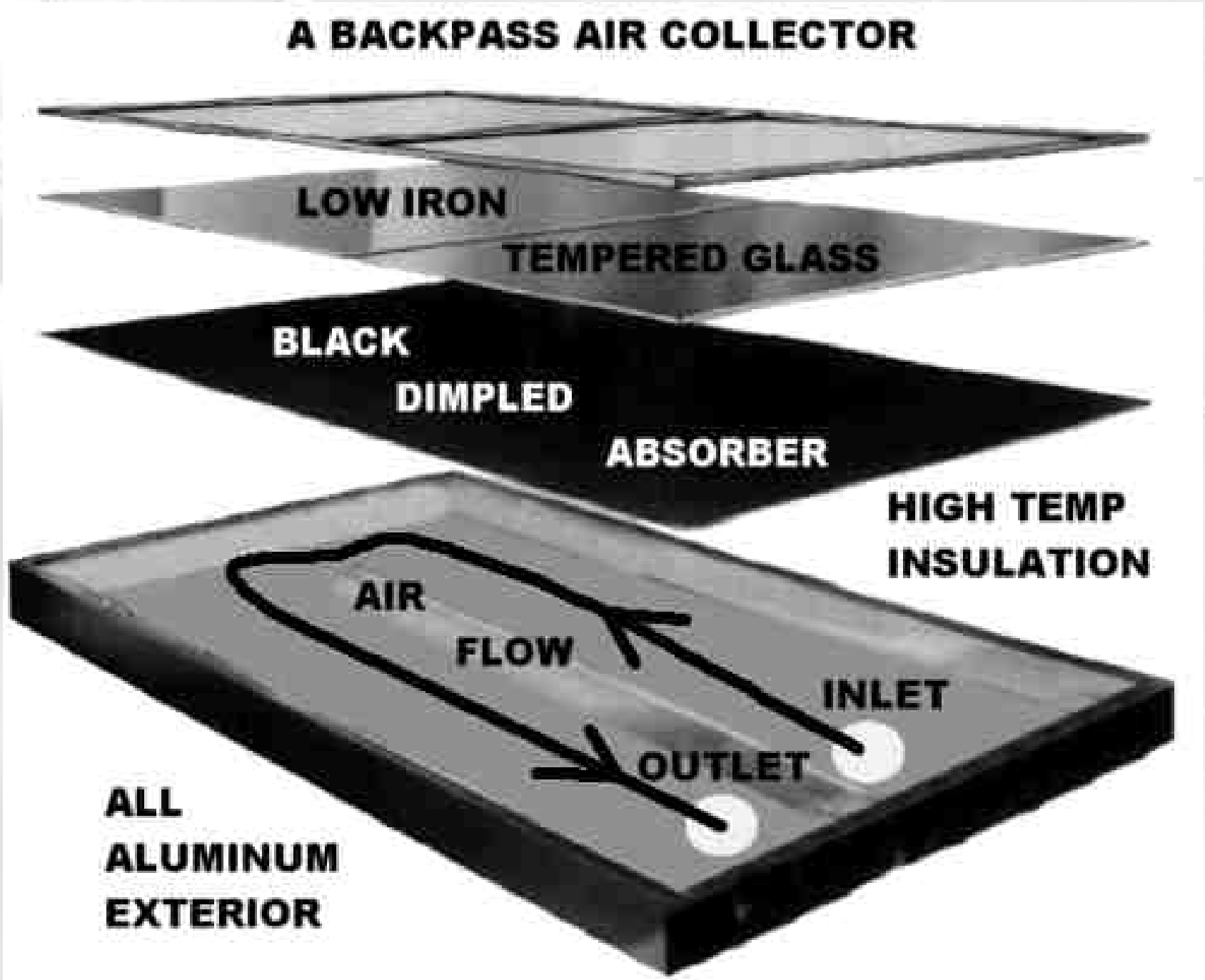
Used in all markets –
residential, commercial, and industrial

Solar Warm Air Systems

Best use: daytime space heating
Secondary: domestic hot water
Cost: least expensive

Recommendations:
One 4'x8' collector for about 400 ft^2 with short duct runs.
Usually have a minimum of two collectors.




