

The vulnerability of refrigerated food to unstable power supplies: a scoping study

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UK household food waste

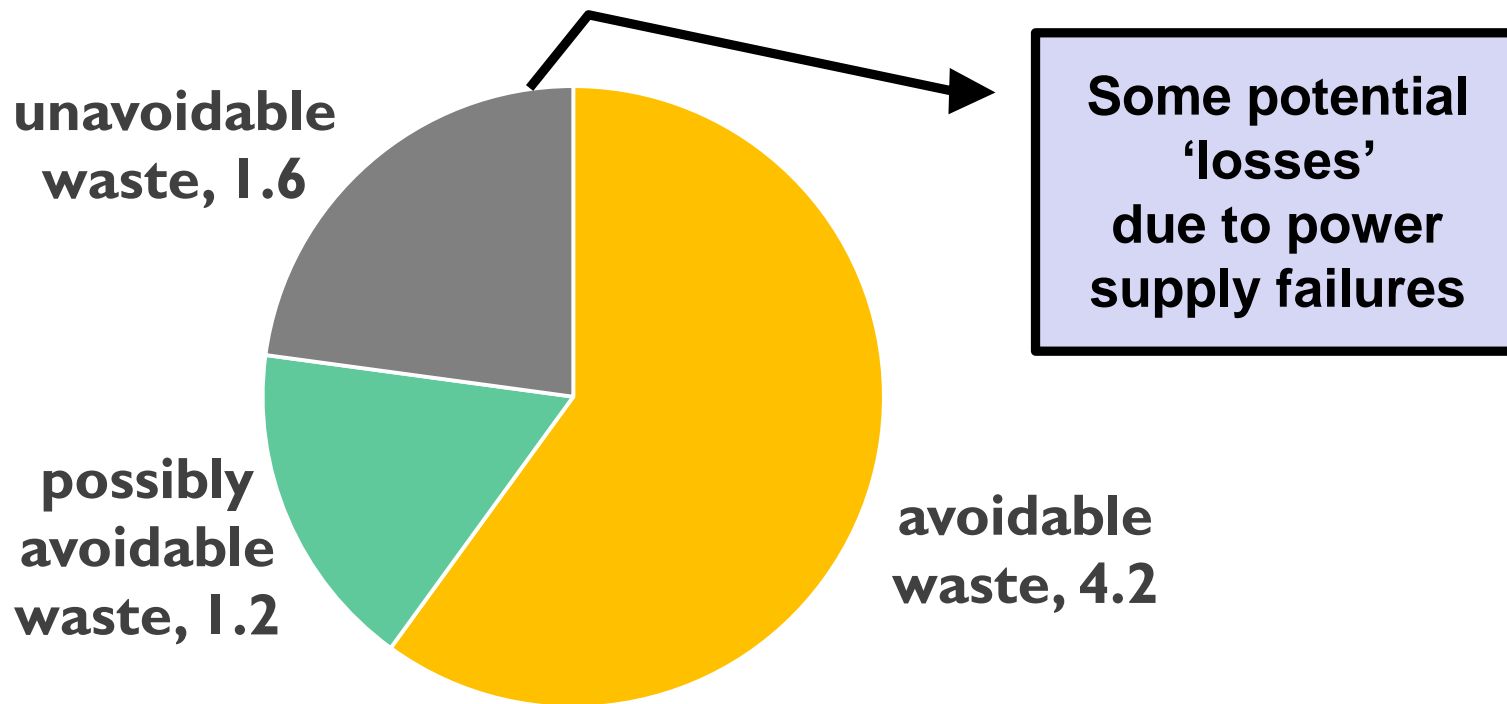


Figure 1: Breakdown of annual household food waste in the UK – millions of tonnes. (WRAP 2012)

Quantifying the potential losses of refrigerated food

Two case studies: UK and India

UK: ‘benchmark’ stable grid supply, with large population of refrigerators and a temperate climate

India: example of unstable grid supply, expanding refrigerator population and various climates

Study areas split into states/countries and urban/rural

Data requirements

Population and household data

Food consumption: 'shopping baskets'

Refrigerator populations

Grid stability: likelihood and duration of interruptions

Refrigerator design: insulation, volumes

Food degradation rates for sample foods

Climate data: mean monthly temperatures

Data problems and solutions

Mostly very poor access to grid stability data

Solution: World Bank state-level data

Few accessible data for refrigerator insulation

Solution: Assumed 40mm 0.94W/K

How much time has the food spent in the supply chain prior to reaching the consumer?

