

Impact of Global Warming on Air Conditioning Demand in Tourism Related Car Travel – case study for Portugal

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International Conference on Climate Change Impacts on Tourism
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Impacts on AC demand in Car Travels

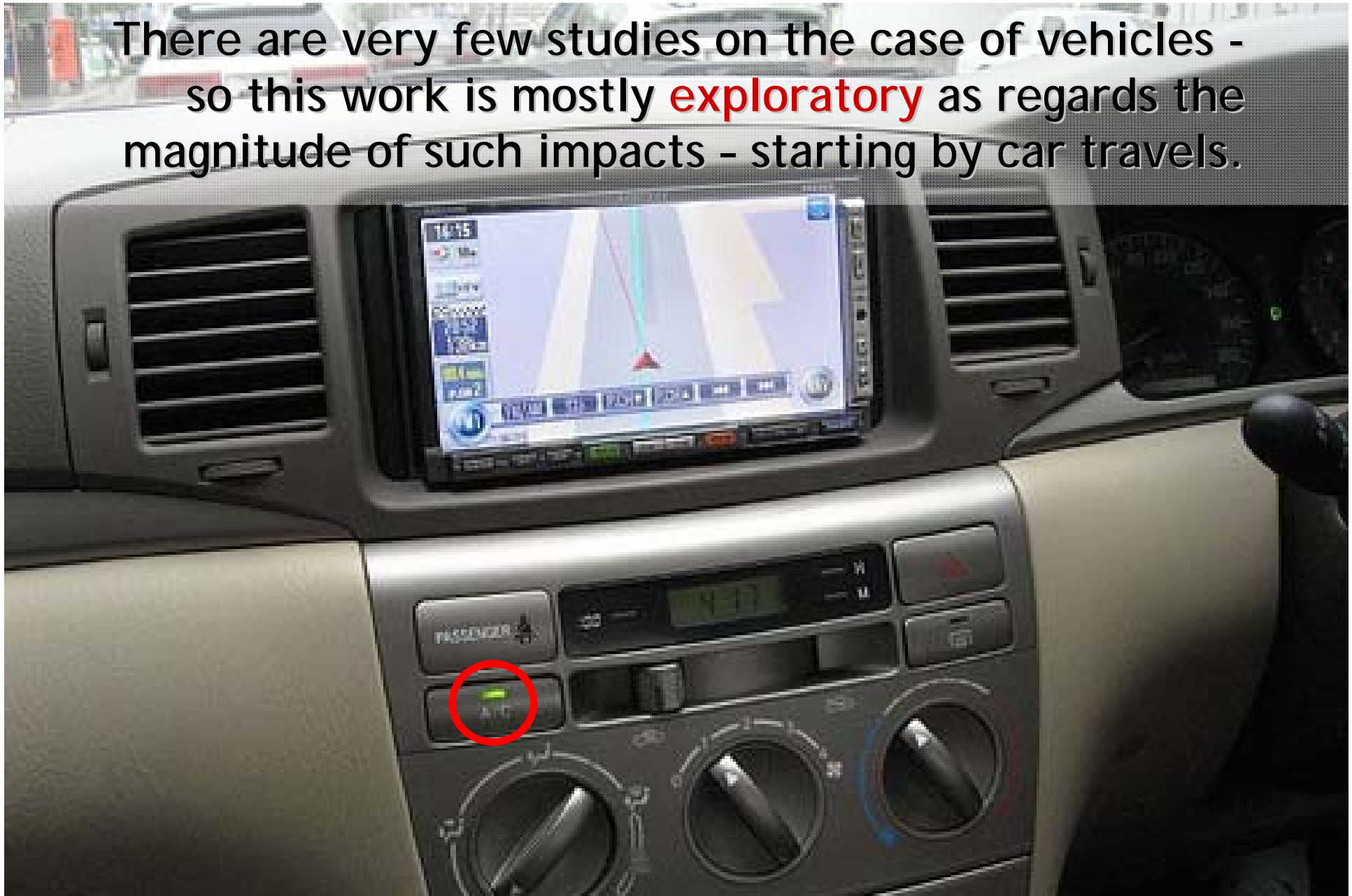
Global warming has impacts
on space conditioning
in **vehicles** as well as in **buildings**.



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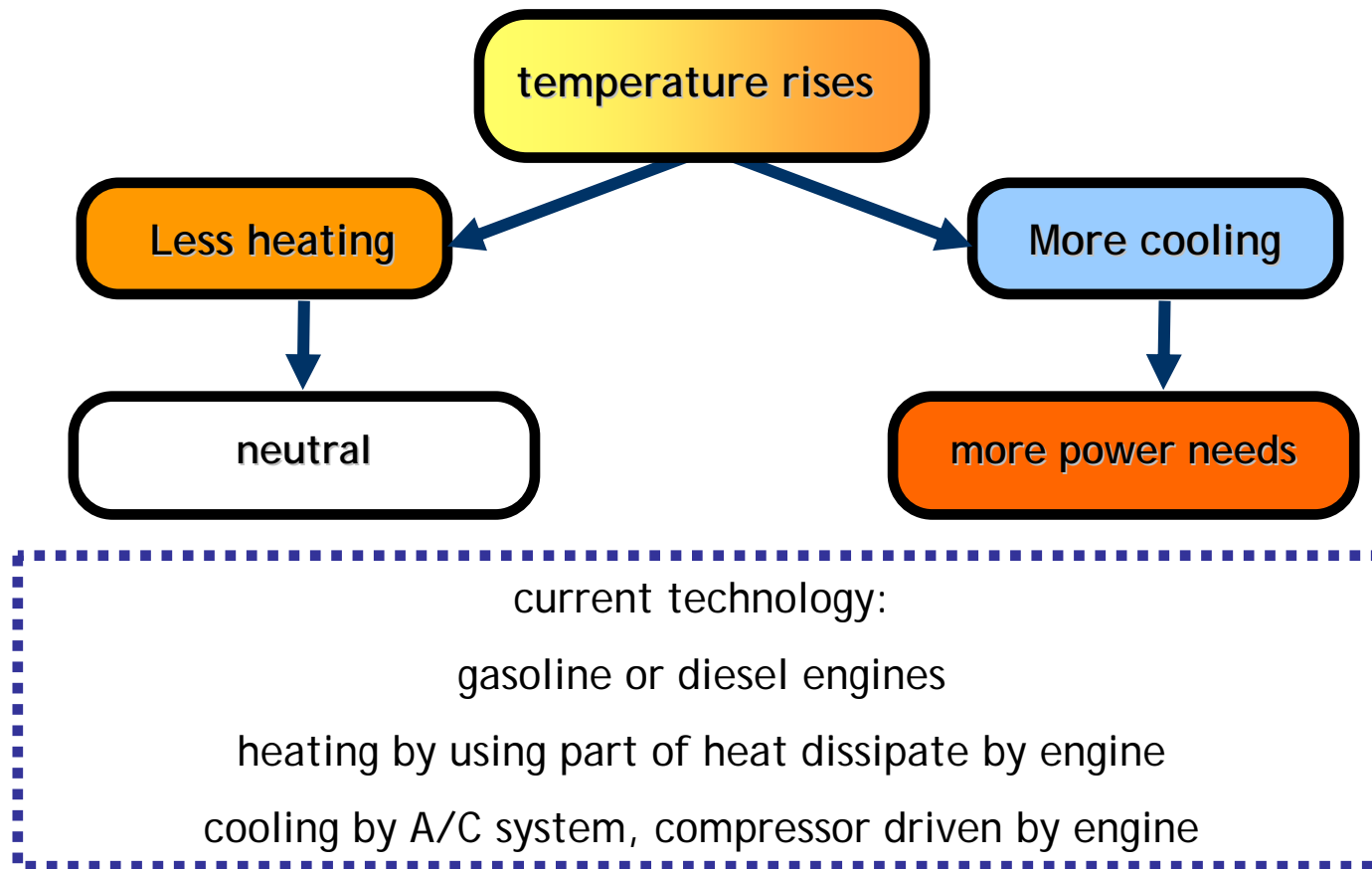
Impacts on AC demand in Car Travels

There are very few studies on the case of vehicles - so this work is mostly **exploratory** as regards the magnitude of such impacts - starting by car travels.



