uk spectrum policy forum

This SPF-DCMS supported 6G research initiative grew out of two observations:

- **You have to think really *long term* to get significant changes in spectrum use**
- **UK's university research base has a great track record in *long term* wireless research**

The broad aim has been to bring spectrum policy makers and university mobile research community closer together and *6G is a perfectly timed project to tap into the potential synergies*

This series of workshops is amply demonstrating our research strength in wireless – my short presentation is a first drilling down into the long term 6G spectrum opportunities and goals

University of Strathclyde led workshop supported by DCMS and UK SPF

Note: Text in blue – thread of the analysis
Text in black – informative background

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The importance of "mobile generation" changes and the *spectrum* challenges of the coming 6G age

- **Importance of mobile - Today there are 5.2 billion unique mobile users, mobile operator revenues total a trillion dollars and expect to invest $900 billion of capital over the next four years, with 80% on 5G. (Source GSMA)**

- **"Mobile" has and will have a vital role in "mitigation management" of severe disruptions from climate change.**

- **The mobile "generation" change was designed as a powerful collaborative tool between MNO's and their system vendors that reduces the cost and risks of upgrading mobile networks. *It uniquely handles advances that a single mobile operator could not do on its own.***

- **Past mobile generations have had a goal of solving "the problems of their age" or pursuing "a vision". The ones that set out to solve the challenge of their age (GSM/2G & 4G) have tended to be the more successful.**

This seems a good place to start for 6G.

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What are the mobile network challenges of our age?

The very heart of the promise of "Mobile" is <u>coverage</u> and is being challenged by the economics of meeting ever higher performance demands with limited capital.

1. **Widespread coverage** (*of ever higher performance)*
2. **Efficient use of spectrum**
3. **Seamless secure connectivity** (network of networks)
4. **Net Zero target**
5. **Economic viability**

} **Inter-dependent**

No single attribute can be pursued in isolations. The challenge will be finding an optimal trade-off.

<u>These five goals define the boundary of this initiative</u>….

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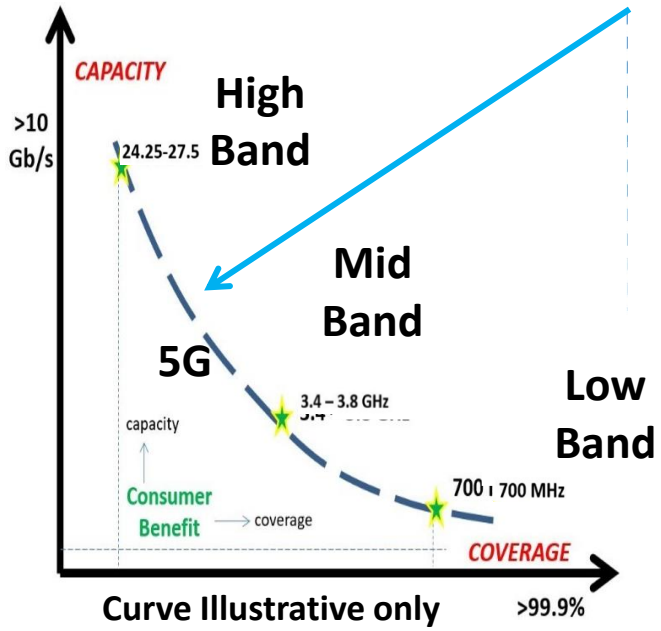
Lessons from Europe's 5G spectrum issues at WRC(15) – Check the spectrum issues before research starts.

Over 2012-2015 the 5G assumption was a single band at 28 GHz

But a single mobile band can never maximise both data rate and national coverage

Important mobile broadband attributes of coverage and capacity pull in polar opposite directions



Curve of Prevailing Mobile Network Economic Limits

The black dashed line was produced in 2016 from Euro5G and directly led to the adoption of the three 5G pioneer bands and a superior 5G spectrum road map

Absolute numbers will vary from country to country but the shape of the curve will be similar

