

Energy Services: Back to Basics and Up to Hybrids

Antoine Guichard¹, Peter Magill², Chris Paterson² and Guy Williams¹

1- Latitude Technologies, Hobart, Tasmania, Australia - www.latitude.aq

2- Australian Antarctic Division, Kingston, Tasmania, Australia - www.antdiv.gov.au

OBJECTIVES

- Review basics to clarify guiding principles
- Provide qualitative examples of system options
- Clarify the reasons behind current development of Energy Management Systems at Au & Fr Stations
- Provide background for other papers presented today

SCOPE

- Fixed station energy supply networks
- Electrical and thermal mix
- Fossil fuel based systems
- Hybrid systems fossil - renewable

- No significant add-on storage
- No standalone renewable system

ENERGY SERVICES

- Heating services (primary function is to deliver heat)
eg. space heating; water heating; oven
 - inherent inertia or buffer storage capacity
 - can be fed with heat and/or electricity
- Non-heating services
eg. lighting; operation of pumps, computers, comms
 - no inertia
 - can only be fed with electricity

ENERGY CARRIERS

- Thermal Carrier
Heating Hot Water (HHW) pipe network
 - inherent inertia or buffer storage capacity
- Electrical Carrier
Electrical cable network or ‘grid’
 - no inertia

ENERGY PRODUCTION

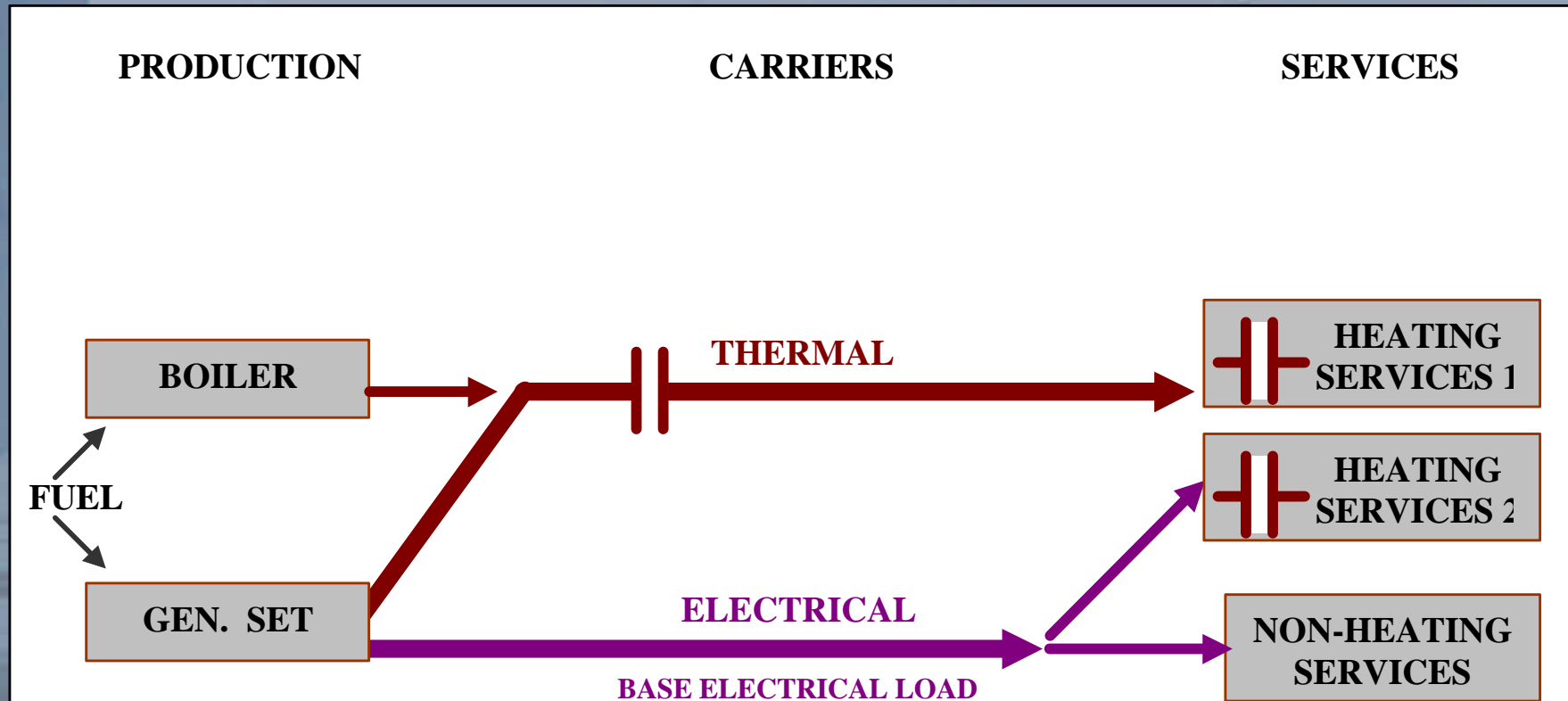
FOSSIL FUELS

- Generator Set - to run in specified load range
Produces electricity on demand and heat as by-product
 - 37% Electrical efficiency
 - 42% Thermal efficiency
 - ie 79% Cogeneration efficiency
- Boiler - inertia of thermal carrier allows on/off operation
Produces heat on demand
 - 80% Thermal efficiency

GUIDING PRINCIPLES

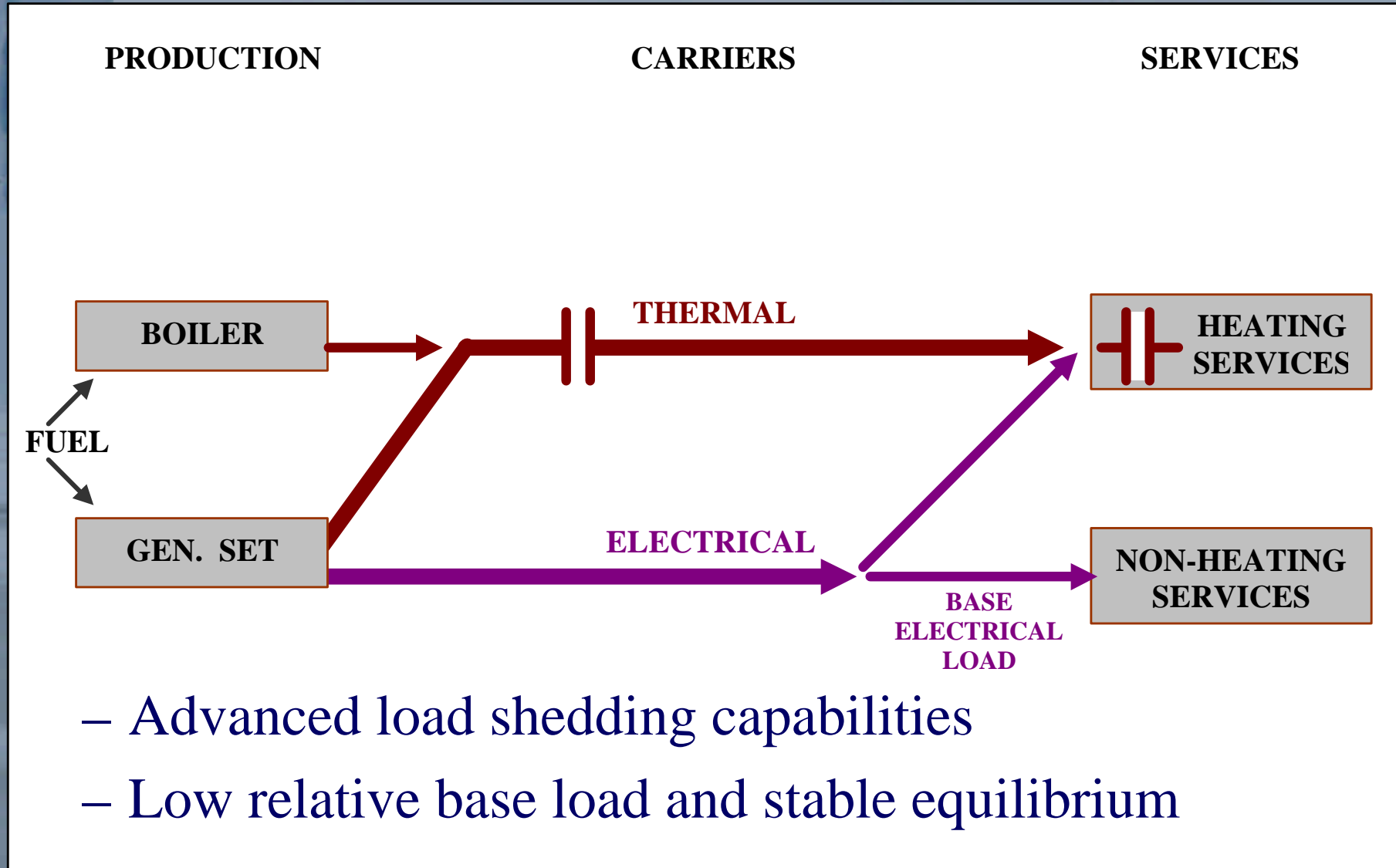
- Electrical load stable and within optimal load range of generator set
 - adequate sizing of generator
 - management of the electrical load
- Heat recovery on generator set not exceeding heat demand
 - minimise load on generator set