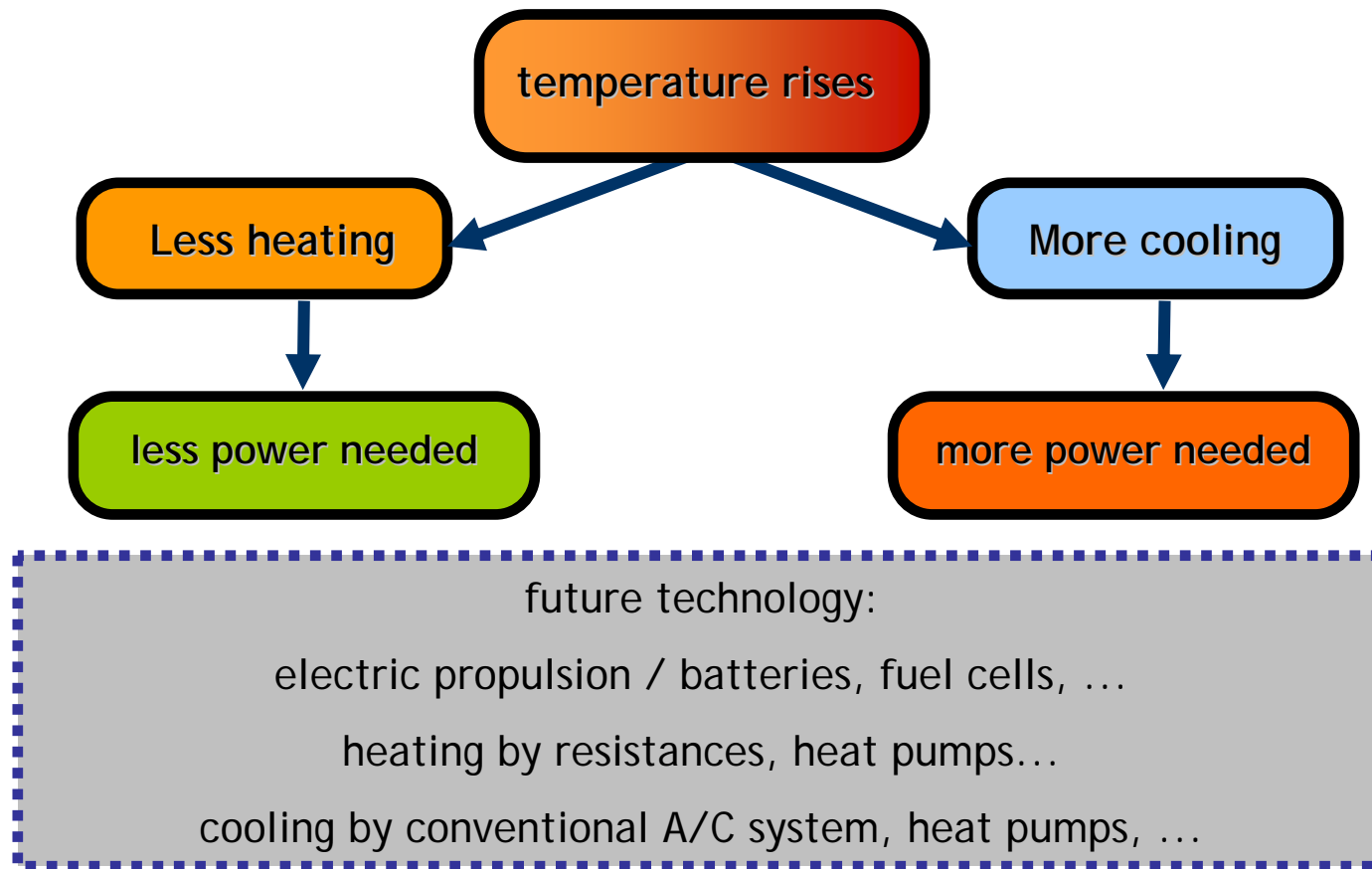
Impacts on AC demand in Car Travels

Fundamental concepts (cars and buses)



Impacts on AC demand in Car Travels

Fundamental concepts (cars and buses)

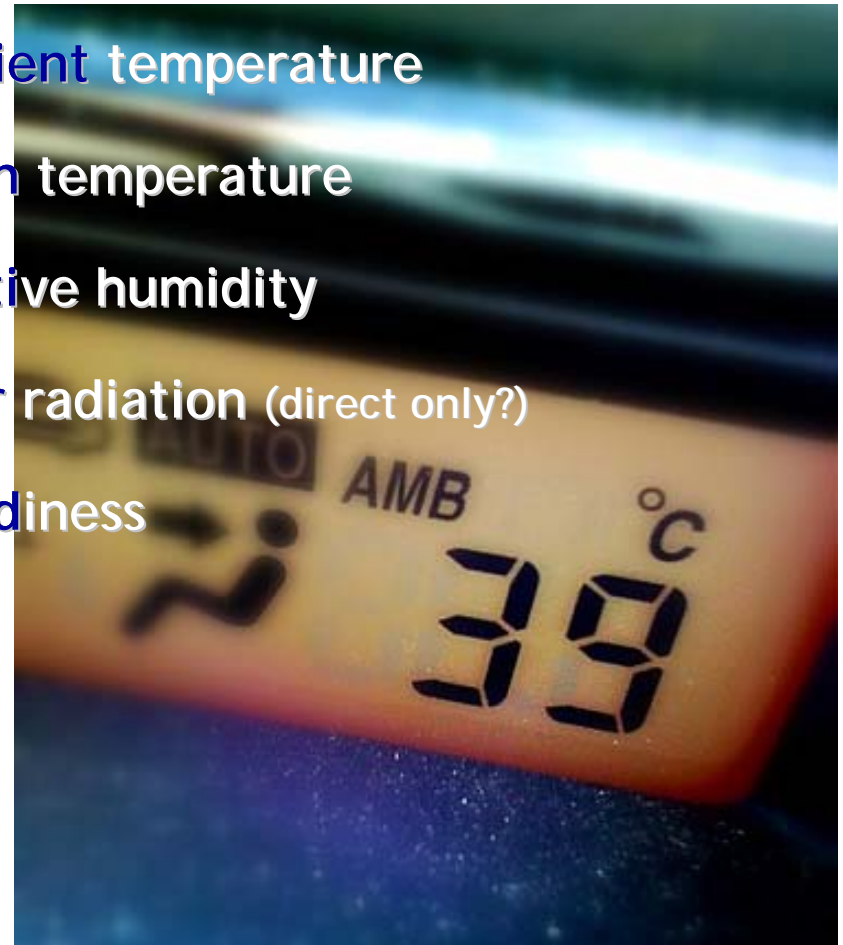


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Impacts on AC demand in Car Travels

Turning A/C on is likely to depend on

- exposure to heat previously to travel
- presence of children, old age passengers...
- trip duration
- culture / motivations
- cost
- etc.
- ambient temperature
- cabin temperature
- relative humidity
- solar radiation (direct only?)
- cloudiness

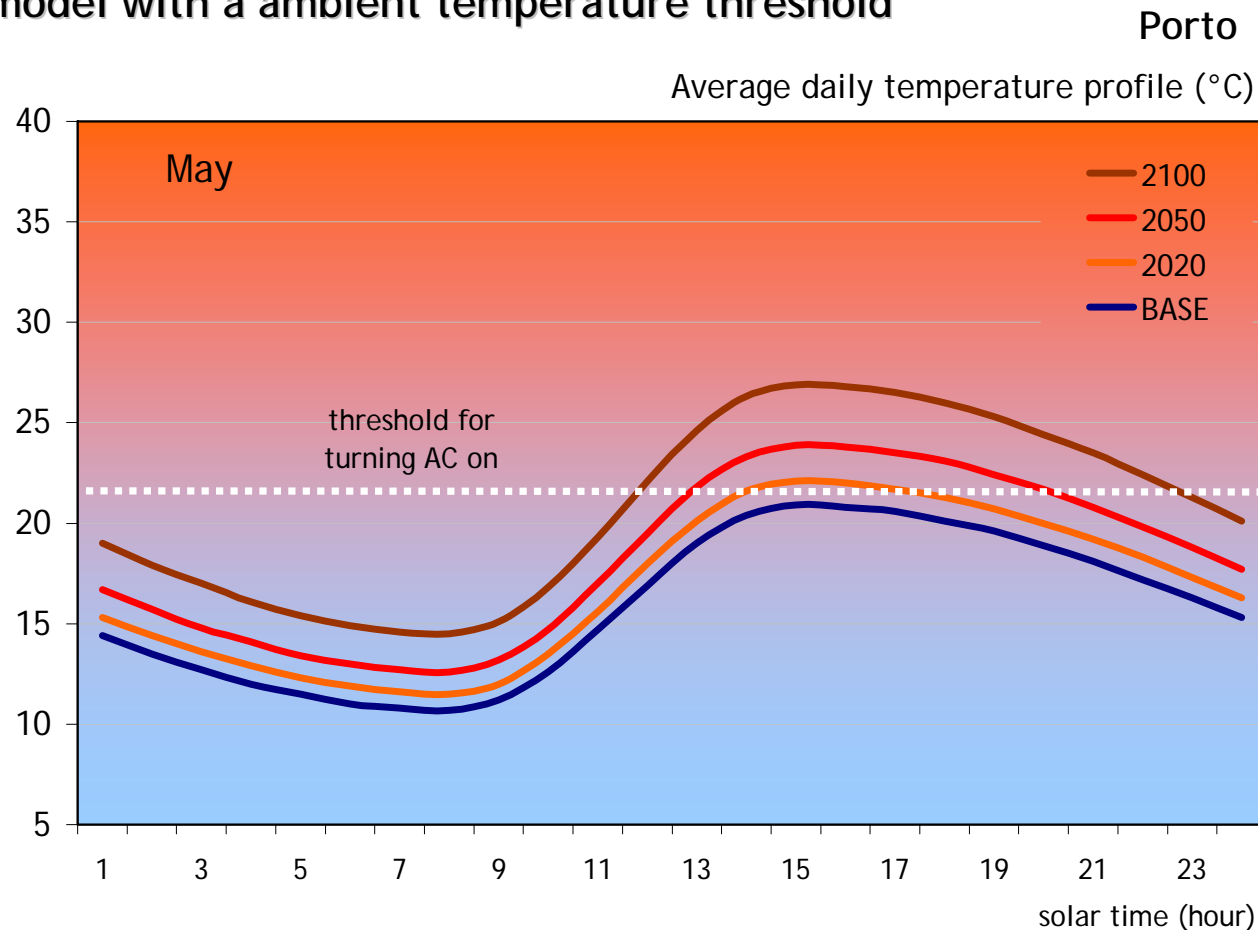


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Simplified decision model for turning A/C

