Greenhouse energy management

Environmental Management

Energy Efficiency
leads to
Lower
monthly bills
and a
Lower
carbon footprint

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Overview

- Background for the study.
- Controlled environment.
- Greenhouse and energy.
- Renewable energy.
- Energy management.
- Practical tips.
- Conclusion.
- Short video.

Background for the study

- What is a transparent agriculture structure which create a ideal environment for plant production, with a heat problem?

Background for the study

Greenhouse also called a controlled environment:

The term “controlled environment” refers to the greenhouse structure which creates a protective and ideal environment for the horticultural crop at a specific time to grow optimally within predetermined parameters. (Boodley & Newman, 2009:38).

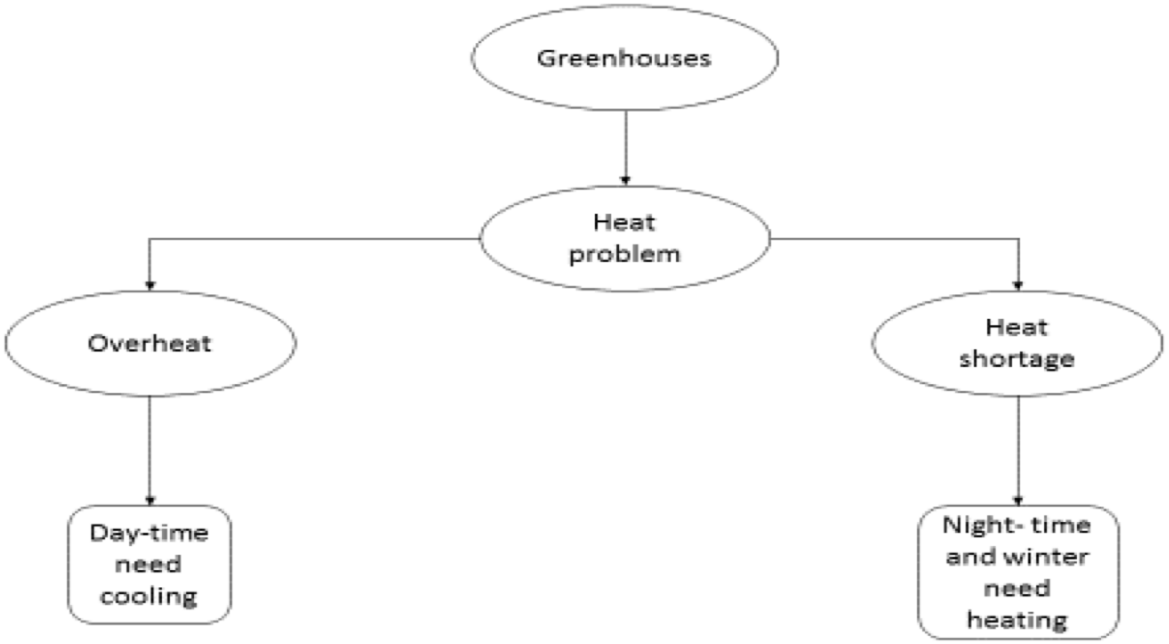
Controlled environment

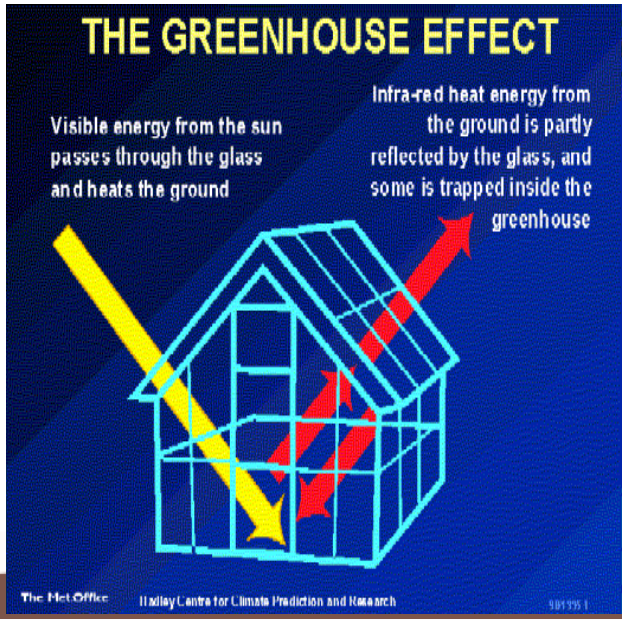
- The reason for having a greenhouse is to balance in growth factors light, temperature, relative humidity ,water ,fertilizers and Co_2(Sethi,Sharma,2008:82)
- All plant growth factors can be controlled and maintained at optimum level year around.
- Greenhouses leads to higher production yield compare to free land cultivation.