FOSSIL - BASIC OPTION



- Limited load shedding capabilities
- High relative base load and potential heat excess

FOSSIL - ADVANCED OPTION



ENERGY PRODUCTION RENEWABLES

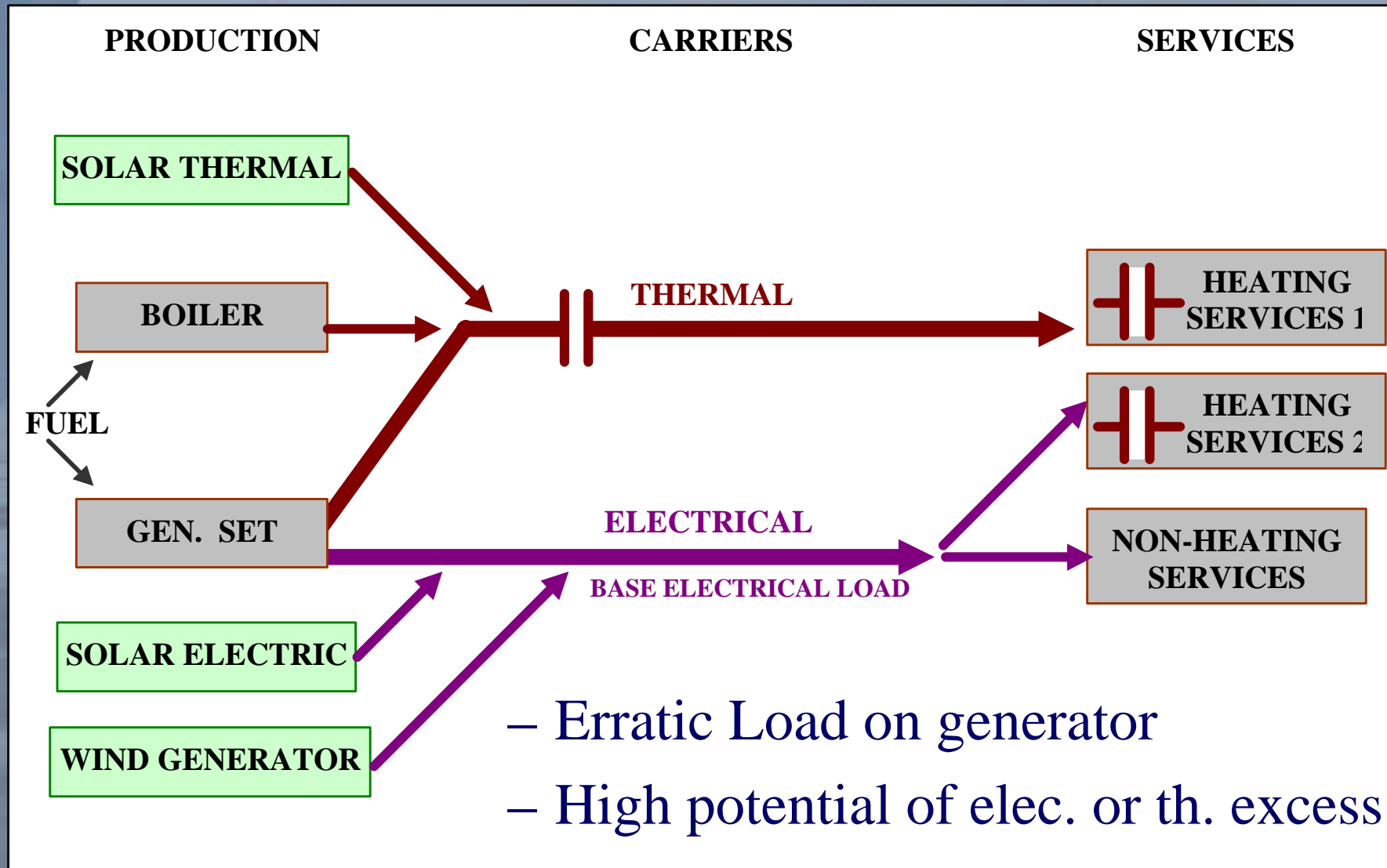
- Wind generator: electricity
- Solar electrical (eg. Photovoltaics): electricity
- Solar Thermal (eg. SHW): heat

