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*We empower people*

# Climate Change in South Africa

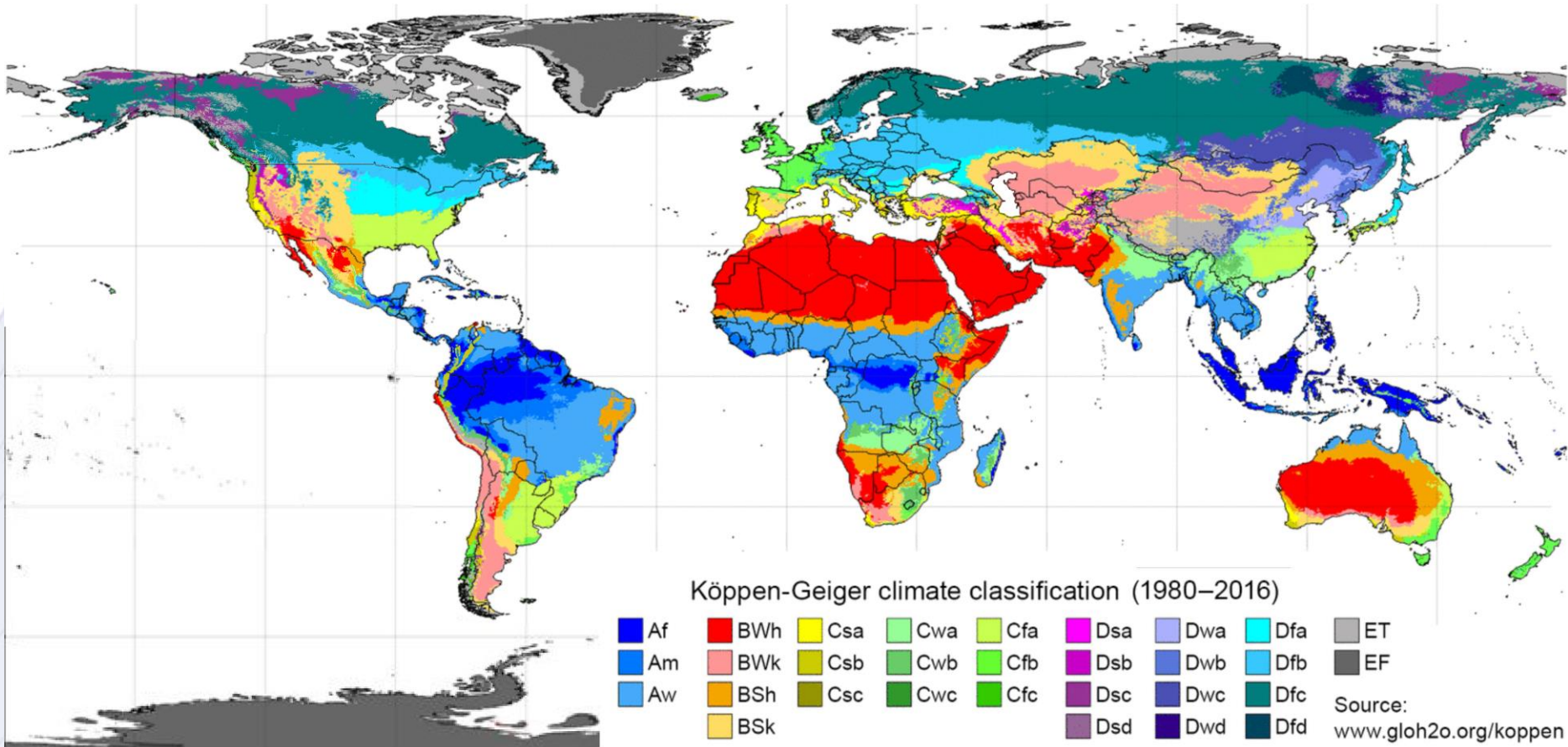
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Zhongjie Huan