A BACKPASS AIR COLLECTOR
LOW IRON
TEMPERED GLASS
BLACK
DIMPLED
ABSORBER
HIGH TEMP
INSULATION
AIR
FLOW
INLET
OUTLET
ALL
ALUMINUM
EXTERIOR

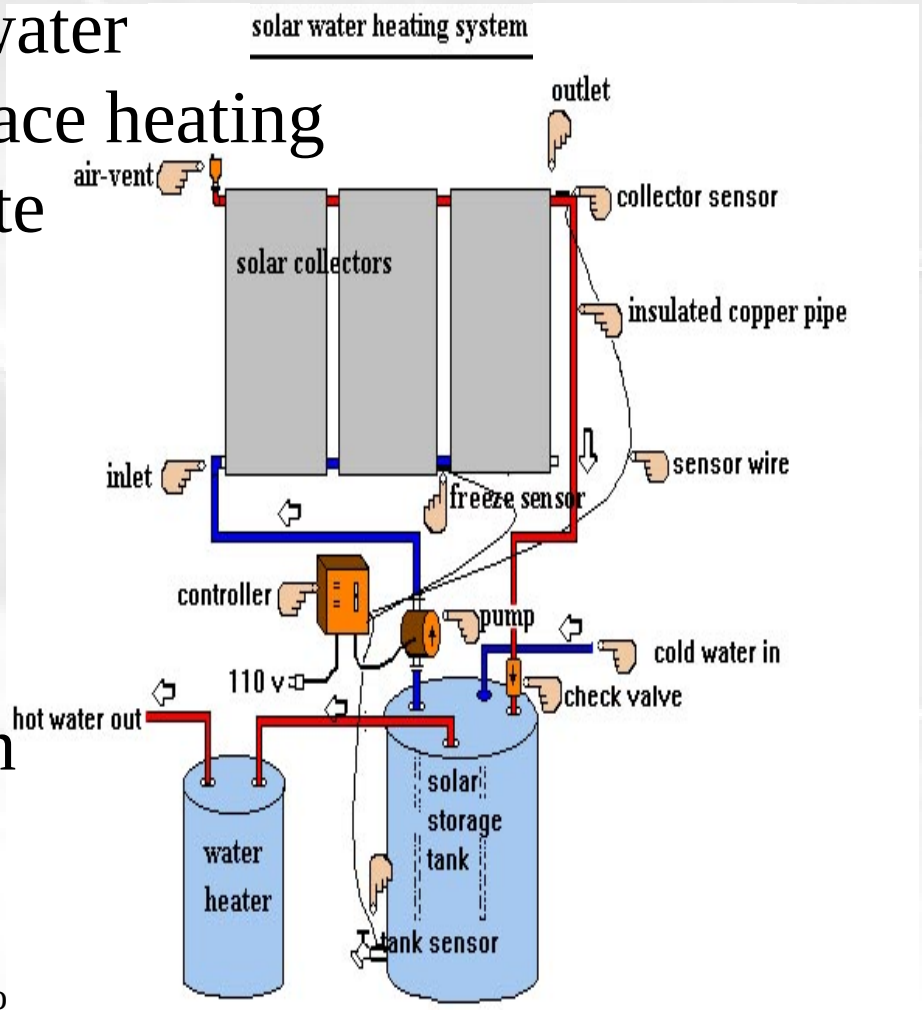
Solar Air Training at Metropolitan CC

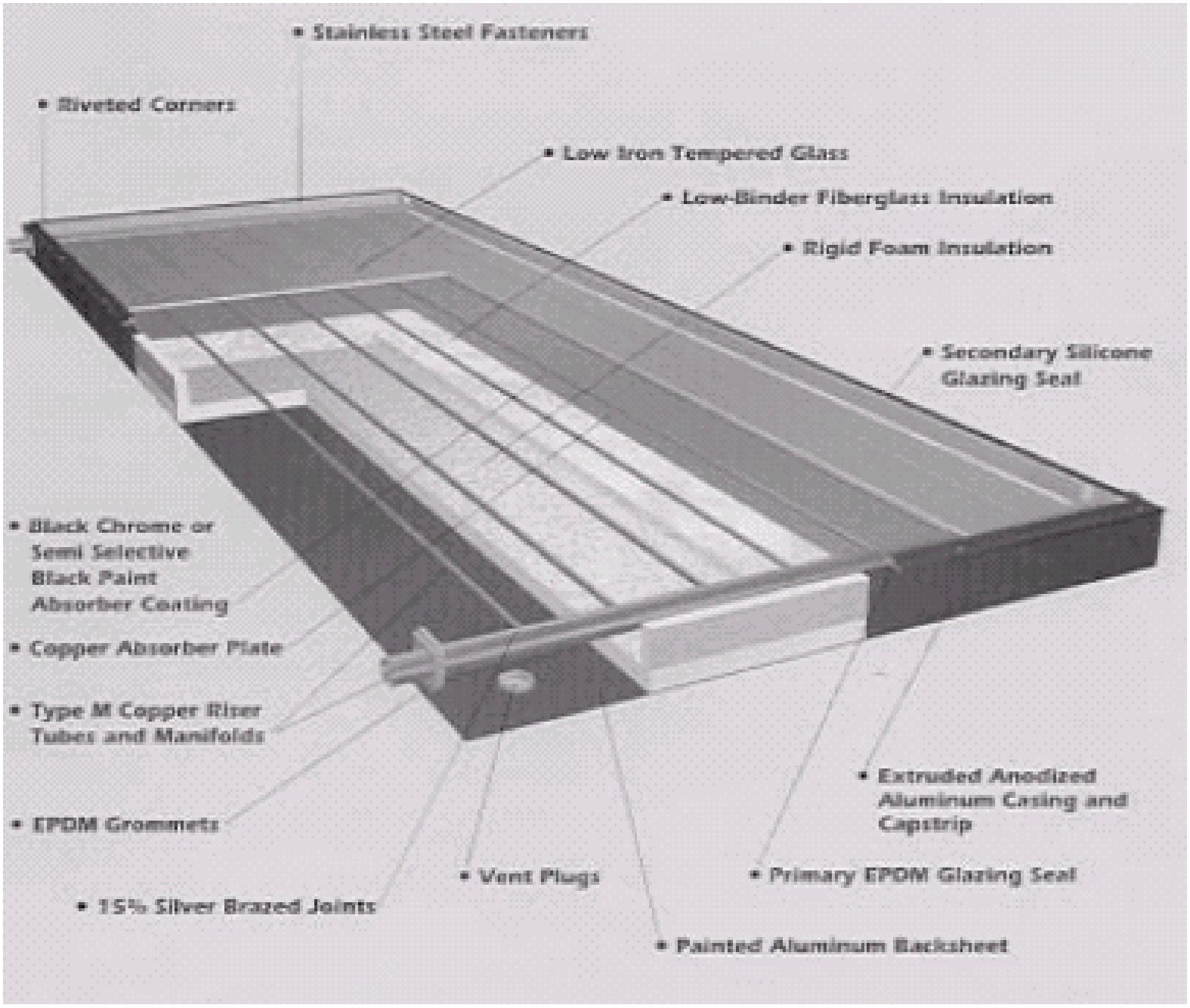
Solar air sidewall mount

Solar Hot Water Systems

Best use: domestic hot water
Secondary: storage and space heating
Cost: low to moderate

Recommendations:
Solar water “Hot Box” for ground mounts only.
Minimum of two 4’x8’ collectors with 60-80 gallon tank for closed loop or drainback systems.