Literature review yielded very few data
Simplified model with a ambient temperature threshold



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Complete energy demand model includes:

- threshold temperature (24°C)
- extra power needed for A/C system (7%)
- 4 regions
- monthly mean daily profiles of ambient temperature
- monthly mean daily profile of travels (passenger.km)
- 4 SRES scenarios (technology improvement, no. tourists, mobility)



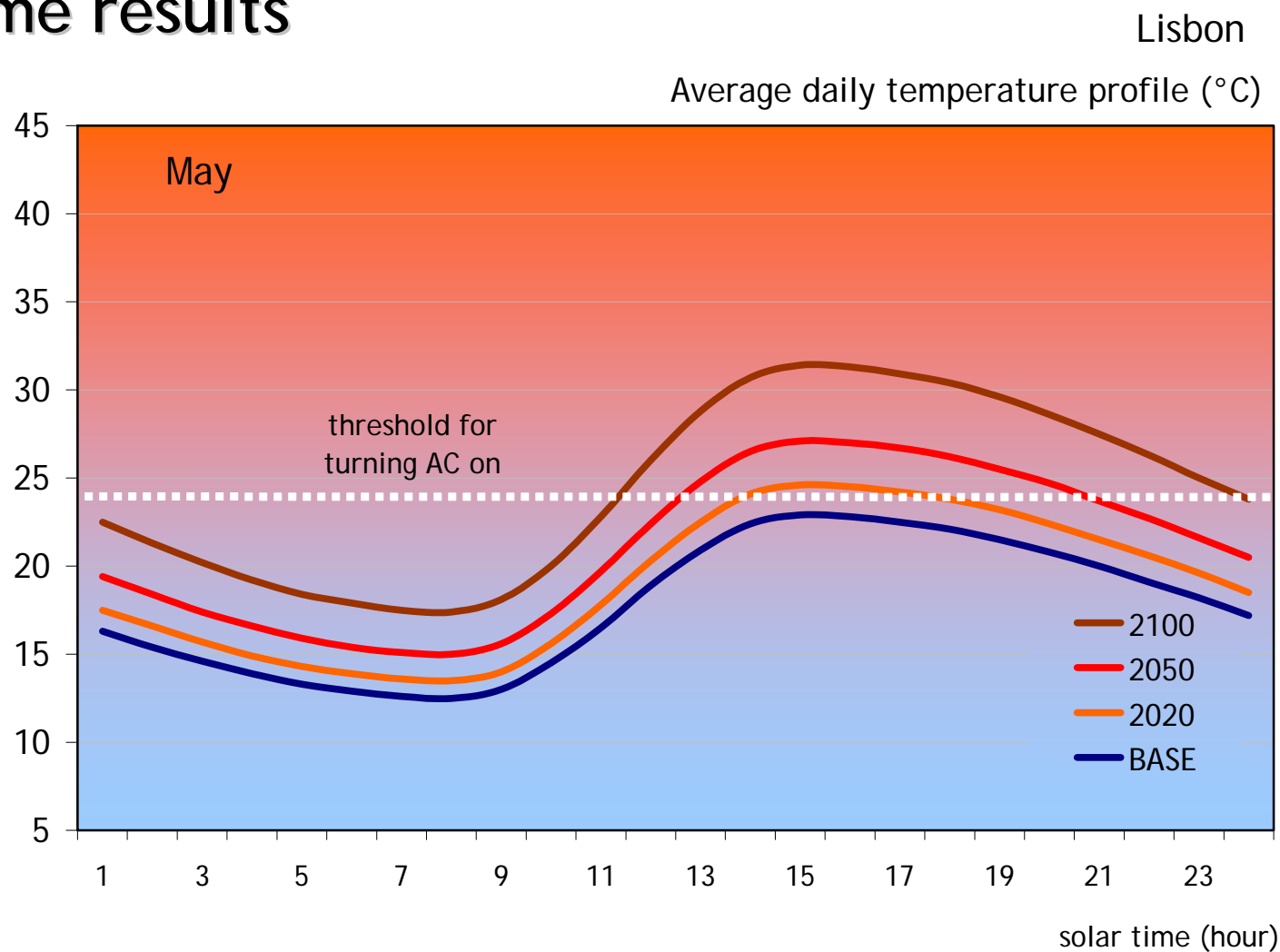
- changes in basic technology
- weather variability
- buses and trains



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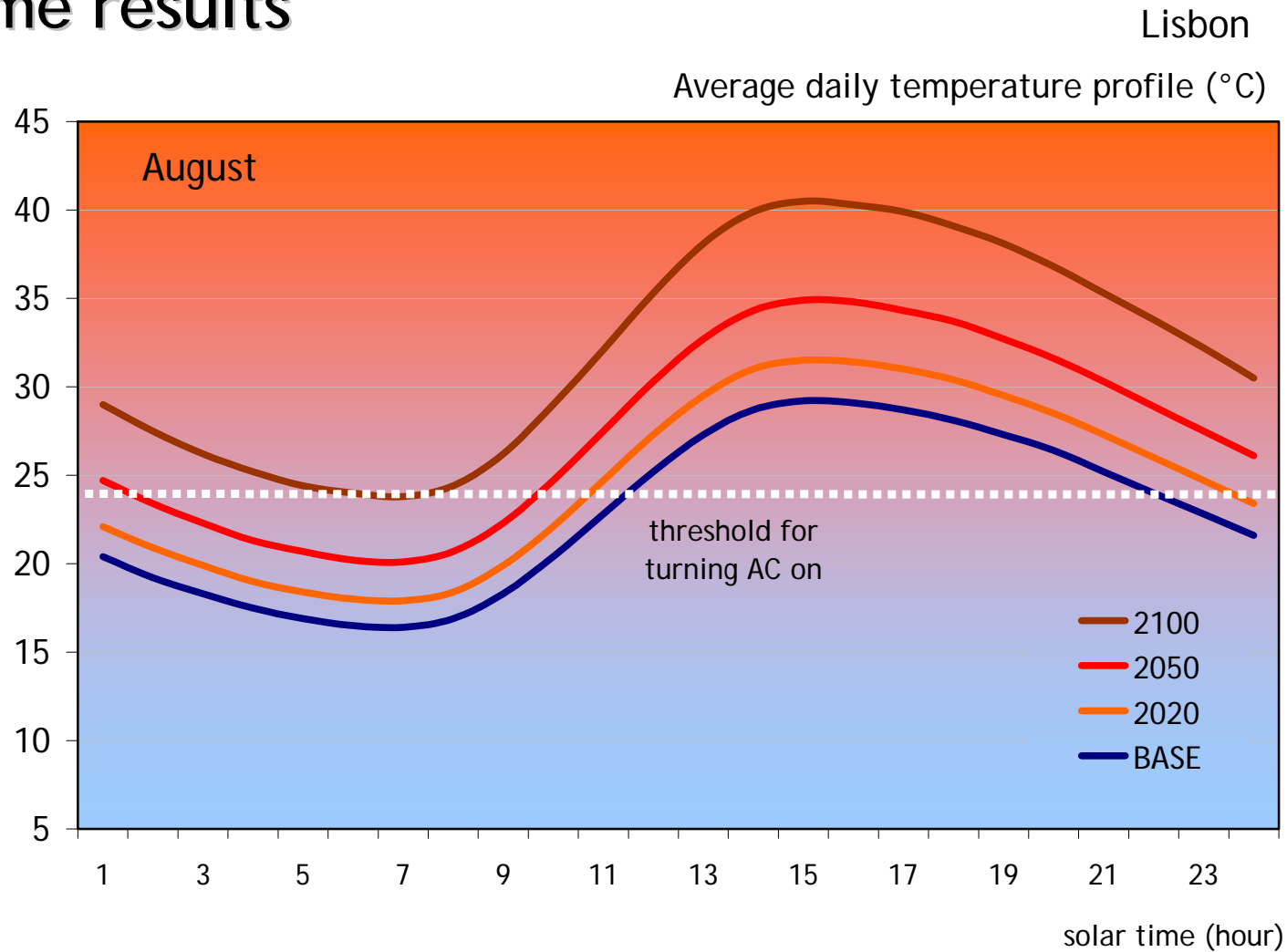
Some results