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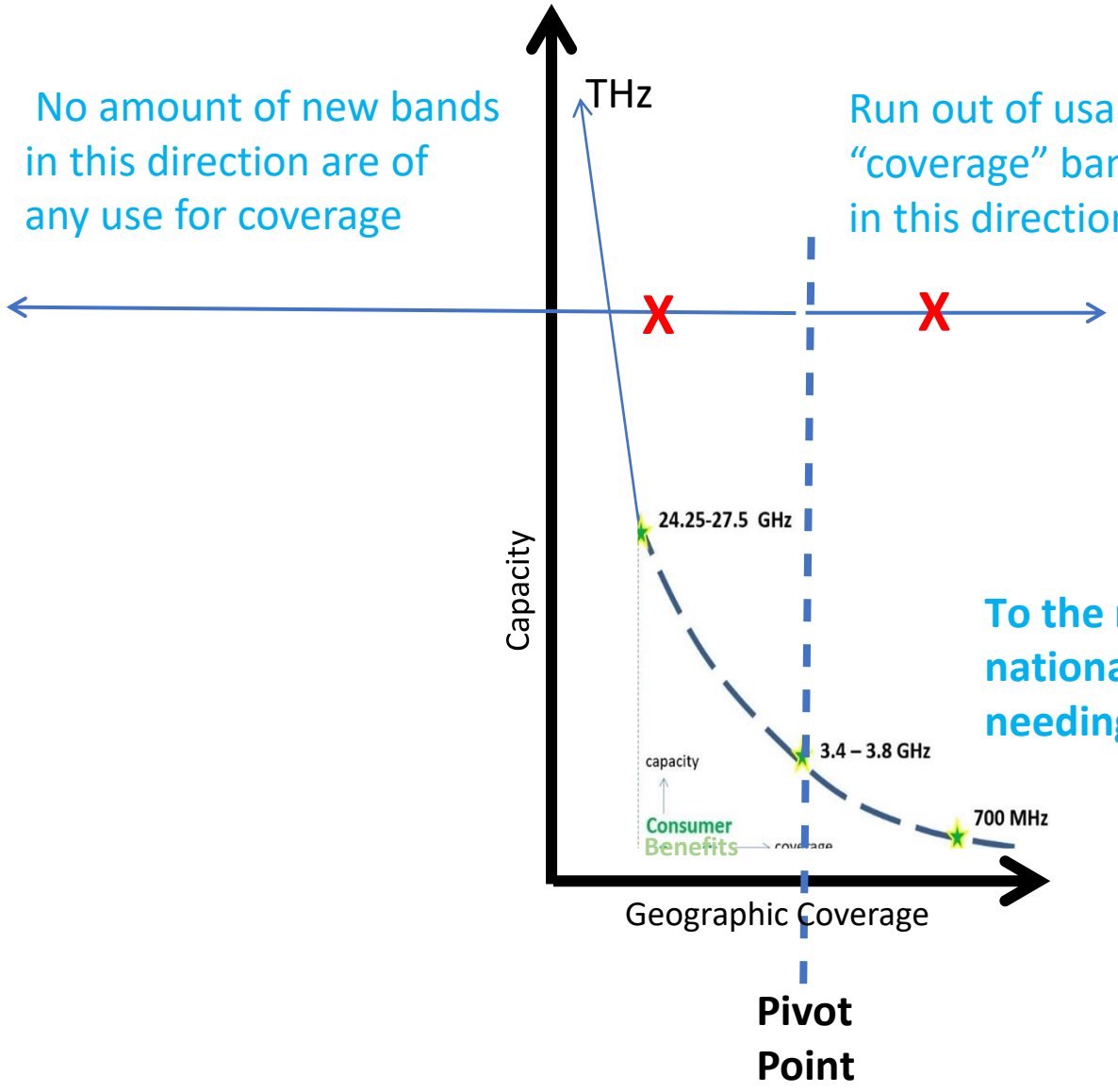
Summary of the 6G mobile spectrum challenges:

THz offer far superior data speeds
but it is no longer "Mobile"

Burden of "Mobile" coverage improvements falls entirely on mid and low bands.



To the right of the pivot point is the national coverage problem area needing to be solved – but how?