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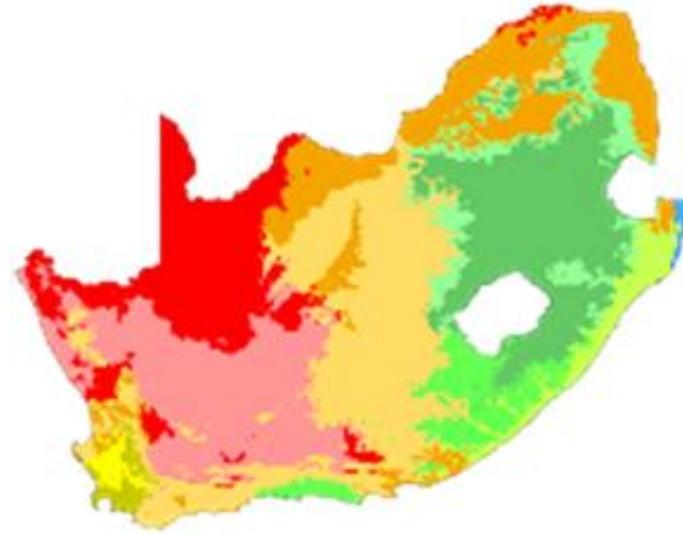




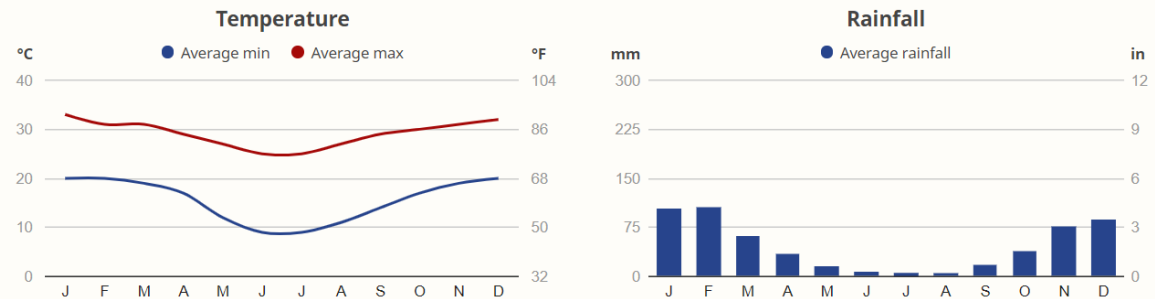


### Average temperatures (°C) in South Africa<sup>[1]</sup>

City	Summer (January)		Winter (July)	
	Max	Min	Max	Min
Bloemfontein	31	15	17	-2
Cape Town	26	16	18	7
Durban	28	21	23	11
East London	26	18	21	10
George	25	15	19	7
Johannesburg	26	15	20	4
Kimberley	33	18	19	3
Mthatha	27	16	21	4
Musina	34	21	25	7
Nelspruit	29	19	23	6
Pietermaritzburg	28	18	23	3
Polokwane	28	17	20	4
Port Elizabeth	25	18	20	9
Pretoria	29	18	24	5
Richards Bay	29	21	23	12
Skukuza	33	21	26	6
Thohoyandou	31	20	24	10
Upington	36	20	21	4



Climate Chart Kruger National Park - 140-783m / 459-2,569ft



\* Averages based on 50 years of monthly climate data, taken from 1km<sup>2</sup> (0.39mi<sup>2</sup>) interpolated climate surfaces.

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# Water crisis in Cape Town

- In January 2018, officials in Cape Town announced that the city of 4 million people was three months away from running out of municipal water.
- April 12, 2018, was to be the date of the largest drought-induced municipal water failure in modern history.