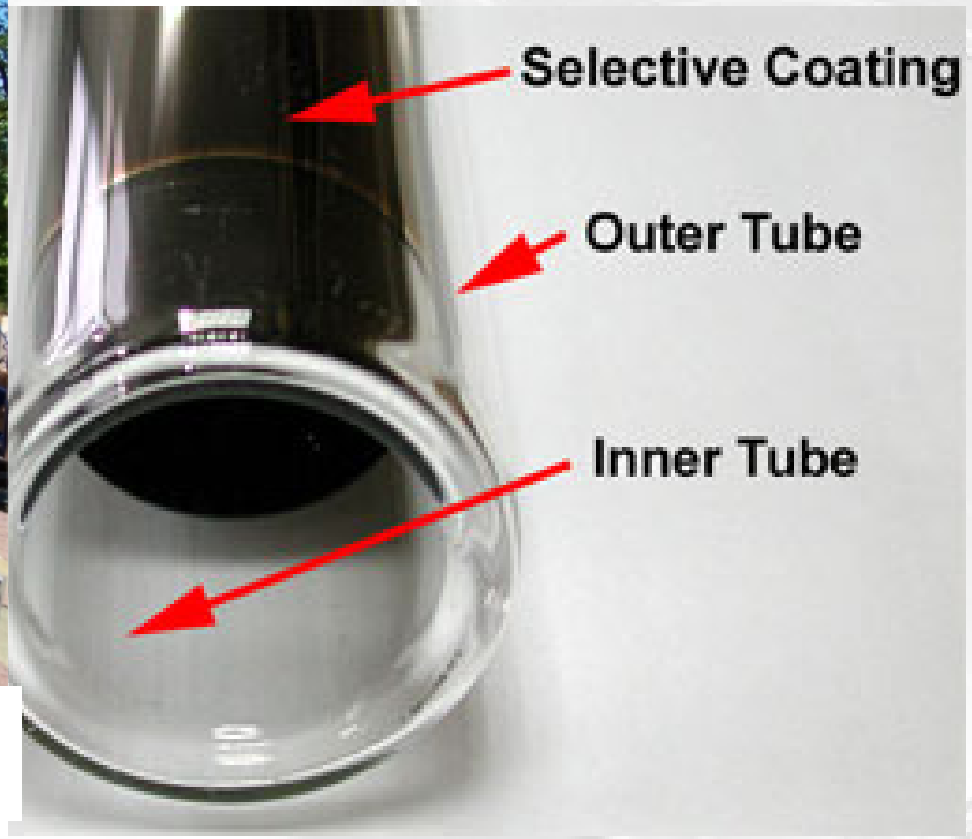



• Stainless Steel Fasteners
• Riveted Corners
• Low Iron Tempered Glass
• Low-Binder Fiberglass Insulation
• Rigid Foam Insulation
• Secondary Silicone Glazing Seal
• Black Chrome or Semi Selective Black Paint Absorber Coating
• Copper Absorber Plate
• Type M Copper Riser Tubes and Manifolds
• EPDM Grommets
• 15% Silver Brazed Joints
• Vent Plugs
• Painted Aluminum Backsheet
• Primary EPDM Glazing Seal
• Extruded Anodized Aluminum Casing and Capstrip