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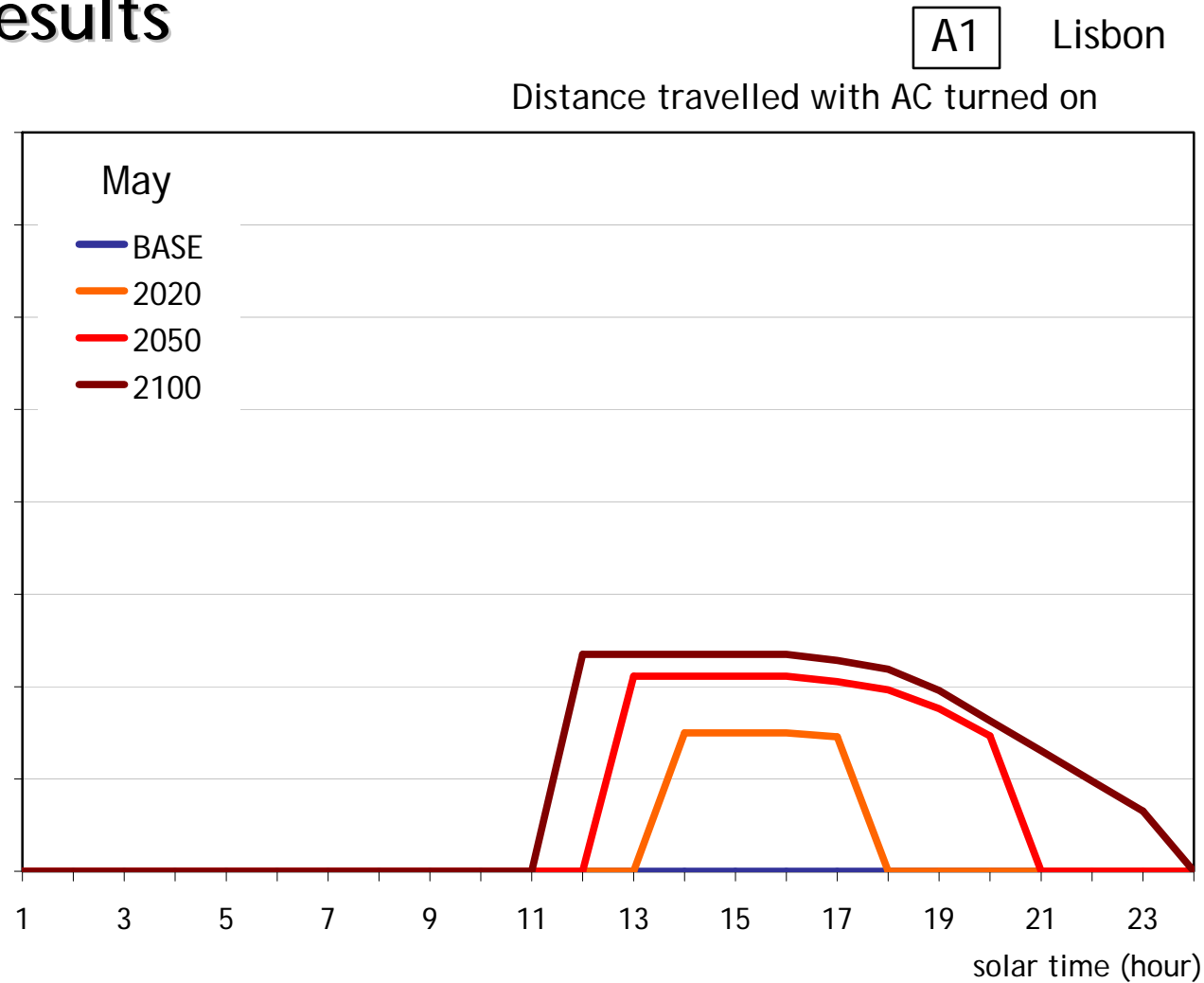
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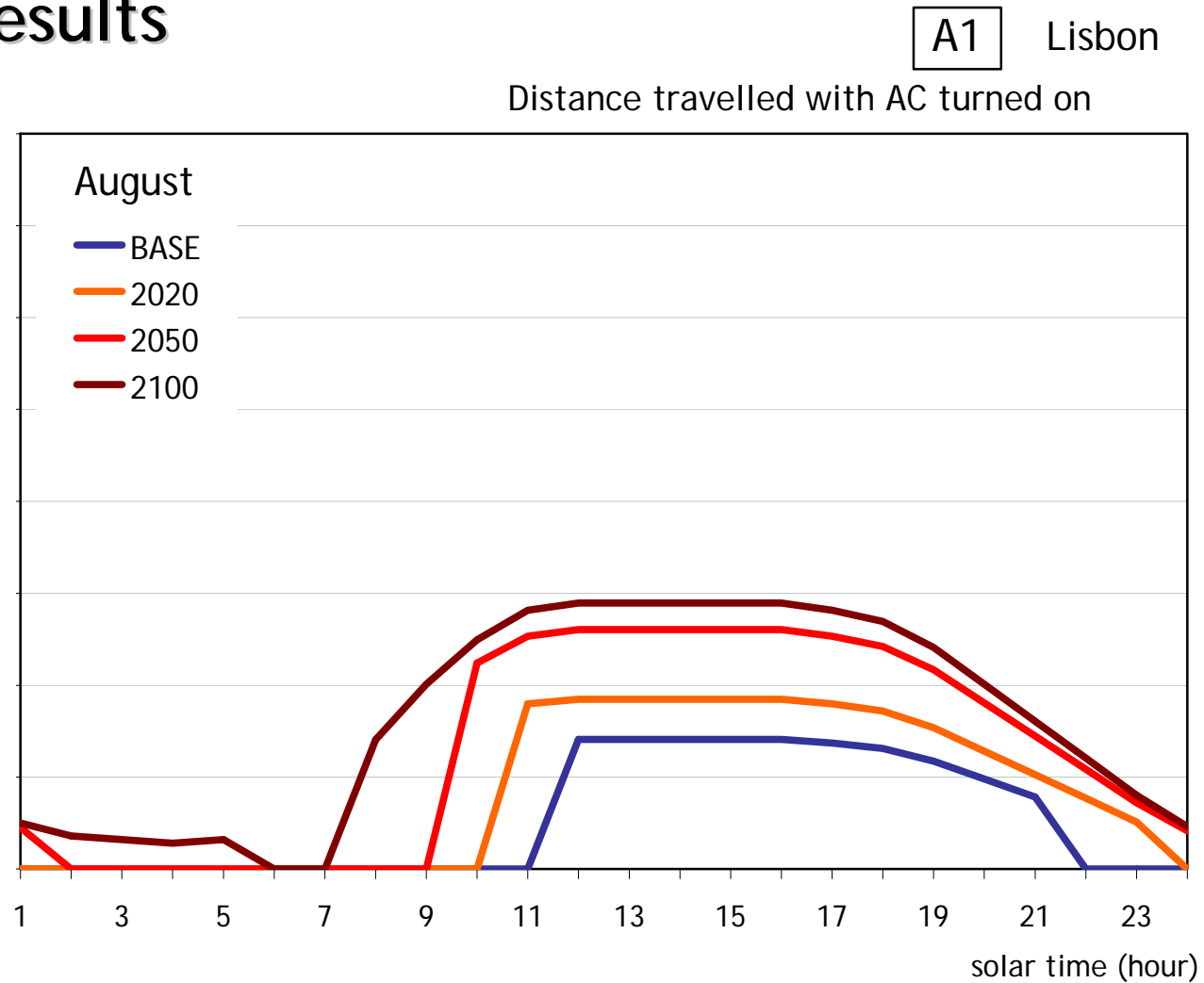
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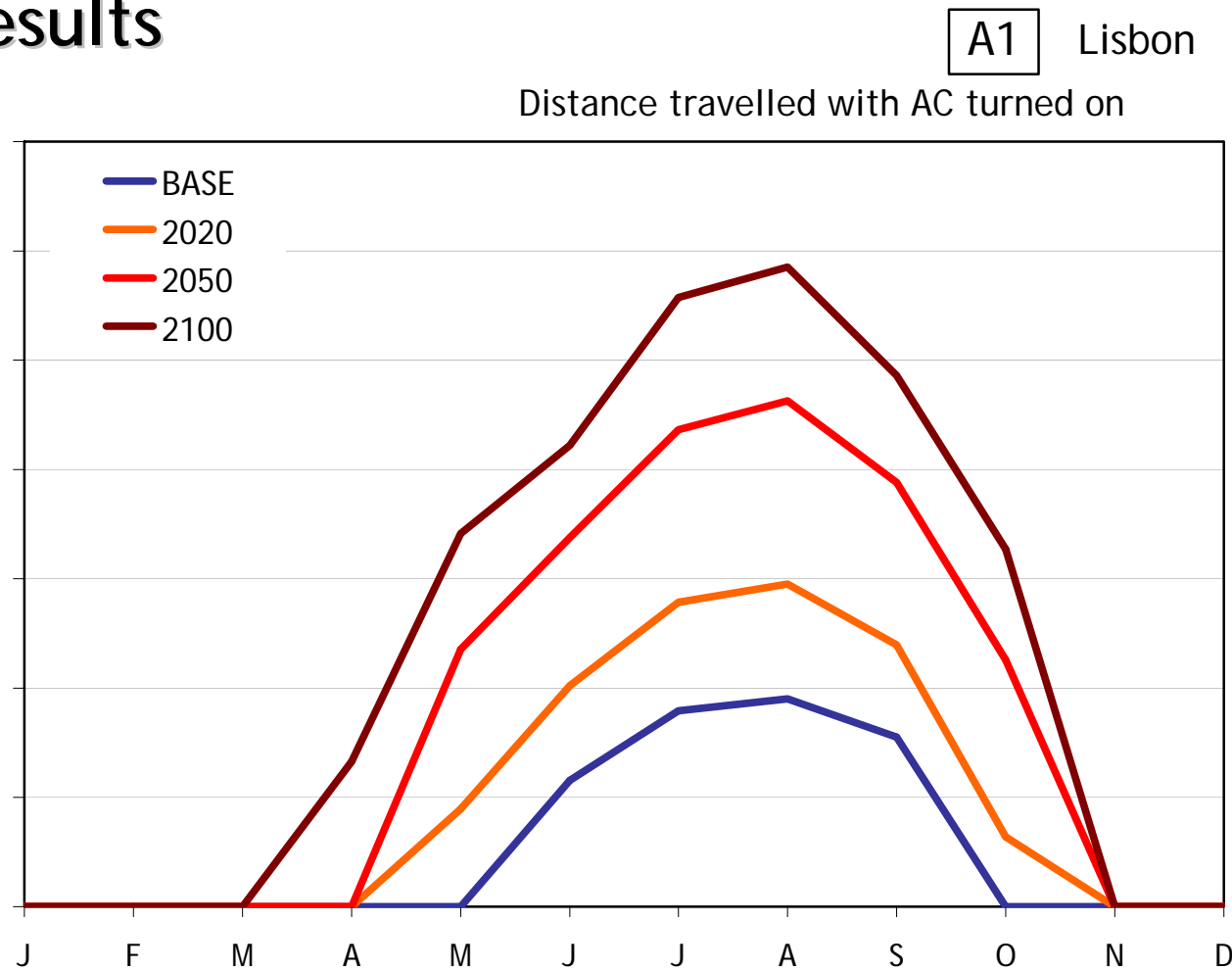
Some results