Sand blows across a normally submerged area at Theewaterskloof Dam near Cape Town, January 20, 2018. (Mike Hutchings/Reuters)





# Dry and flooding 2019-2020

- Feb- Aug 2019: no rain
- Recent 2 months: flooding



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high alert amid heavy rains  
ewn.co.za



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Gauteng Weather (@tW...  
twitter.com



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flooding | The South African  
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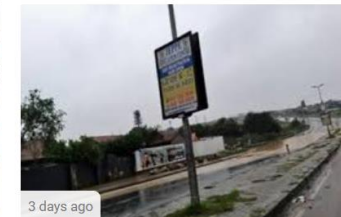
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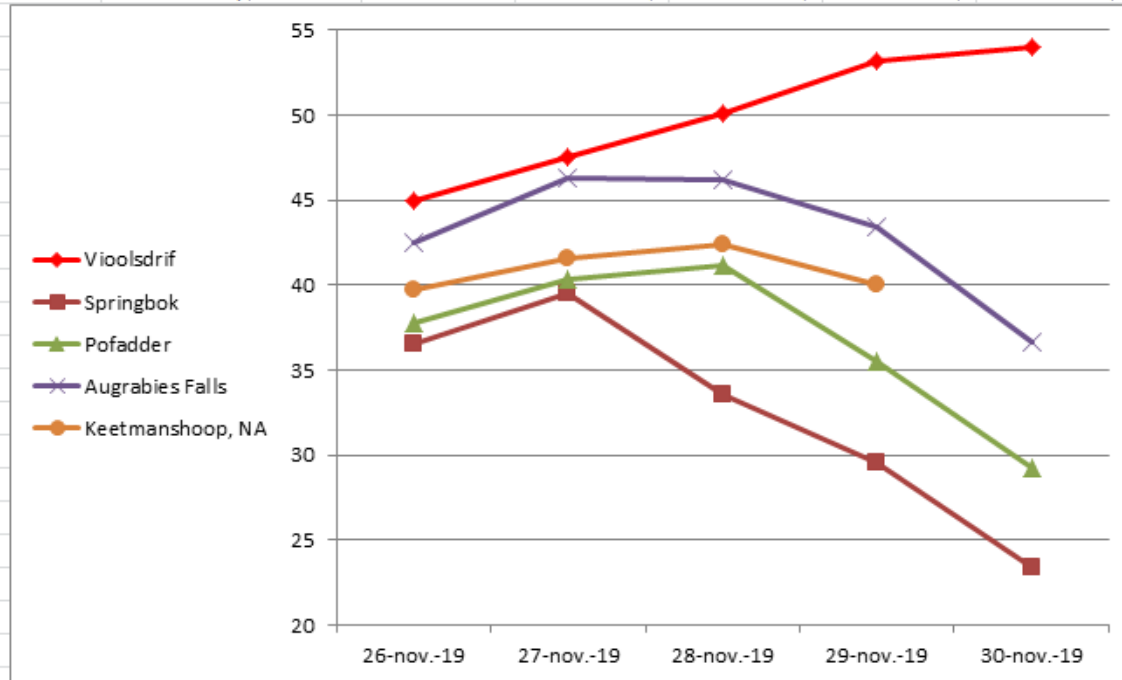




# Extreme weather

**Maximum temperatures (°C) in the Vioolsdrif area from 26 to 30 Nov 2019**

Longitude (°)	altitude (m)	station	26-nov-19	27-nov-19	28-nov-19	29-nov-19	30-nov-19
17,62	174	Vioolsdrif	45	47,5	50,1	53,2	54
17,87	1006	Springbok	36,5	39,5	33,6	29,6	23,4
19,38	989	Pofadder	37,8	40,3	41,2	35,5	29,3
18,12	1067	Keetmanshoop, NA	39,7	41,6	42,4	40	
20,35	635	Augrabies Falls	42,5	46,3	46,2	43,4	36,6
17,87	1100	Mariental/Hardap, NA	41	42,5	41,3	41,9	39,7