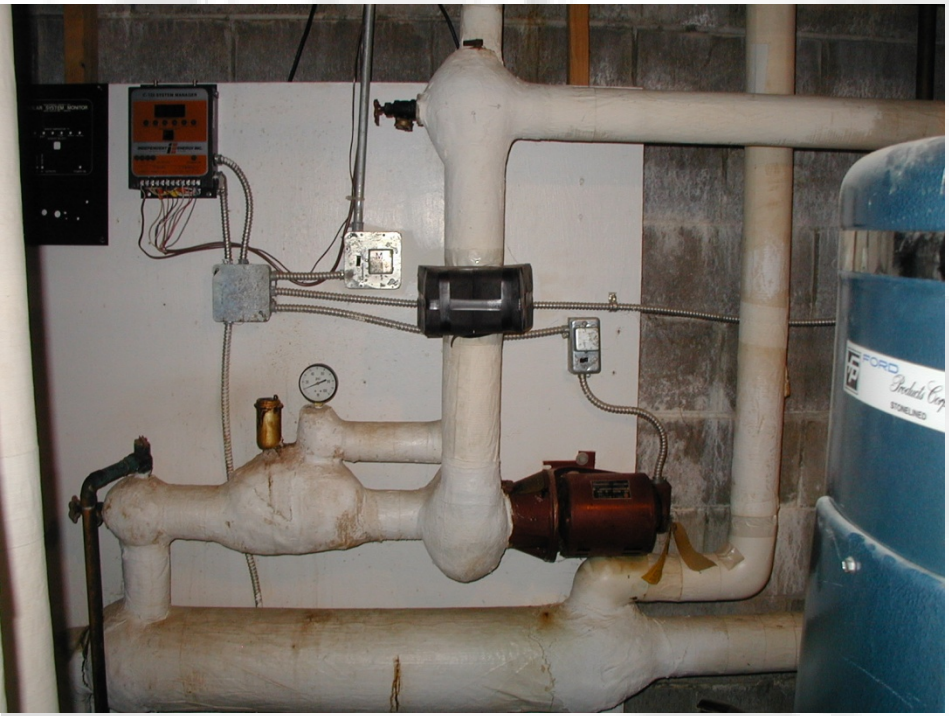
Solar Hot Water – Flat Plate vs. ETs

Higher Temperature, but drawbacks.