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Impacts on AC demand in Car Travels

Some results



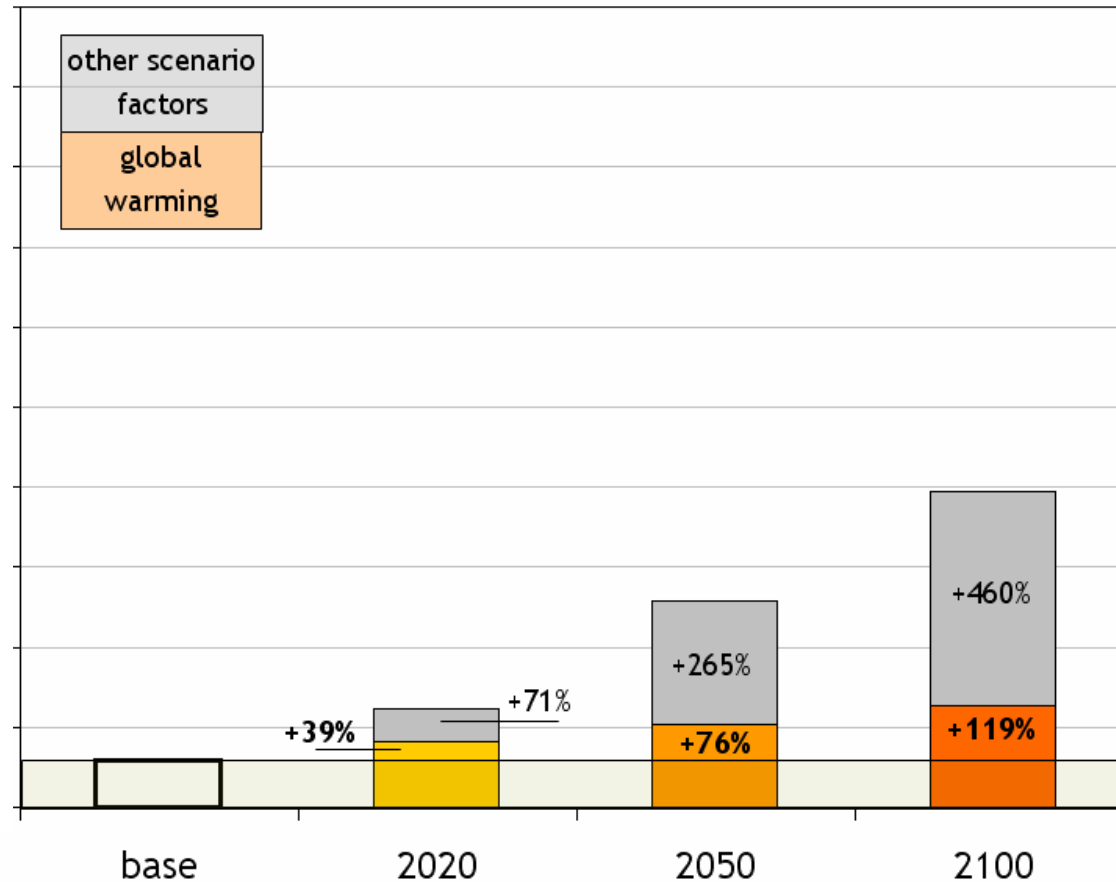
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Impacts on AC demand in Car Travels

Some results: different scenarios

A1 Lisbon

Energy demand for AC in tourism related travels



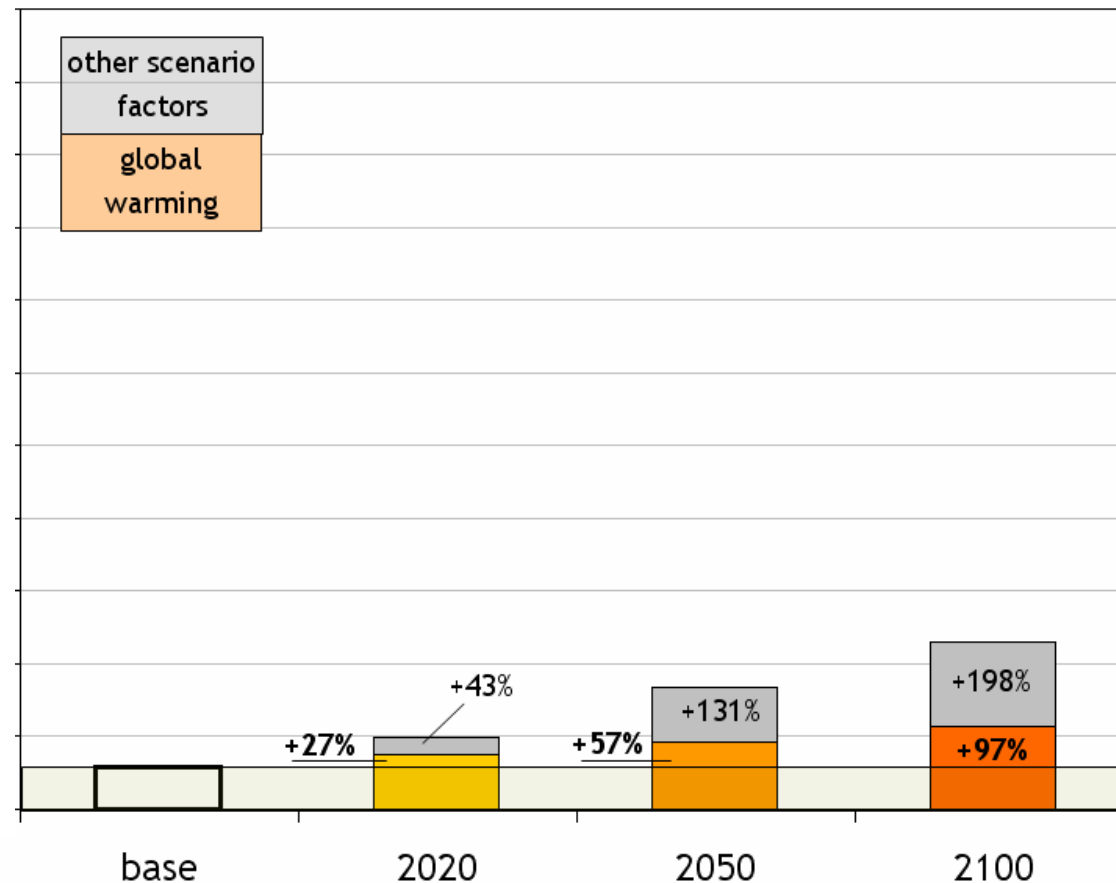
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Impacts on AC demand in Car Travels