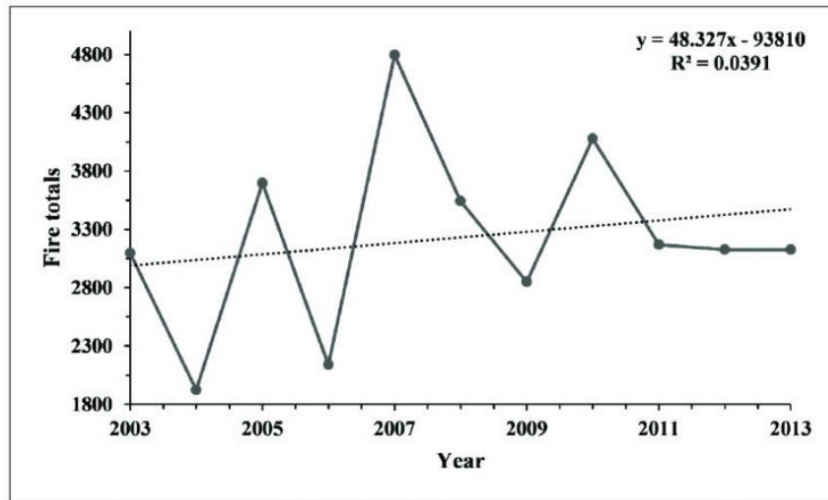


**Vioolsdrif claimed SA's hottest day at 54°C on 30 November 2019**

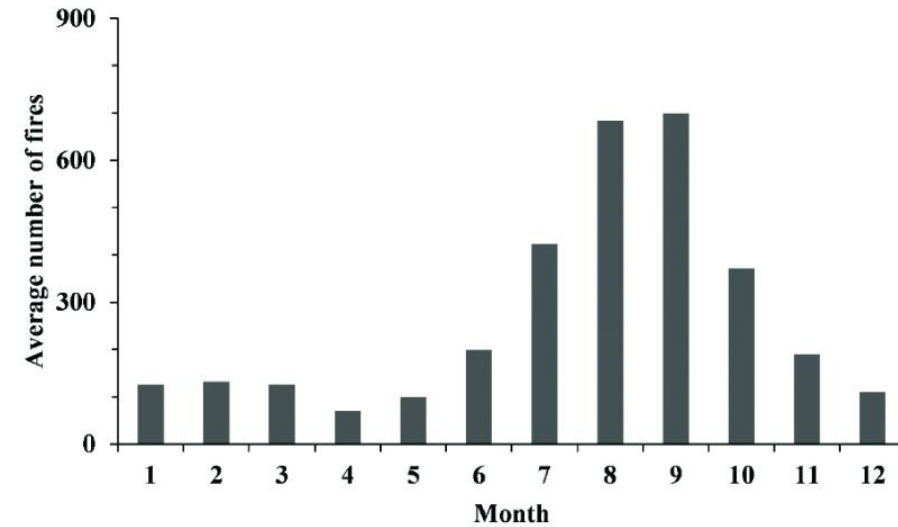




# Fire



*Annual fire totals for South Africa.*



*Monthly fire averages between 2003 and 2013 for South Africa.*





# General observation

- **Storm:** South Africa has 3,079 km of coastline. Coastal areas of South Africa, particularly the Cape Peninsula, have been impacted by heavy waves and storm surge during violent coastal storms. However, such events have not been severe enough to limit development and trends have not been increasing.
- **Sea level:** Regarding sea level rise, significant increases beyond global average have not been observed
- **Drought:** A drying trend has been observed for western portions of the country and surrounding region during the second half of the century. It has been shown that severe summer drought in South Africa tends to occur under El Niño conditions
- **Rainfall:** Although the significant change of average rainfall is not observed, there is a tendency towards an increase in rainfall extreme events and a significant in the number of rain days
- Maximum and minimum temperatures all show significant increases with few exceptions, high temperature extremes have increased significantly in frequency, and low temperature extremes have decreased significantly in frequency. Across the country, mean annual temperatures have increased at least 1.5 times the observed global average increase of 0.65°C during the last 50 years [LTAS].







# Load Shedding

## Municipal Loadshedding Schedules

How to read/understand the schedules.

Example: Municipality = Naledi, Town = Wepener

Static monthly version . This schedule would apply each month. For 30 day month just drop day 31 and for Feb drop days 29 to 31.