Solution: Assumed 58 hours

How much food in the fridge?

Solution 1: Assumed a weekly shop and if household has a fridge, the food will be stored in it

Solution 2: Half of purchased food is in the fridge, when the supply is interrupted

Sample foods

Two sample foods are presented, based on widespread use and inclusion within FRISBEE *:

Chicken fillet

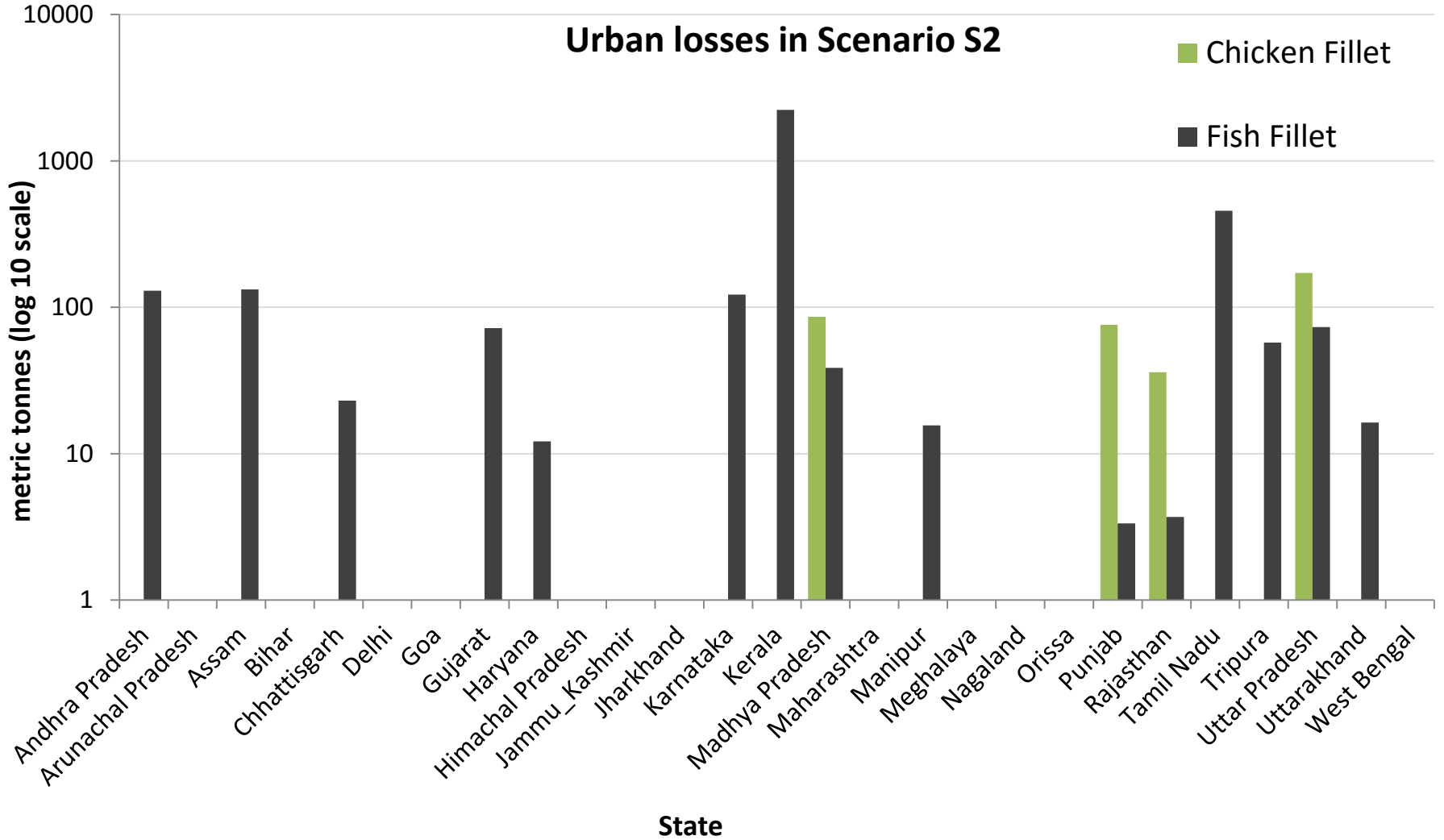
Fish fillet

*** FRISBEE: EU-funded project including collection of data on degradation of food in the cold supply chain.**

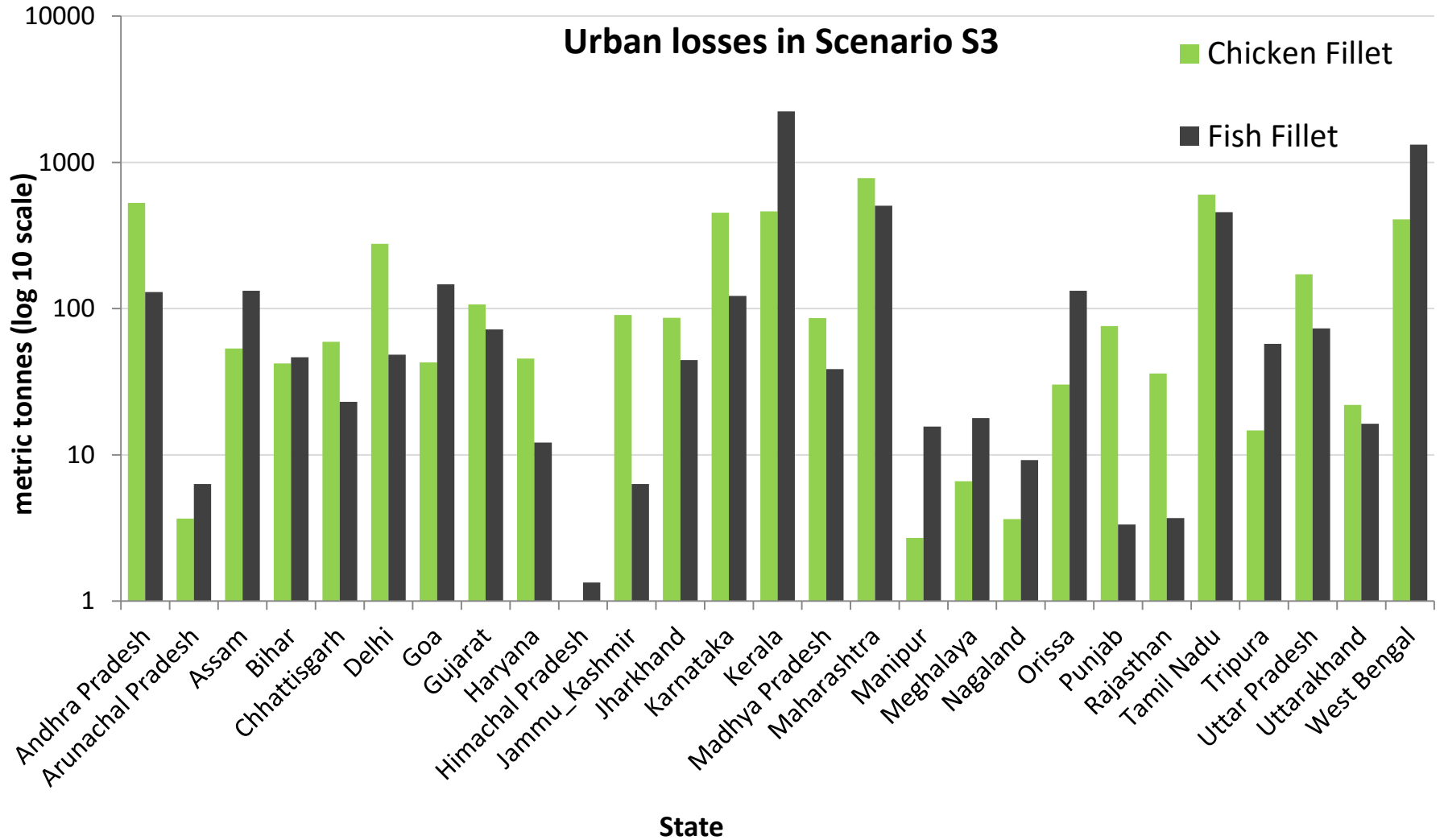
Scenarios

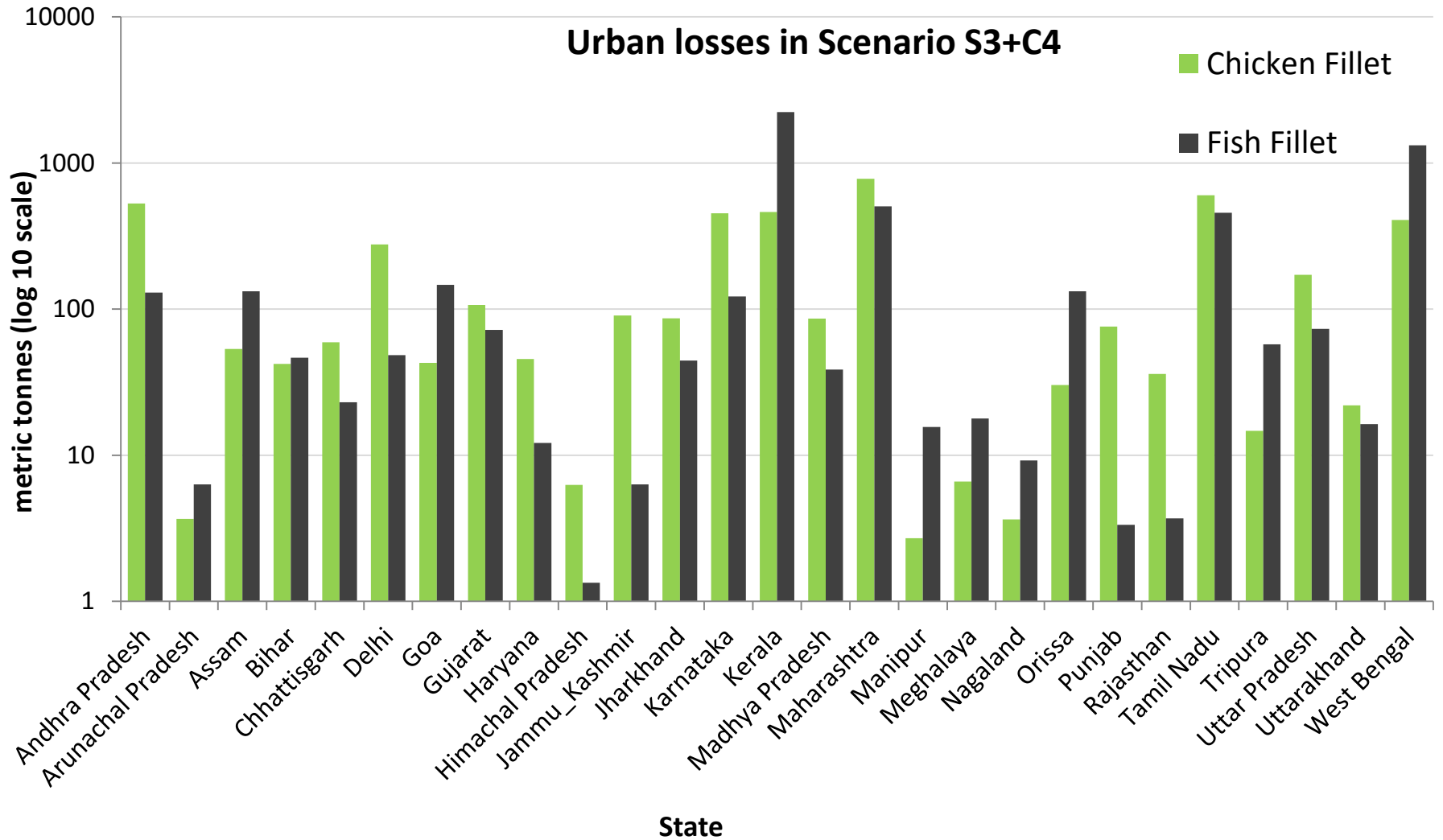
Business as usual:	S1
Duration of interruption doubled:	S2
Duration of interruption quadrupled:	S3
4 Celsius increase in mean monthly temperature, to simulate heatwave:	C4
	S1 + C4
	S2 + C4
	S3 + C4

Urban losses in Scenario S2



Urban losses in Scenario S3





Initial Results Summary

In the UK, the risk to the modelled refrigerated foods is very low and requires a significant heatwave and longer average interruptions to become a serious problem.

Food in domestic refrigerators in India is currently able to withstand an average duration power failure, but would suffer if this average increases significantly.

Ambient temperatures play little role in the degradation risk until the power network fails.

Project team and funding

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Catalina Spataru:	UCL Energy Institute
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UCL Centre for Energy Epidemiology

With thanks to FRISBEE

Caveats

Some of the ‘weekly shop’ is likely to be consumed within hours of purchase.

The amount of milk sold through informal trade has not been quantified; neither have the proportions of pasteurised and unpasteurised milk

No allowance has been made for the existence of refrigerators containing phase change materials that can keep a refrigerator cool for several hours.