Some results: different scenarios

A2 Lisbon

Energy demand for AC in tourism related travels



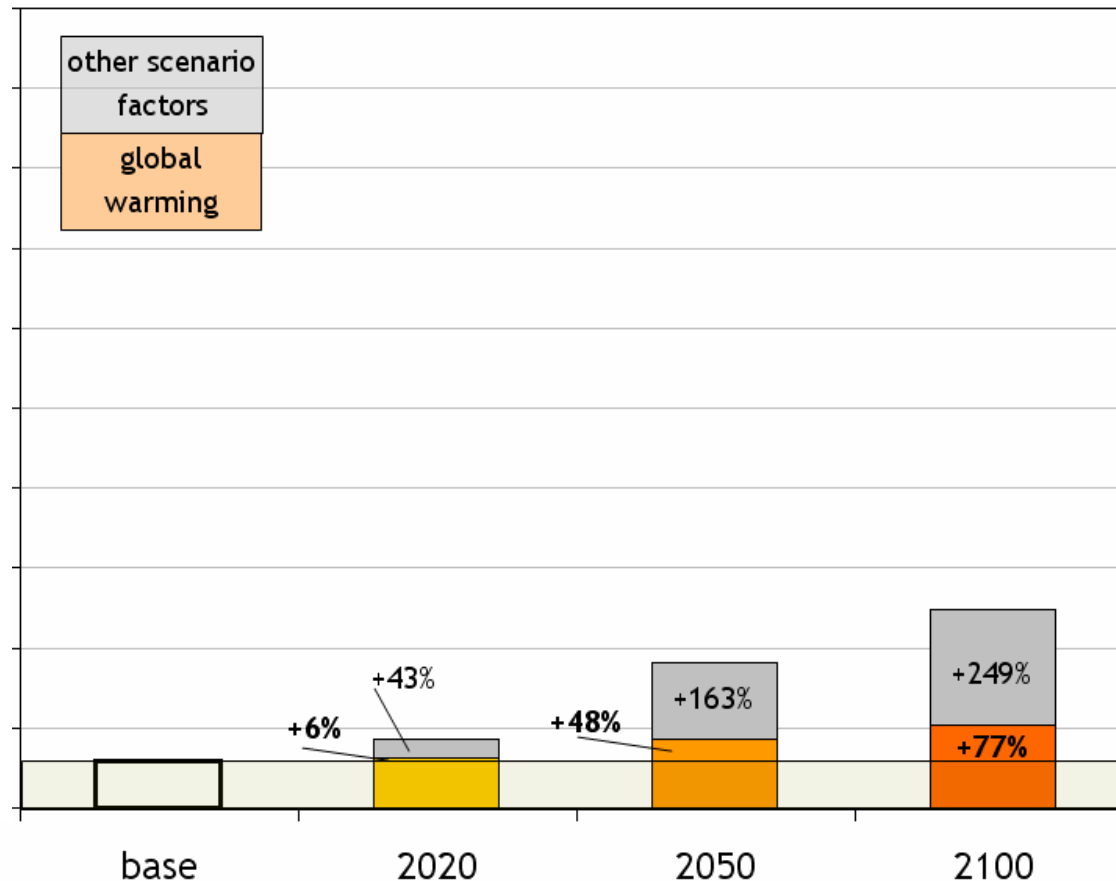
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Impacts on AC demand in Car Travels

Some results: different scenarios

B1 Lisbon

Energy demand for AC in tourism related travels



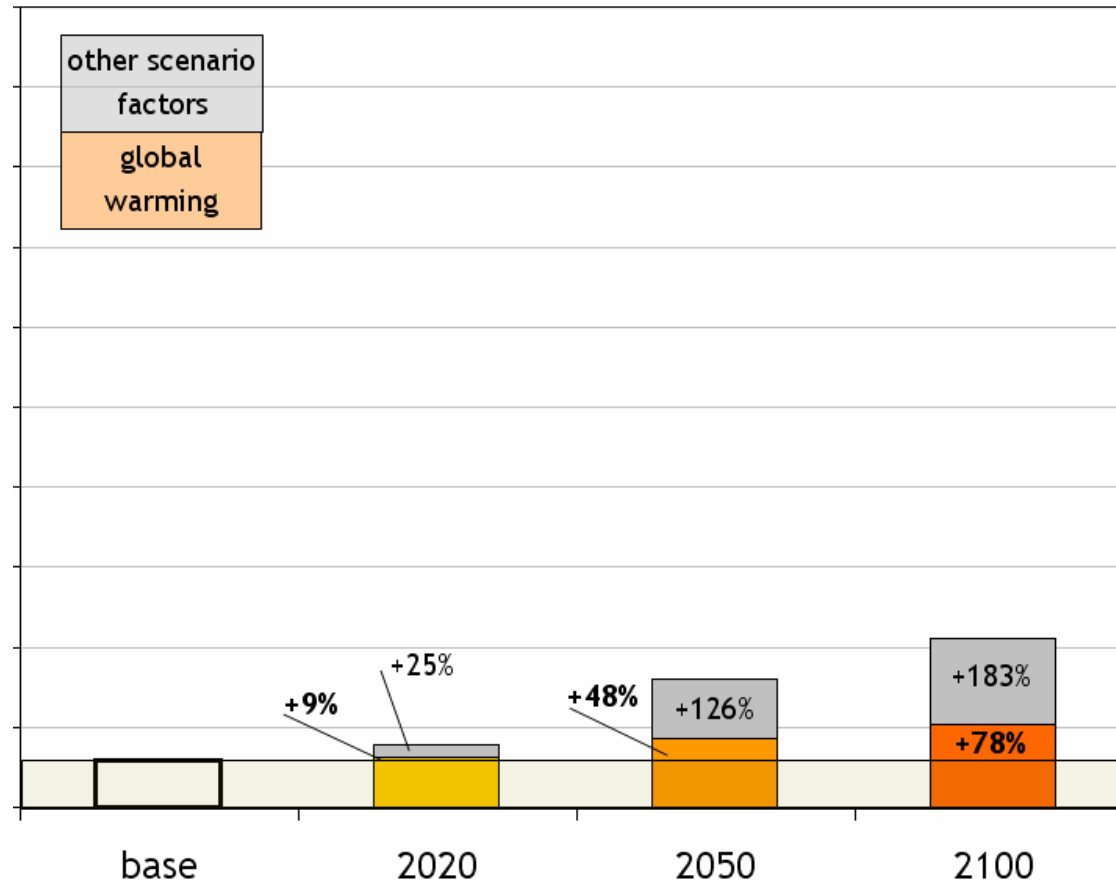
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Impacts on AC demand in Car Travels

Some results: different scenarios

B2 Lisbon

Energy demand for AC in tourism related travels



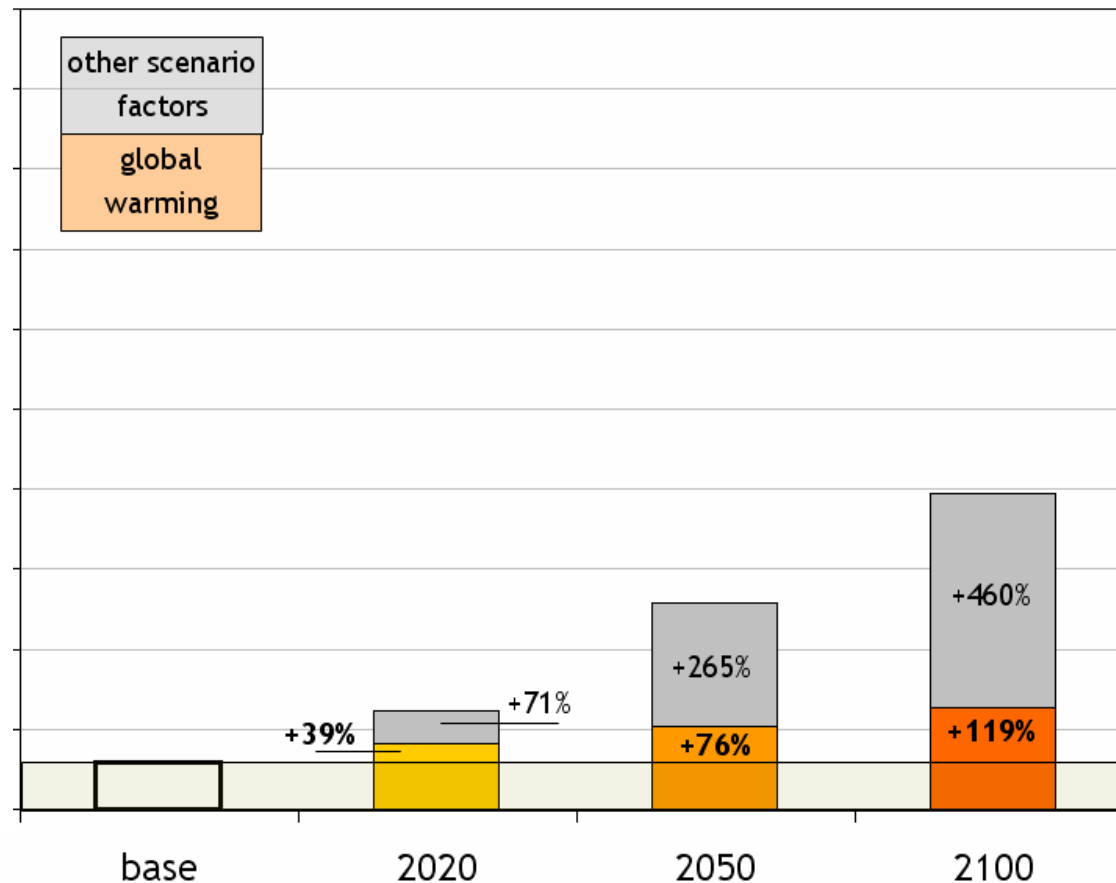
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Impacts on AC demand in Car Travels