Note: Mid-band coverage limitations could be putting massive strain on low bands over large areas by 2030

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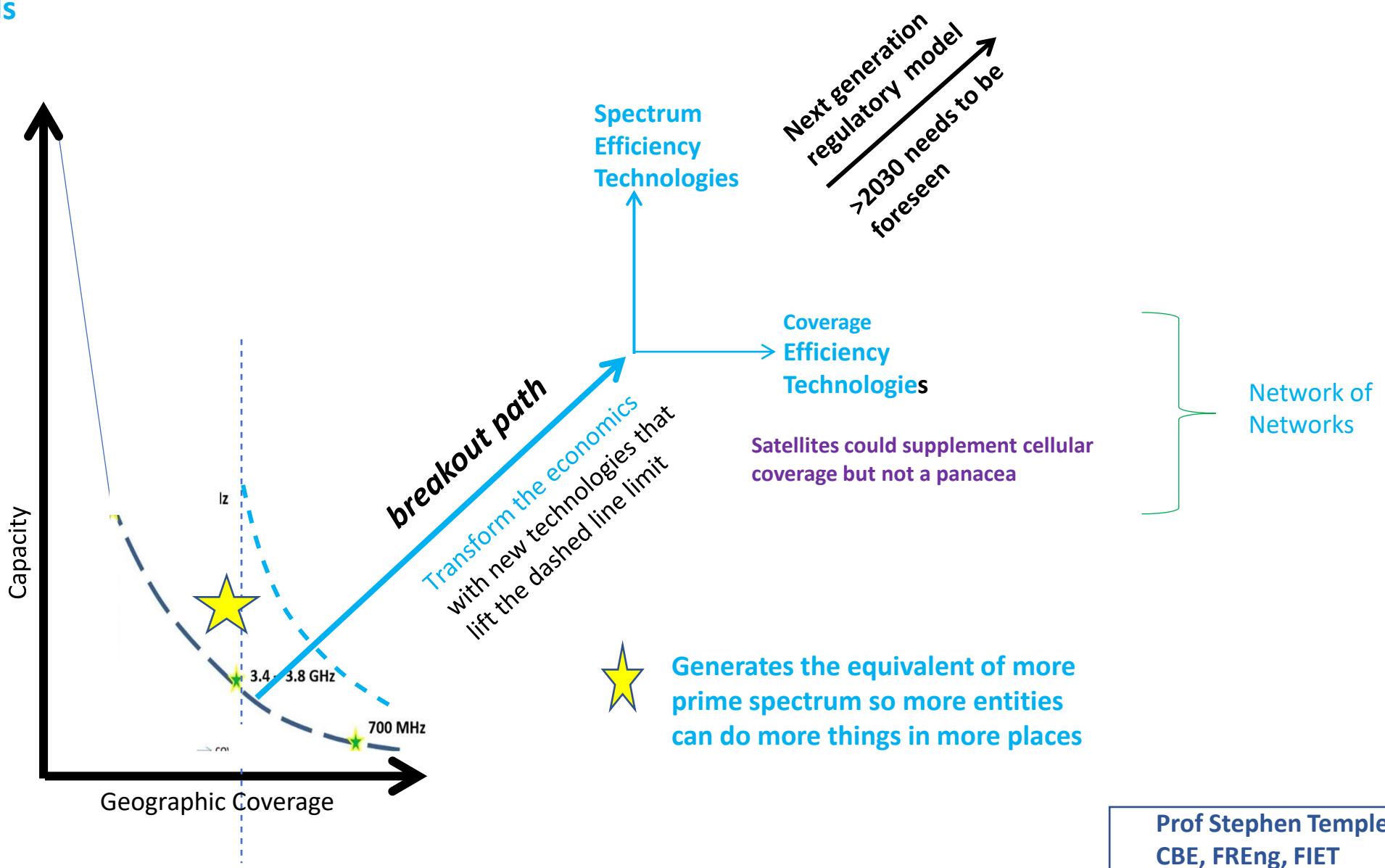
A 6G mid-low band model that ties together the five goals