Evacuated Tubes



Solar Hot Water & Storage System



Inspecting a 100 collector solar heating system

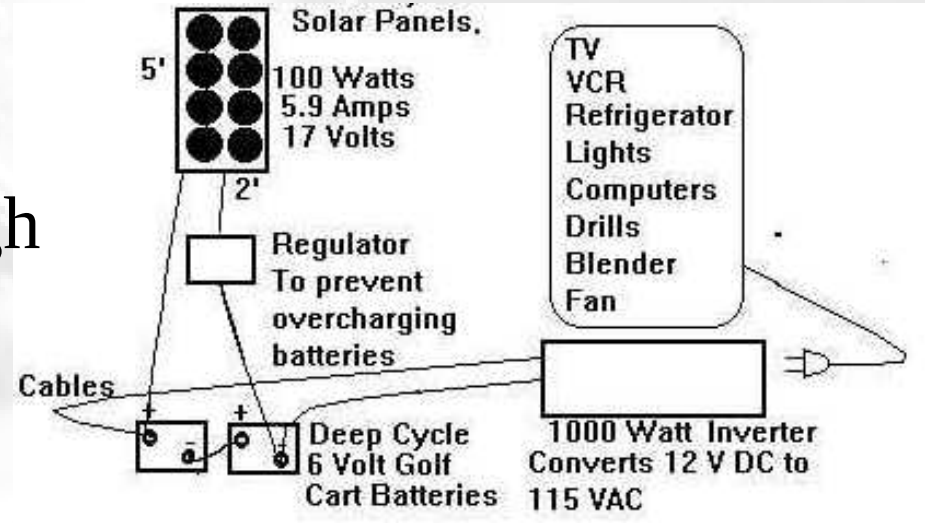
Electric, www.solaromania.com

Solar Electric Systems

Best use: lighting, electronics, remote applications, back-up power

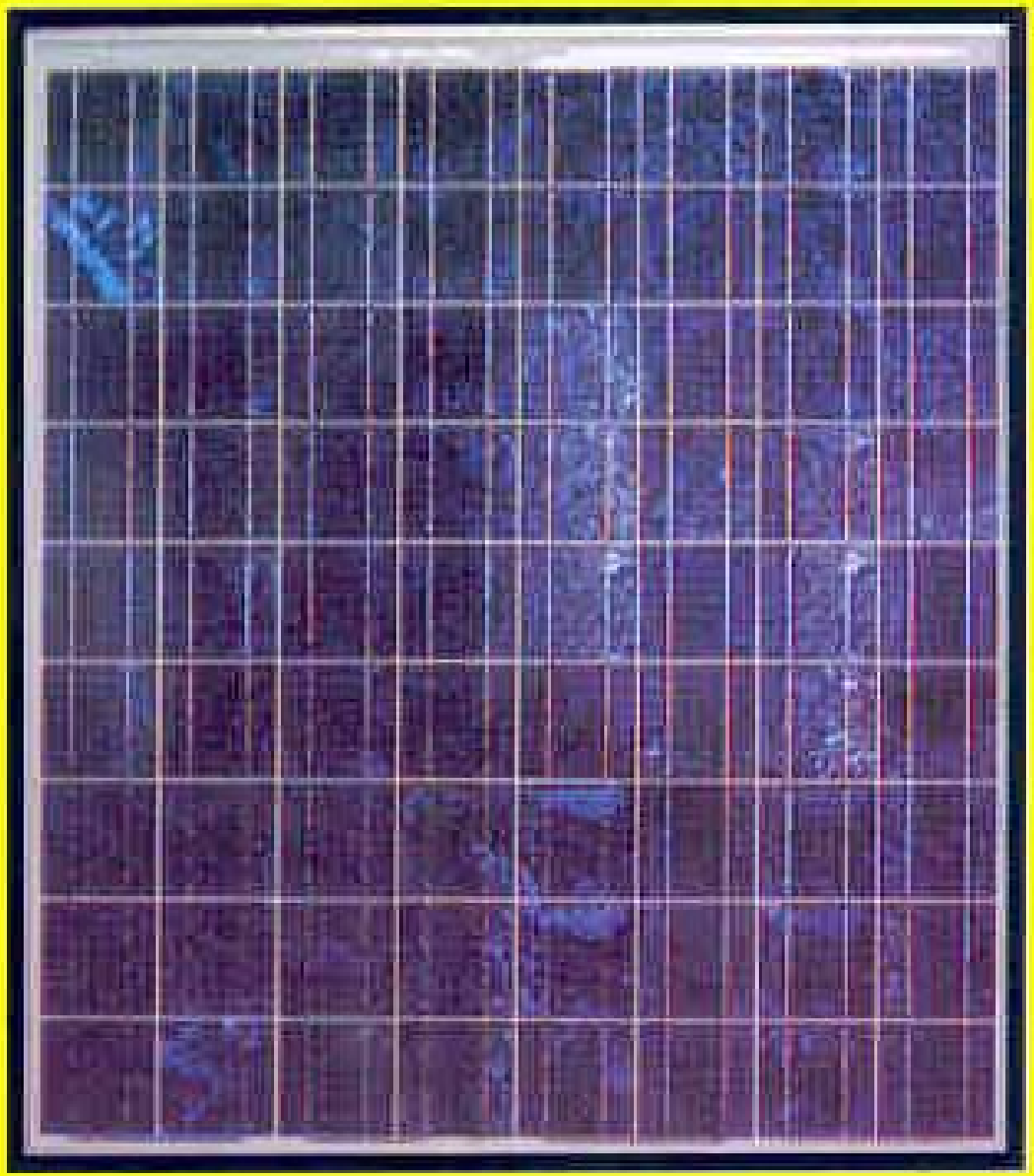
Secondary: stand alone or utility intertie

Cost: moderate to high



Recommendations:

Excellent for running other solar components (controller and either blower or pump). Very good for remote lighting and water pumping if power is cost prohibitive.