GUIDING PRINCIPLES

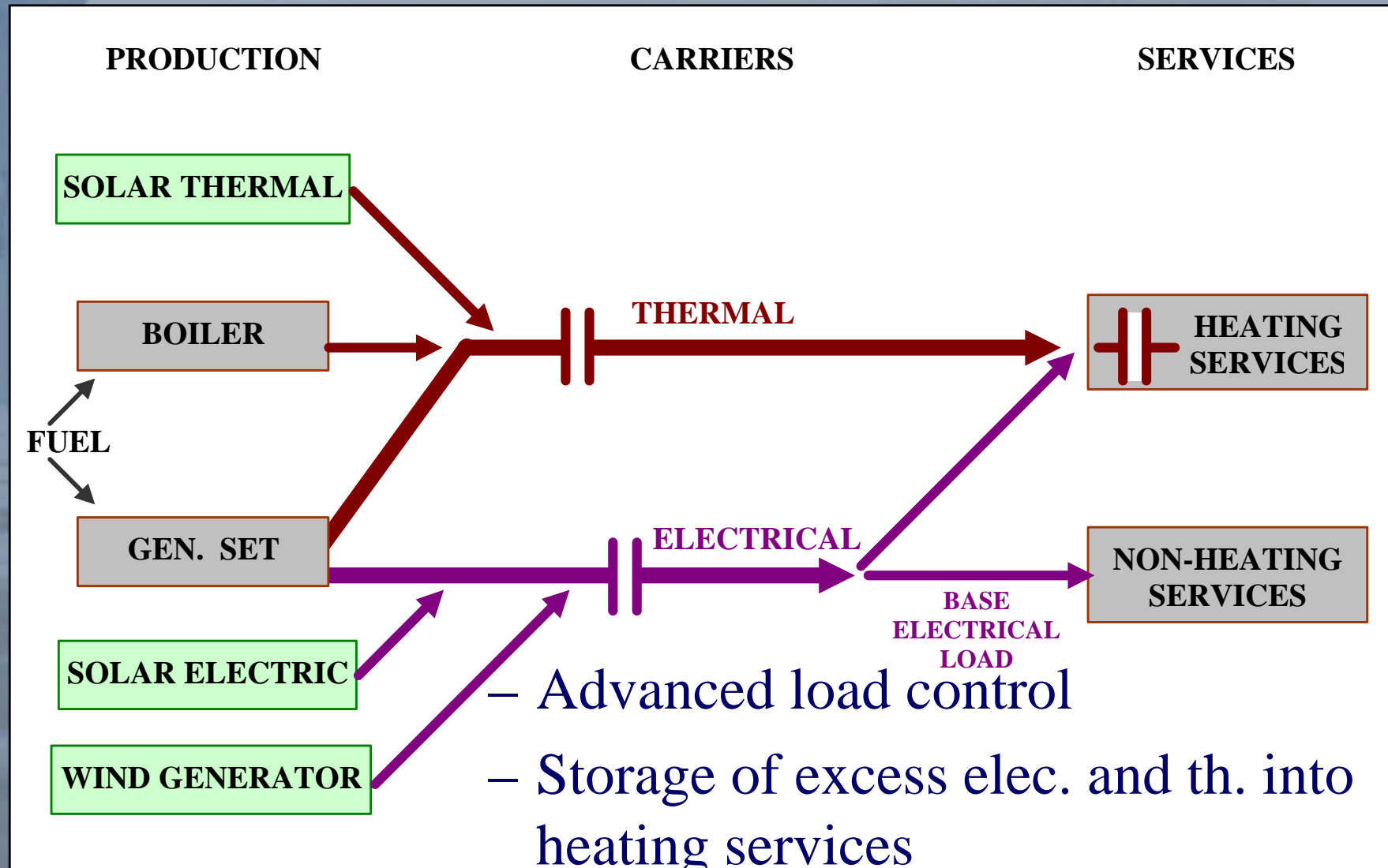
- Minimise waste of renewable production

The resource may be free but harnessing it is not free
waste = higher production costs per unit used

HYBRID - BASIC OPTION



FOSSIL - ADVANCED OPTION



CONCLUSIONS

Advanced Energy Management Systems controlling a large number of heating services

- fed with either heat or electricity
- with significant thermal inertia

Can provide the means of

- optimising the efficiency of fossil based systems
- allowing a large penetration of renewable energy with little waste of excess power and a limited need for add-on storage media

CONCLUSIONS

But advanced energy management systems require a clear, thorough understanding of the energy supply network and the establishment of detailed operating rules