Controlled environment

- Greenhouse = heat problems = balancing act

Conundrum for greenhouses

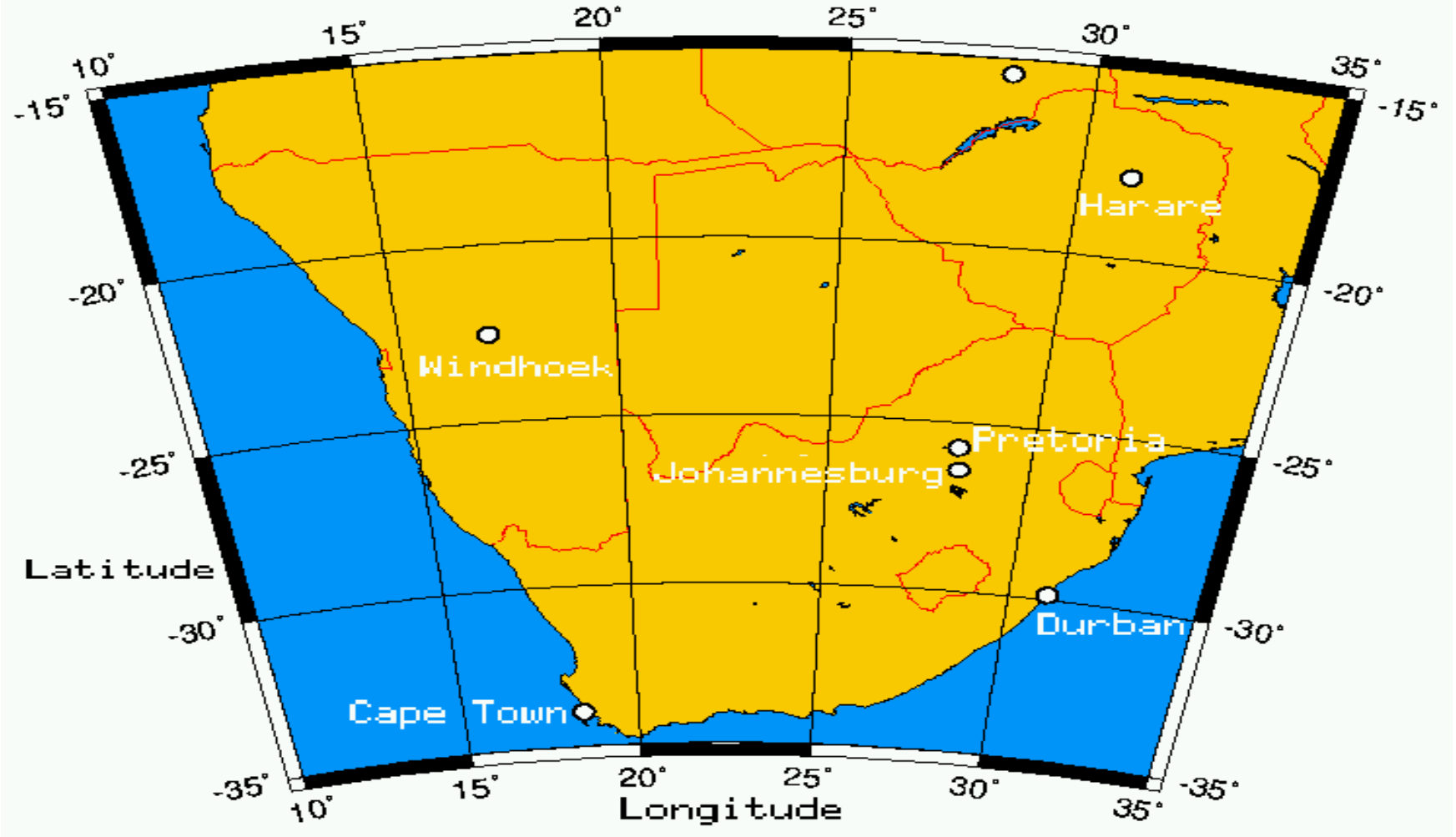




Controlled environment

- The location of the greenhouse has an influence on the running cost. Greenhouse located below 30th degree latitude experience increase in cooling cost while greenhouses above 40th degree latitude experience an increase in heating cost (Canakci et al., 2013).