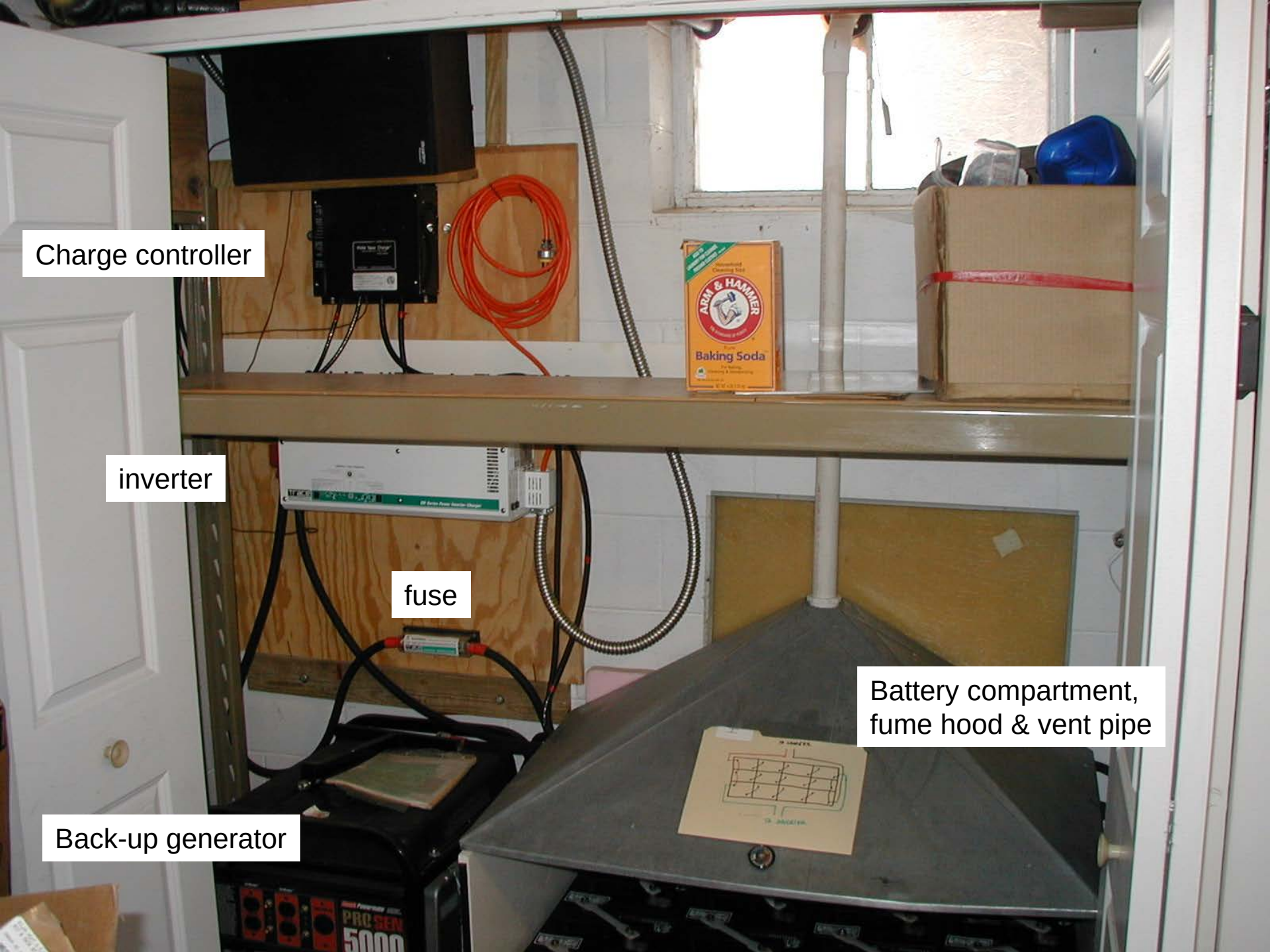
Three types of PV;

-mono silicon
  -black, 20%

-poly silicon (left)
  -bluish, 15%

-thin film
  -dark blue, 8%

Residential Solar Electric System


Charge controller
inverter
fuse
Battery compartment, fume hood & vent pipe
Back-up generator
ARM & HAMMER
Baking Soda
PRO SERIES
5000