Some results: different regions

A1 Lisbon

Energy demand for AC in tourism related travels



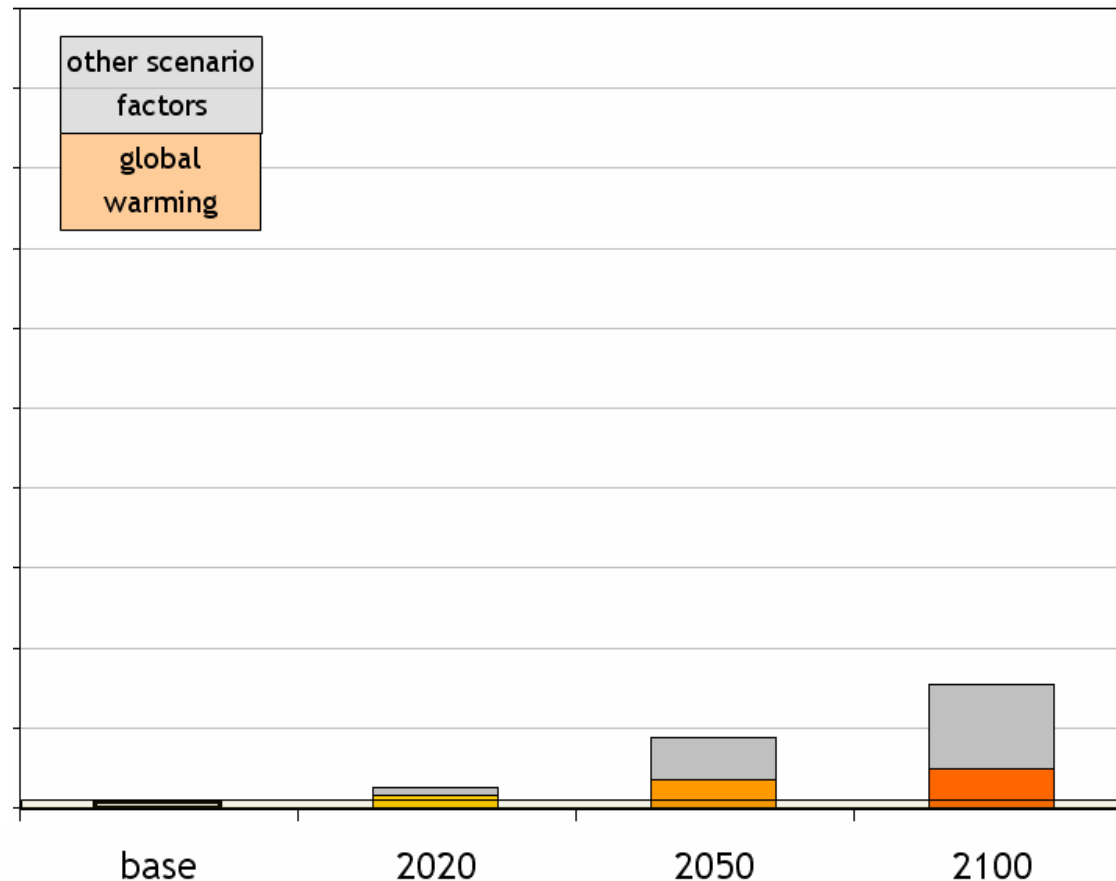
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Impacts on AC demand in Car Travels

Some results: different regions

A1 Madeira

Energy demand for AC in tourism related travels



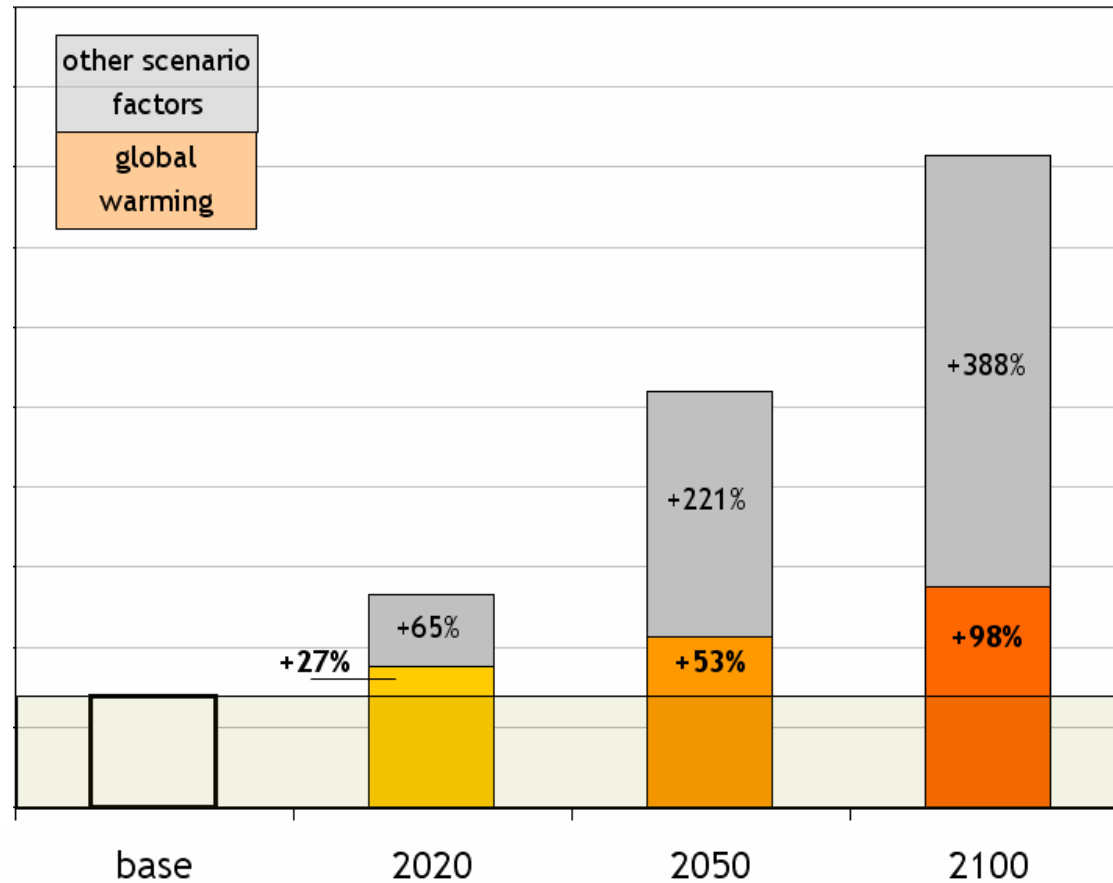
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Impacts on AC demand in Car Travels

Some results: different regions

A1 Algarve

Energy demand for AC in tourism related travels



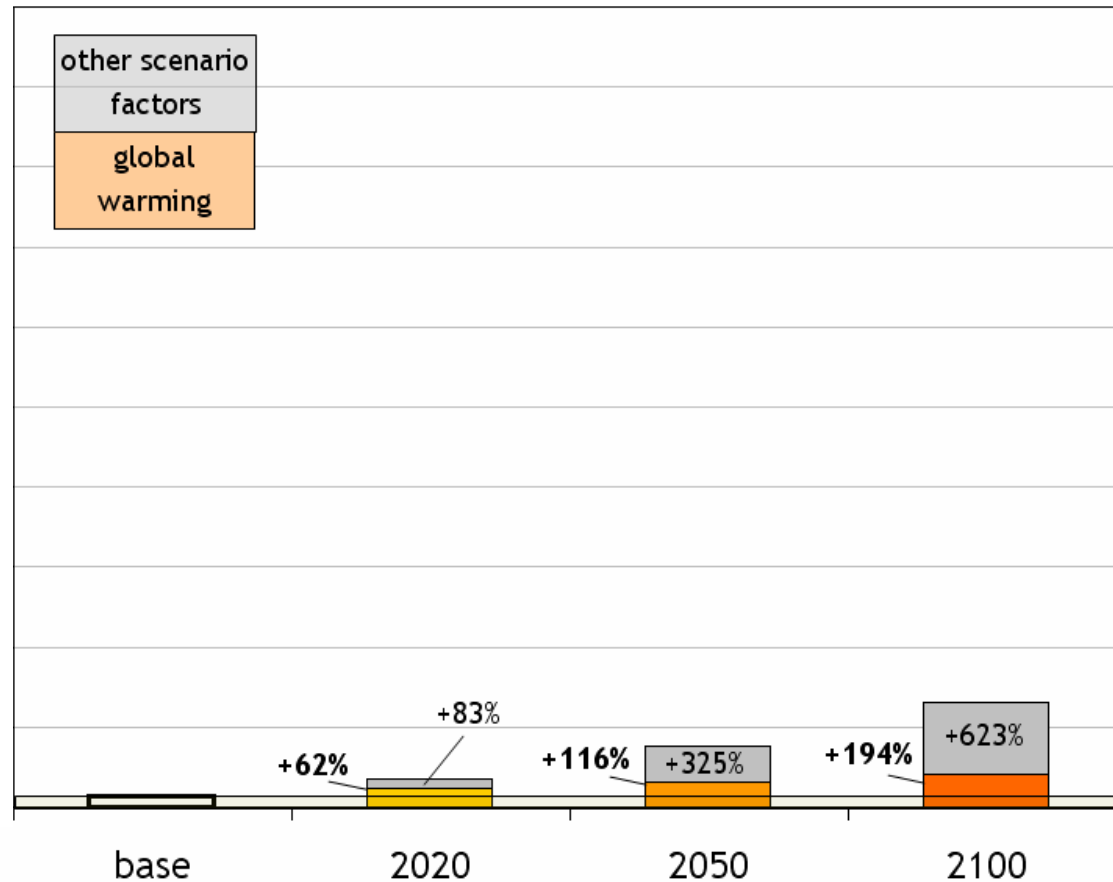
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Impacts on AC demand in Car Travels