Day of the month		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	00:00 - 02:30	7								1	2	3	4			6	7	8	5							4	1	2	3			5	6
	02:00 - 04:30					1	2	3	4	5	6	7	8										4	1	2	3	8	5	6	7			
Province	04:00 - 06:30	1	2	3	4	5	6	7	8										4	1	2	3	8	5	6	7							
Free State	06:00 - 08:30	5	6	7	8										4	1	2	3	8	5	6	7								3	4	1	
City/Munic	08:00 - 10:30									4	1	2	3	8	5	6	7										3	4	1	2	7	8	5
Naledi	10:00 - 12:30					4	1	2	3	8	5	6	7										3	4	1	2	7	8	5	6			
Suburb/Town	12:00 - 14:30	4	1	2	3	8	5	6	7										3	4	1	2	7	8	5	6							
Wepener	14:00 - 16:30	8	5	6	7										3	4	1	2	7	8	5	6								2	3	4	
	16:00 - 18:30									3	4	1	2	7	8	5	6										2	3	4	1	6	7	8
	18:00 - 20:30					3	4	1	2	7	8	5	6										2	3	4	1	6	7	8	5			
	20:00 - 22:30	3	4	1	2	7	8	5	6										2	3	4	1	6	7	8	5							
	22:00 - 00:30	7	8	5	6										2	3	4	1	6	7	8	5								1	2	3	

Please note that all shaded areas will be times when the power will be off. Schedules are cumulative, i.e. stage 3 will include the times as scheduled for the preceding stages 1 and 2.

**Stage 1**, this would mean he/she would be shed from 01:00 - 03:30

**Stage 2**, this would mean he/she would be shed from 01:00 - 03:30

**Stage 3**, this would mean he/she would be shed from 01:00 - 03:30 AND 17:00 - 19:30

**Stage 4**, this would mean he/she would be shed from 01:00 - 03:30 AND 09:00 - 11:30 AND 17:00 - 19:30

**Stage 5**, this would mean he/she would be shed from 01:00 - **05:30** AND 09:00 - 11:30 AND 17:00 - 19:30

**Stage 6**, this would mean he/she would be shed from 01:00 - **05:30** AND 09:00 - 11:30 AND 17:00 - 19:30

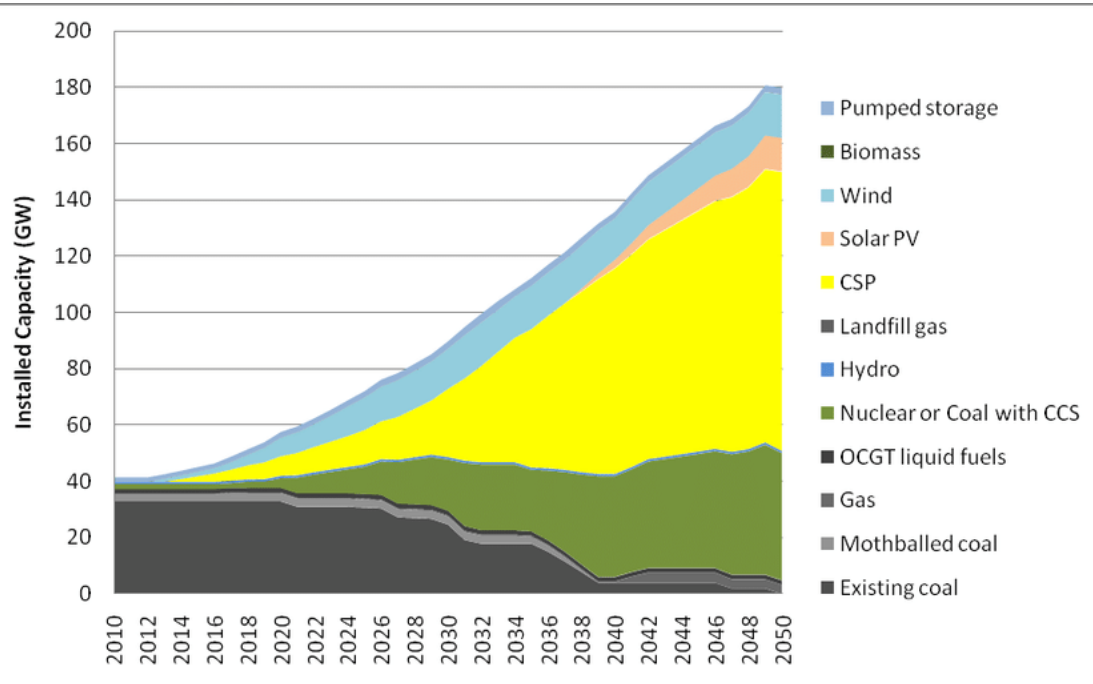
**Stage 7**, this would mean he/she would be shed from 01:00 - **05:30** AND 09:00 - 11:30 AND 17:00 - **21:30**