Controlled environment



Controlled environment

A greenhouse needs to cool down in day.

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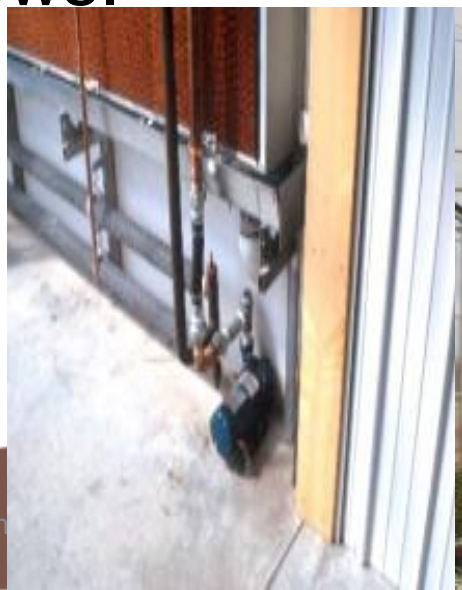
Seasonal

- Summer
  - High temps inside
  - High temps outside
- Winter
  - High temps inside
  - Low temps outside

Cooling:

- Turn the fans.
- Run wet-wall pump.
- Open side and roof windows.
- Open and close screens.
- Vertical ventilation.



Controlled environment

A greenhouse needs heat up at night specially in winter .

Heating:

- Coal boilers (water heating).
- Gas heaters (air heating) .
- Electrical, diesel and paraffin heaters.
- Up to 80% of total energy demand.

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Why Heat

- Off-season production
- Supplement solar gain
- Compensate for heat loss

Greenhouses and energy

- Greenhouses has the ability to produce better quality plants and to increase the plant production.
- Greenhouses create the opportunity to cultivate out of season green products.
- Greenhouses is high energy consumers.
- Greenhouse electricity needs can make up 20% of total production cost.

Greenhouses and energy

Electrical energy is needed for:

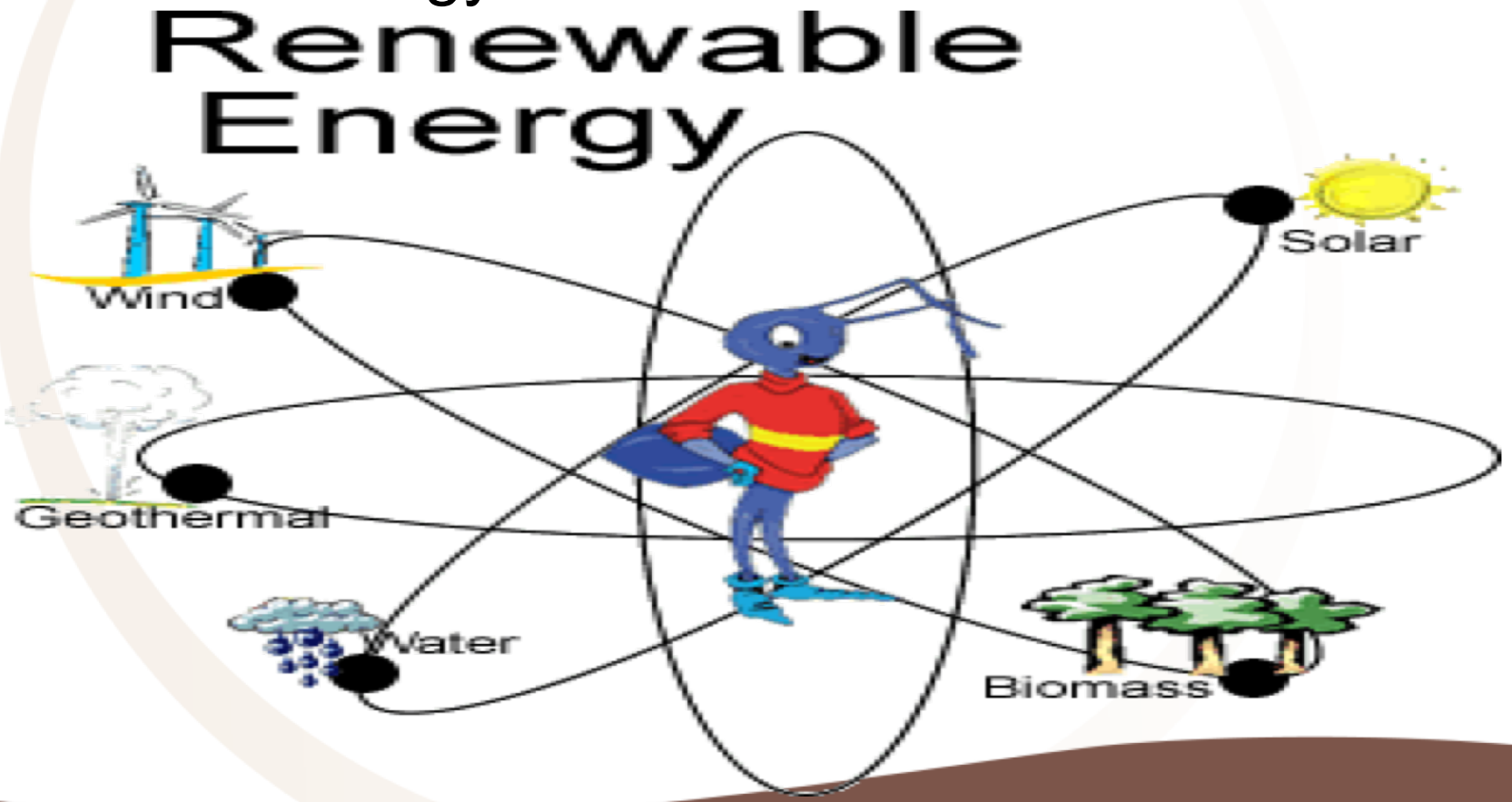
- Lights.
- Ventilation fans.
- Movable screens.
- Window motors.
- Pumps at wet-wall and irrigation.
- Heating.
- Control systems.

Greenhouses and energy

- Over 90% of this energy for the green industry is supplied by the power distribution grid (Eskom). This was in the past the preferred source. Greenhouse growers need a reliable energy supply. The yearly price increase, unreliable supply of electricity results in loss of income urge the greenhouse growers to look for alternative options to satisfy their energy needs.

Energy sources

- Grid (Eskom).
- Renewable energy.



Renewable energy

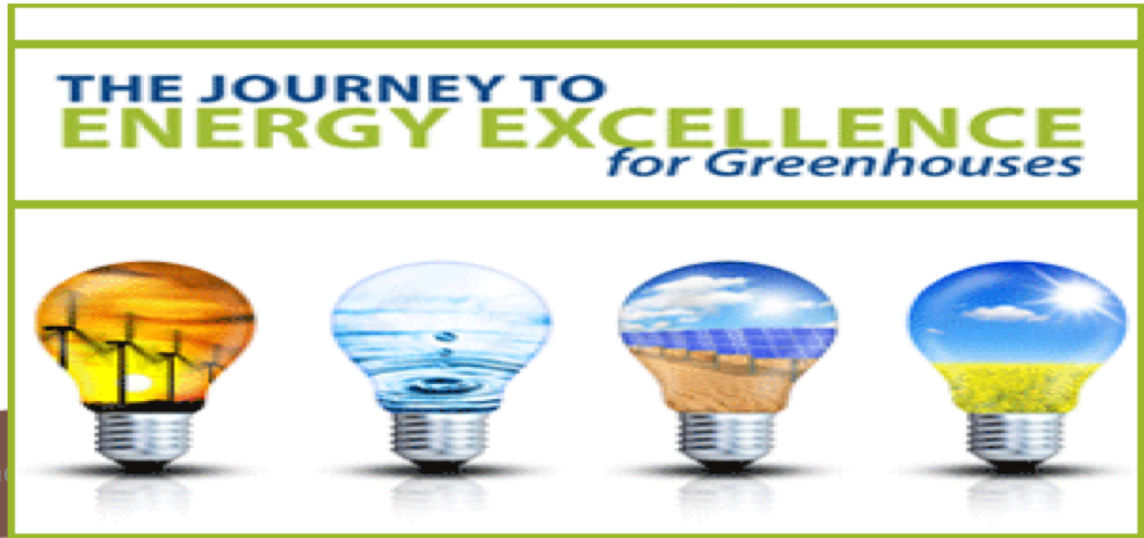
Advantages of renewable energy:

- Independent from electricity network (grid).
- Reduction of energy cost eventually(5-6years payback).
- Environmental friendly production system.
- Little or no impact on the environment.
- Use available natural resources.
- Little or no greenhouse gas emissions.