Some results: different regions

A1 Porto

Energy demand for AC in tourism related travels



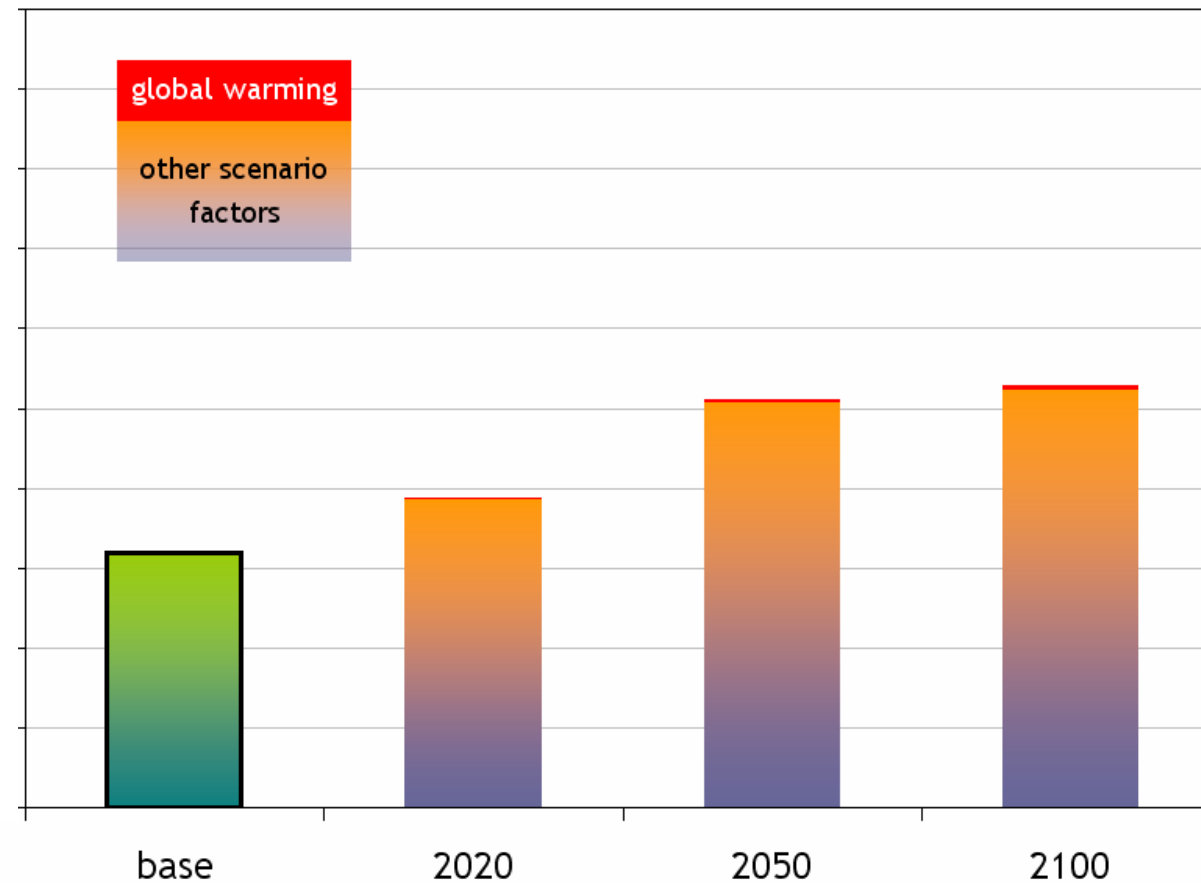
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Impacts on AC demand in Car Travels

Some results: the overall context

A1 Lisbon

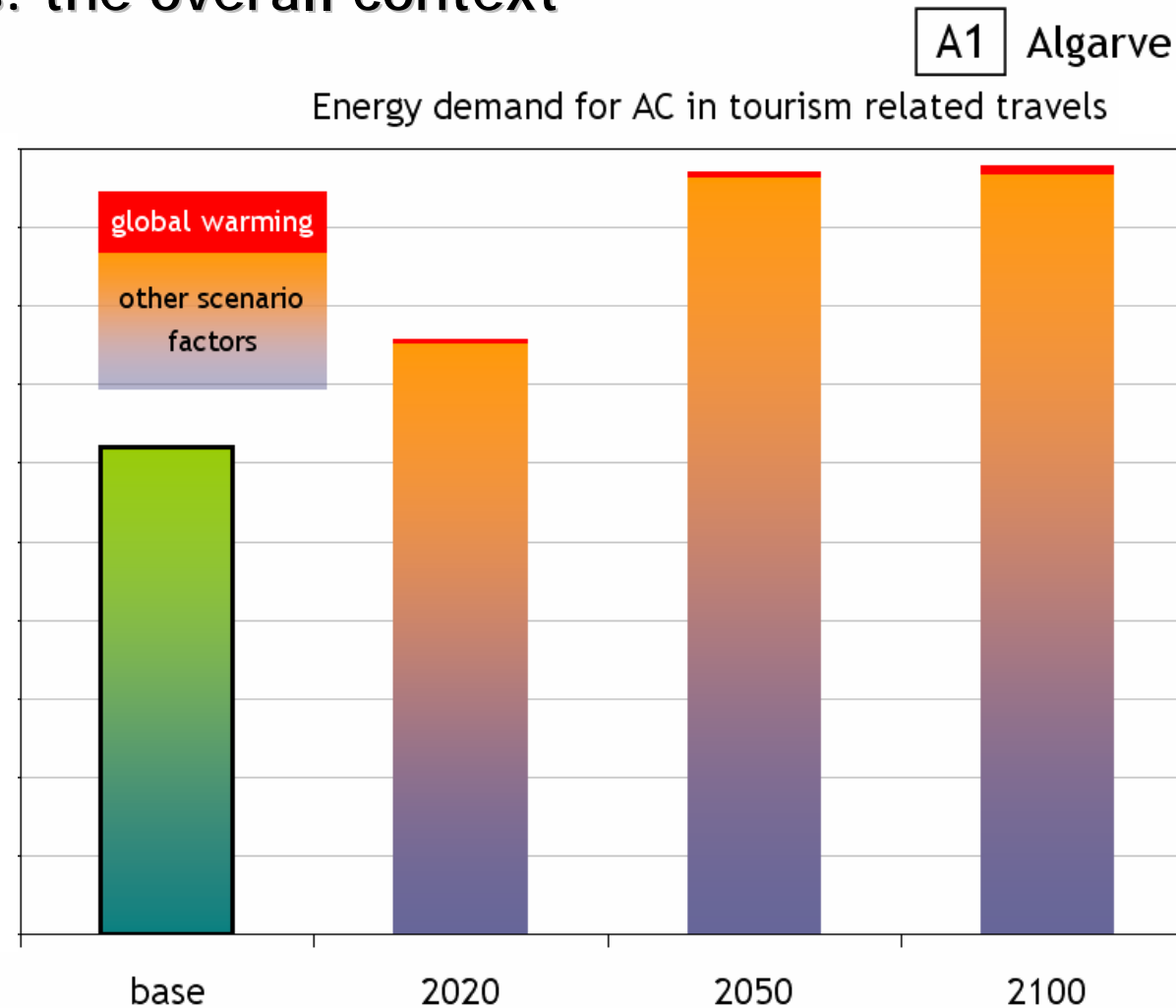
Energy demand in tourism related car travels



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Impacts on AC demand in Car Travels

Some results: the overall context



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Conclusions

- A/C energy demand in car travels with the model used is estimated to represent today about 0.1% (Madeira) to 0.7%(Algarve) of the overall demand values;
- in the future (2070) it should step up to about 0.9% (Madeira, B1) to 3.4% (Algarve, A1);
- the responsibility of climate change in this rise should amount to about 1/2 (A1) to 2/3 (B1) of the total rise by 2070.

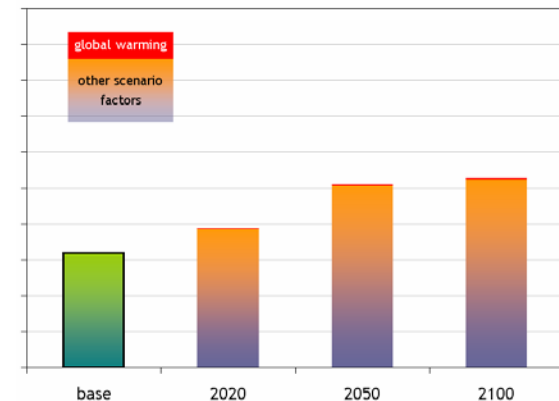


Impacts on AC demand in Car Travels

(final slide)

Conclusions

- The approach taken was exploratory and surely lacks proper validation - simplified decision model, need for survey data, cars only, improved technology but no change of paradigm - but the results are clear enough to show that ...
- ...indeed A/C use in cars will increase in Portugal as a result of global warming, but it is the change of socio-economic factors that will dominate the increase of energy demand for car travel.



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