**Stage 8**, this would mean he/she would be shed from 01:00 - **05:30** AND 09:00 - 13:30 AND 17:00 - **21:30**





# ESKOM – Sole supplier



- Eskom provides ~90% of South Africa electricity
- 45% of Africa electricity
- 30 Power stations with a nominal generating capacity of ~45 GW
- Coal fired power stations: 77%
- 85% access to electricity
  - 90% urban access
  - 77% rural access
- Power generation efficiency: 30-35%





South Africa is advancing to a greener economic path, and a number of policies are introduced create a culture of energy efficiency (EE) and renewable energy (RE) in society to promote technologies:

- NDP2030: National Development Plan 2030
- NGP Framework: The New Growth Path framework
- NGP Accord 4
- National Climate Change Response White Paper,
- White paper on the energy policy,
- NEES,
- NSSD: National Strategy for Sustainable Development
- NATMAP): National Transport Master Plan,
- Carbon Tax Policy Paper
- .....





- Refrigeration creates greenhouse gases both because of the energy used to operate the equipment and because of the inherent global warming potential (GWP) of the refrigerant gases.

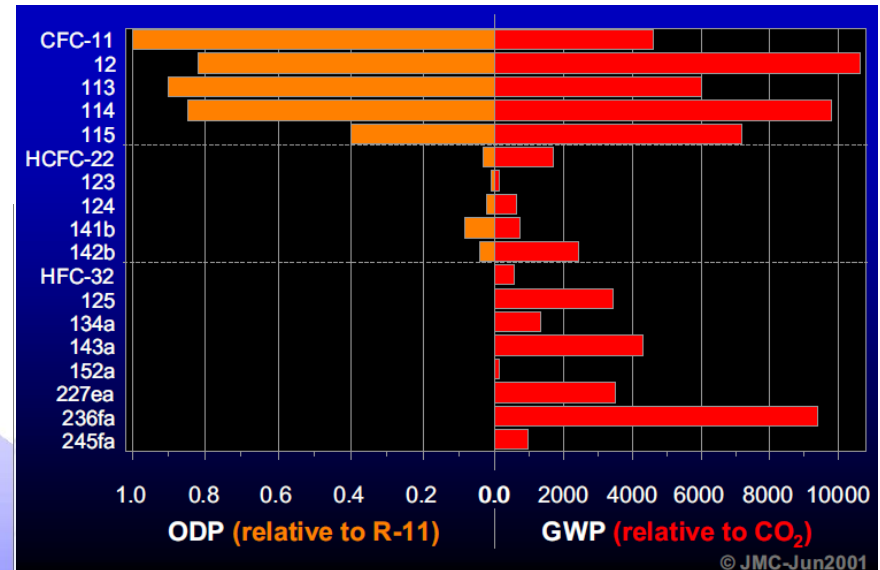
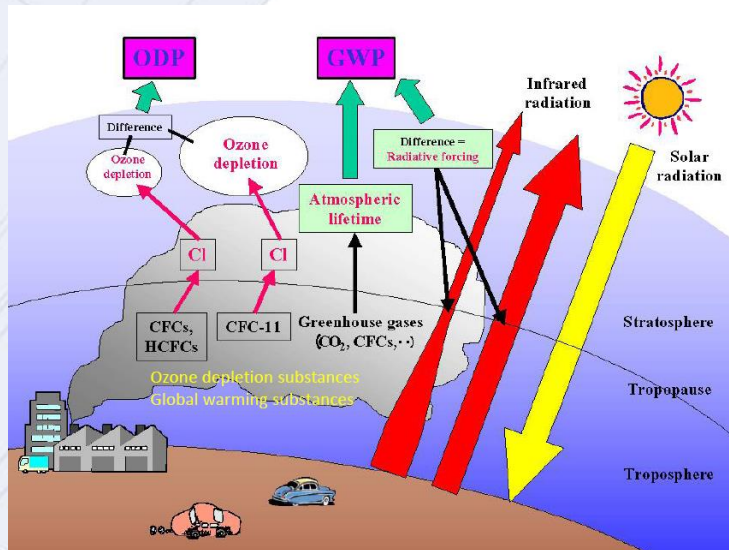