A 4.8 KW grid tied solar electric system

Dish Sterling – 25kW

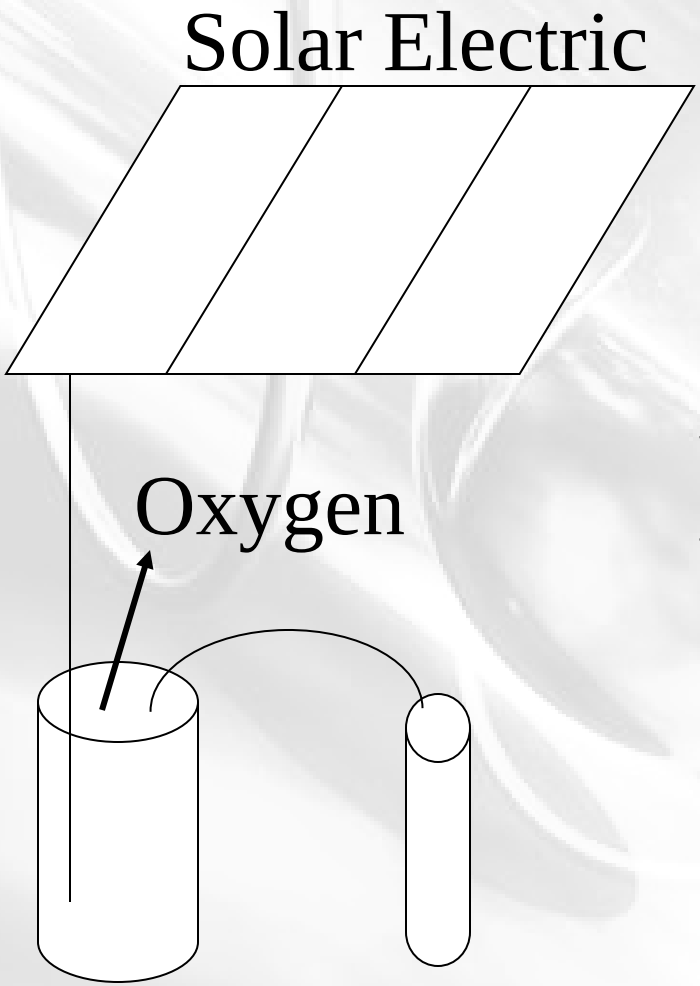
Solar One – Barstow, CA - 1981

Super heated steam – 3000 F – 10kW

Solar Tower – EnviroMission - Australia

1600’ tall, 260’ diameter, 200 MW

Example of Distributed Energy



"The Hydrogen Economy"
Produced at point of use
Requires water and sun
Clean, no waste and safe
Starts and ends with water

Water → Hydrogen for car

The “Grand Plan” for Solar in Nebraska

Move toward a renewable economy with investment incentives for residential, commercial and non-profits

Accelerate local adoption with;
-training the trades through community colleges
- buying incentives to increase demand (credits, property and sales tax exemptions)
-leverage Public Power with bulk buying and economic development strategies

Economic Impact of Solar

Renewables Multiplier Effect …

Investment in a renewable industry has an economic multiplier of eight to eleven times in the local economy.

Imagine what this could do if we transitioned from just one coal plant in Nebraska.

What Should Nebraska do about Energy?

<u>Nebraska imports 89% of its energy!!!</u>

1. Coordinated energy strategy – Business / Govt
2. Build on our resources
   - ❖ Water – more hydro power
   - ❖ Wind – accommodate private investment
   - ❖ Solar – tax credits, incentives, education
   - ❖ Ethanol – move to switchgrass
   - ❖ Innovation – manufacturing incentives
3. Inculcate a cultural sense of energy leadership … awareness, legislation, investment

Future Trends

- Continued development of large scale, expensive and centralized systems – requires re-alignment of incentives
- Increasing development of smaller scale, mixed investment and distributed systems using renewable technologies
- Power management increases in importance because grid must be finely tuned

Solar and Renewable Energies

Thank you

for your
time and consideration.

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