- New 6G technologies that transform the dashed curve network economic limits



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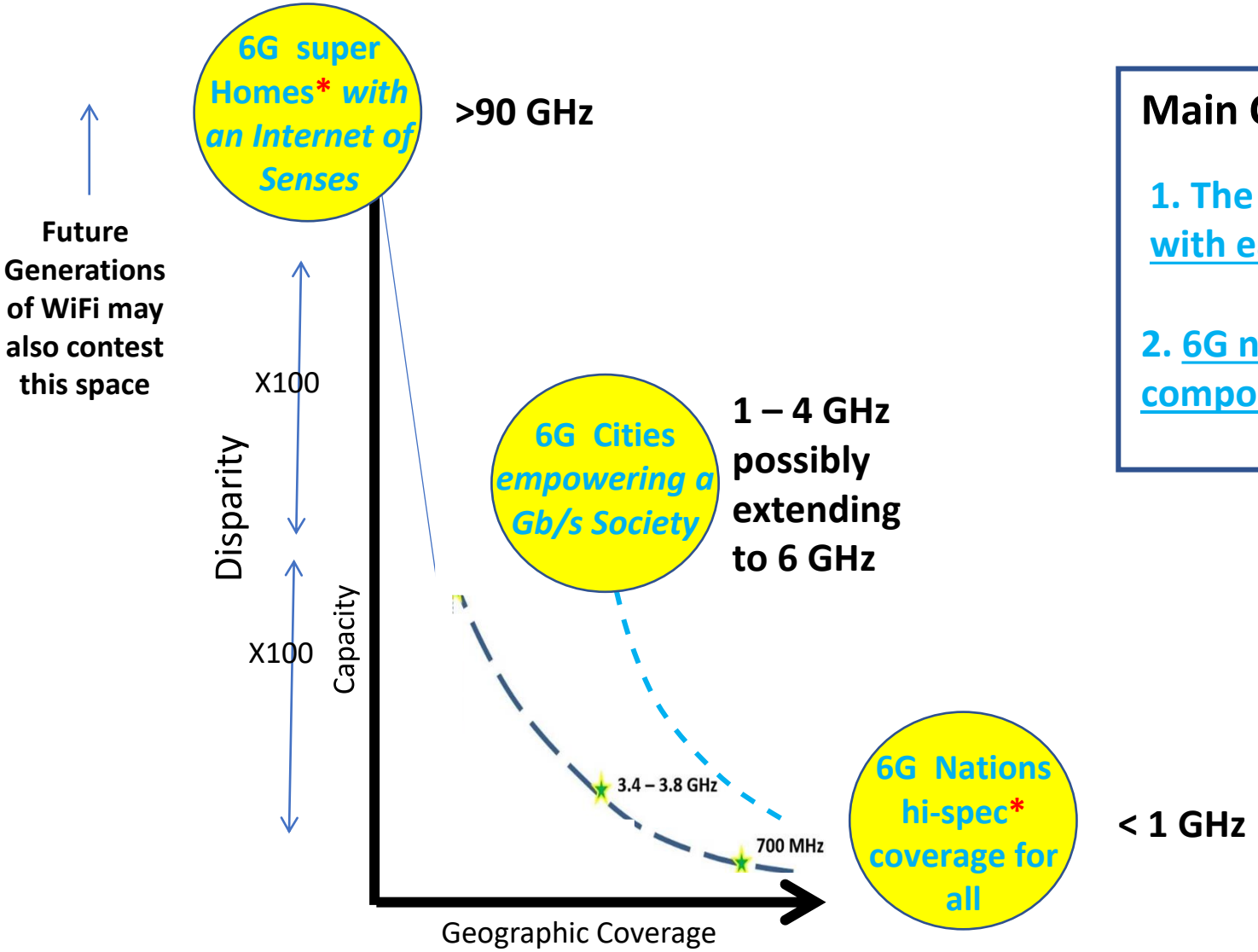
It becomes clear that spectrum choices will dictates the nature of 6G !



Main Conclusions

1. The huge disparity leads to three divergent choices with each needing its own distinct optimisation

2. 6G needs a really strong mid and low band component *to maximise the 6G benefits to all*

Points for industry discussion

*As it is not "mobile", it would be helpful to clarify the THz 6G use cases eg Hybrid Sensing-Communications

* hi-spec coverage (ultra reliable, low latency, high QoS, resilient) may be a better focus than higher speed alone

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Mid to low band 6G would be one component on a larger 6G Canvas but one which the UK can excel at - with its significant strength in its University research base and track record in regulatory innovation