# Research focus

## (1) Environmental friendly refrigeration (GHG emissions)

- CO<sub>2</sub>
- HCs



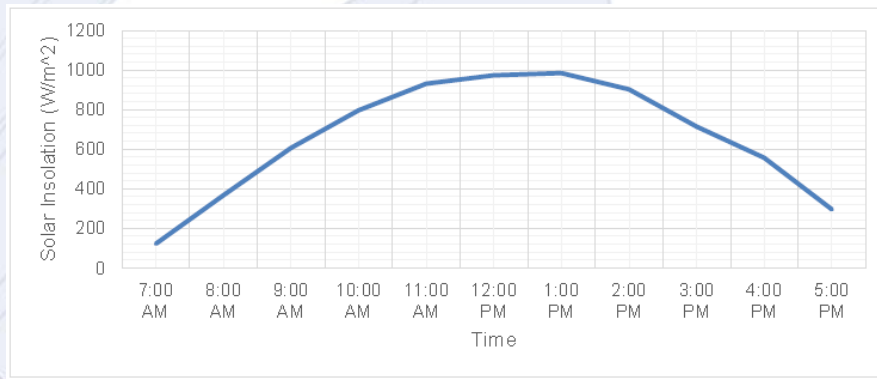
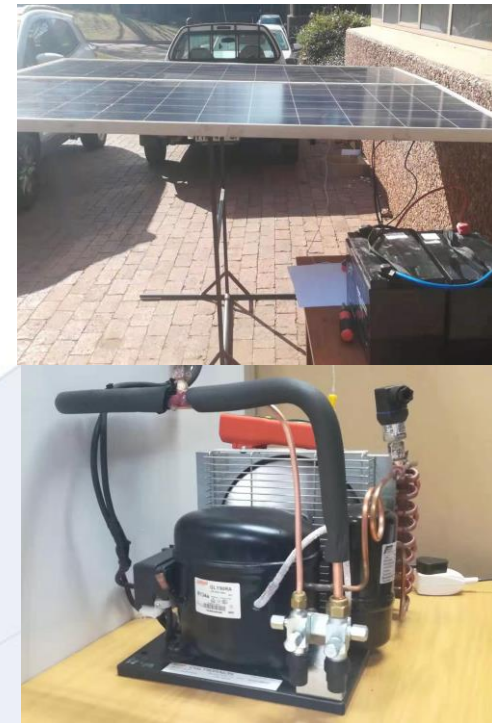
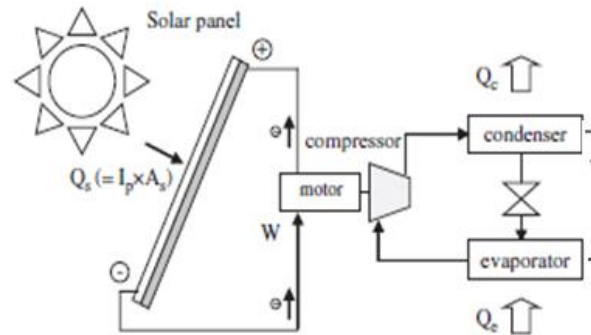
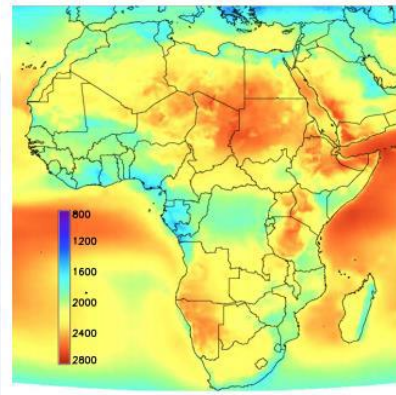