Renewable energy

Advantages of renewable energy:

- Lowering the carbon footprint of your production.
- Does not place unnecessary risk on future generations.
- It is sustainable.
- It is safe.



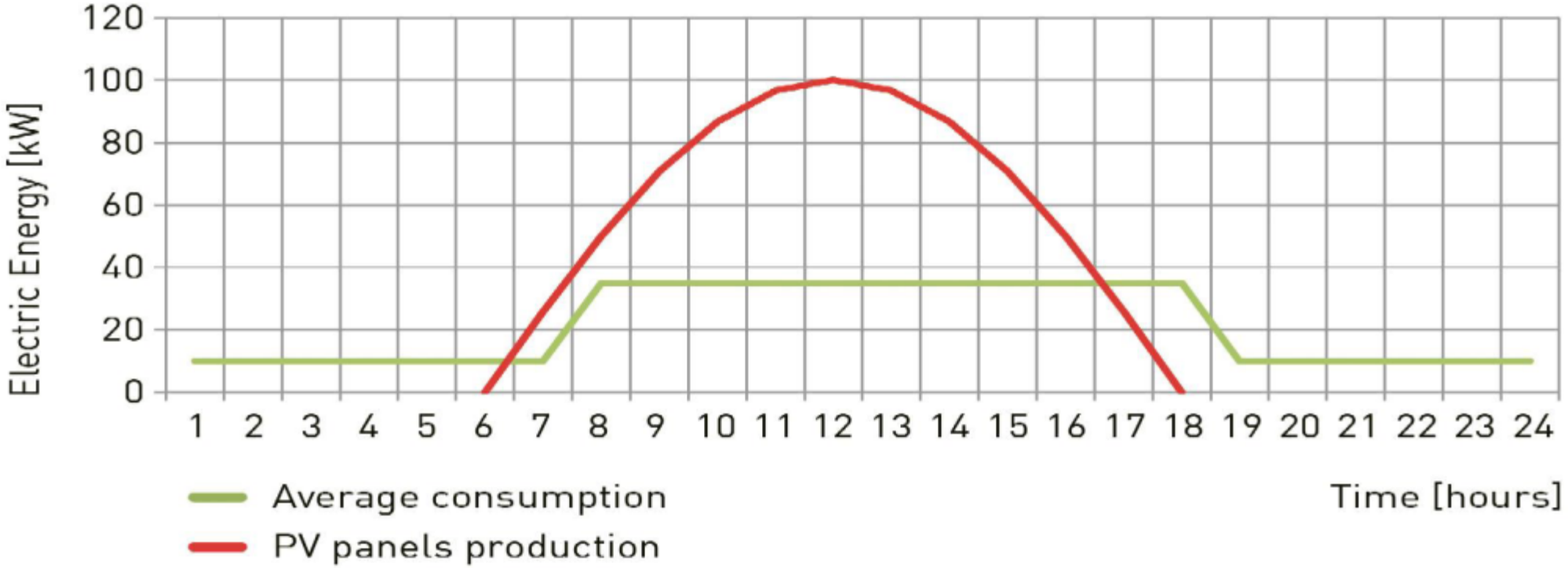
Renewable energy

Disadvantages of renewable energy:

- High capital investment is necessary (5-6 years pay back).
- Reliability of power supply is often dependent on the weather (need wind or sun).
- Good management of supply is needed.

Renewable energy

- Use solar power directly when it is available (in the day) or store for later use. (at night)



We know

- Every m² in the greenhouse counts. It is in an expensive structure we build it for one purpose and that is to make money.