# Research focus





## (2) Renewable energy RHP systems (RE)





## (3) Heat pump drying and heating (EE)

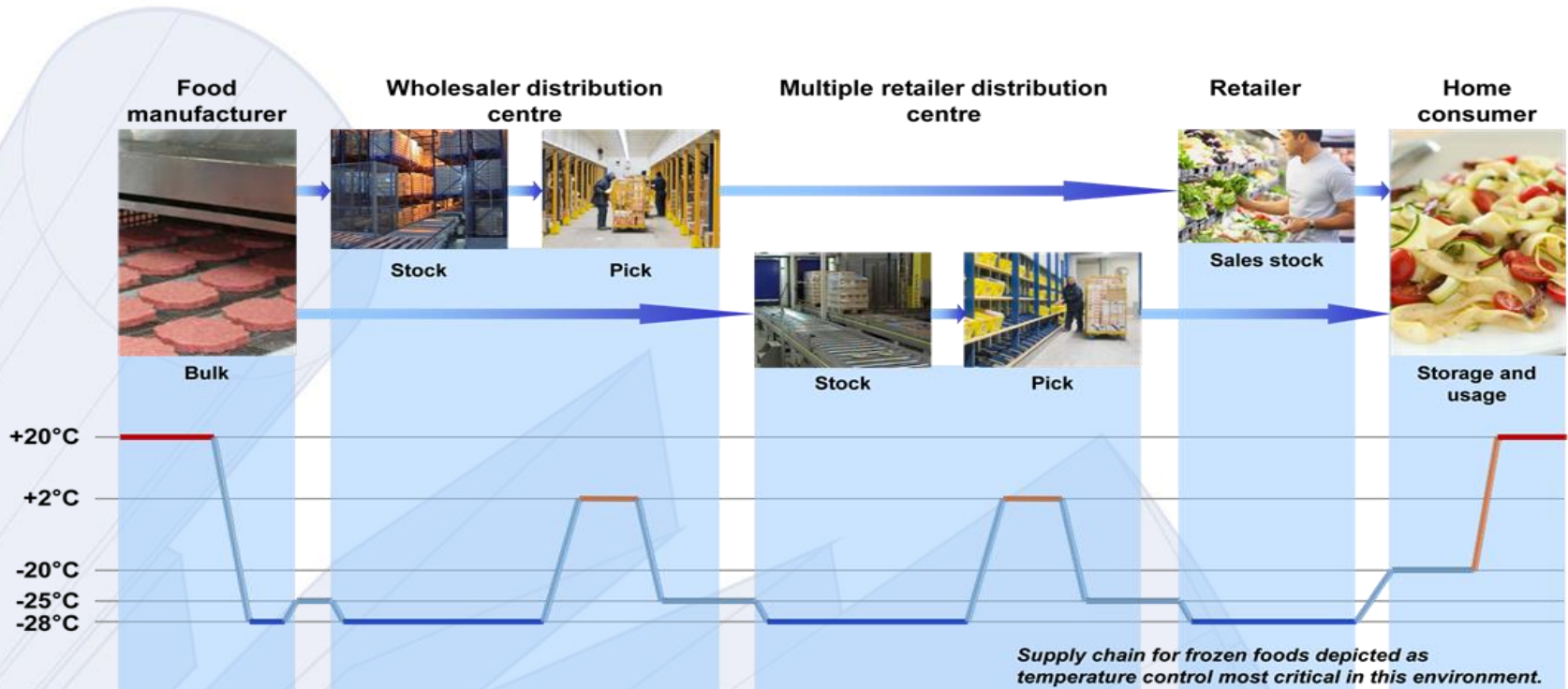
- Drying of biological materials
- Water heating







## (4) Energy Efficiency of Cold Chain (EE)





# Thank you