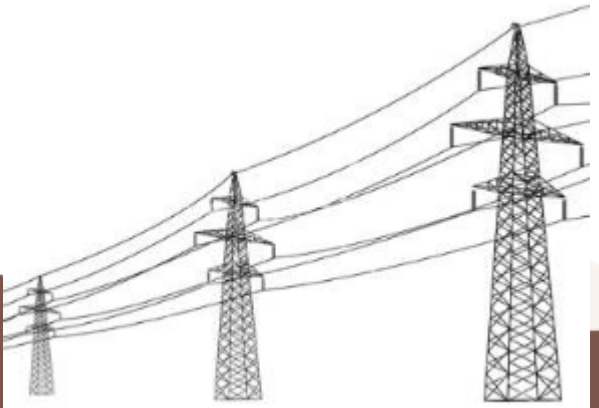
Energy management

- The size of the greenhouse m^2.
- The nature or type of the greenhouse.
- The cover material.
- What is the energy / electricity needs.(consumption)
- The energy source for the greenhouse and cost.
- Do the product in greenhouse justify the investment and running cost of systems?

Energy management

Action Plan:

- Identify the big energy users items on your farm.
- Do a tariff check.
- Upgrade equipment.
- Monitor use.



“If you don’t measure it, you can’t manage it! “

Energy management

- Complete an energy used audit.
- Establish energy use patterns.
- Valuate the products in the greenhouse.

  (Does the value of the product justify the energy use?)
- Identify energy saving opportunities.

Energy management

Use of engineering and economic principles

- Use new improved processes.

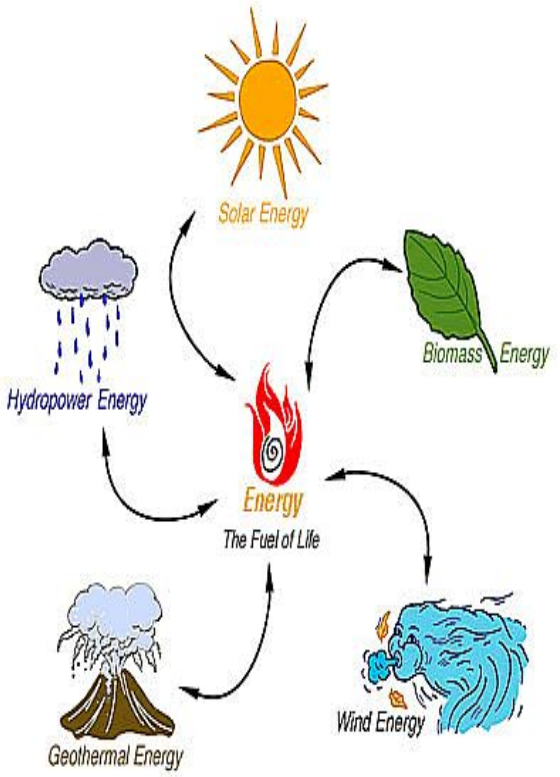
  (new equipment smaller fan motors, variable speed drive motors)

- Improvements in efficiency

  (match usage to requirements).

- Changing energy use patterns

  (If you don't need it, do not use it).



Practical energy wise tips around the greenhouse

- Isolate the greenhouse to minimize heat lose and maximise heat storage (air-tight).
- Double layer of cover material has better thermal energy storage ability.
- Extend the gutter height 6-8 meters.

(bigger air pocket more stable climate)

Practical energy wise tips around the greenhouse

- Prevent spikes in electrical use. (example were al fans start at once)
- Replace light globes with LED lights.
- Lower the production temperature.(do you really need 18°C at night)
- Shading, installation of retractable screens can save on energy use.(reduce energy use, extractor fans run less).

Practical energy wise tips around the greenhouse

- Delay opening and closing of greenhouse earlier in winter.

  (store natural afternoon heat in greenhouse)
- Solar panels (PV) for irrigation pumps.
- Starting up of boiler outside peak hours.
- Switch off, if not in use.

Conclusion

- In the past Horticulturists had to familiarise them selves with the term water wise and how to work with water shortage. It is time now to become energy wise.

- Horticultural growers using greenhouses for production are familiar with climate control, water and fertigation control. The new dimension of energy control needs to be included.

Conclusion

- The answer is in a combinations of energy supply.
- There is not one renewable energy option working alone which will meet all your greenhouse energy and electricity needs.
  (low light days, windless days).
- Be in control, flexible and make quick changes between energy options can save energy.
- Be energy wise , grow environmental friendly, and reduce your carbon footprint.

Short Video

Energy Efficiency
leads to
Lower
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Thank you

Learn without limits.

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