

Energy sufficiency in urban planning and transport: a discussion

London workshop report, February 2019



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eceee's energy sufficiency project is funded by the KR Foundation.

It aims at exploring how we can live well, within the limits.

Learn more at energysufficiency.org.

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Introduction

This workshop was convened at the offices of the Association for Decentralised Energy, Dean Farrar St, London, on 11th February 2019, to discuss how the idea of energy sufficiency applies to urban planning and transport. It is part of the eceee’s ‘Energy Sufficiency’ project, supported by the KR Foundation. The project is helping us think about how to go beyond energy efficiency and to think innovatively about how we can generate sustained reductions in energy demand.

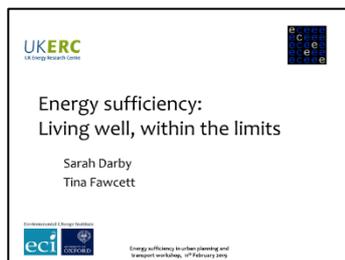
The workshop brought together authors of some of the concept papers developed in this project, members of eceee’s Board, and invited guests representing policy, academic, commercial and third sector stakeholders. We would like to thank the participants for their time and for sharing their ideas. We would also like to thank the UK Energy Research Centre for their support for the meeting, and the Association for Decentralised Energy for hosting.

This report summarises the material shared at the meeting and the discussions that took place. It is a record of comments made and does not necessarily indicate a consensus of views from the group.

Slides from the four presentations given at the meeting are also available.

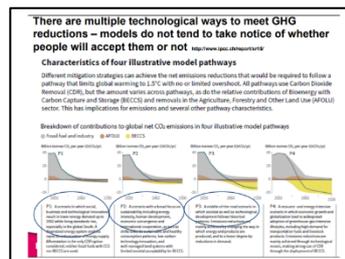
Energy sufficiency: living well, within the limits

Presentation from Sarah Darby and Tina Fawcett, University of Oxford

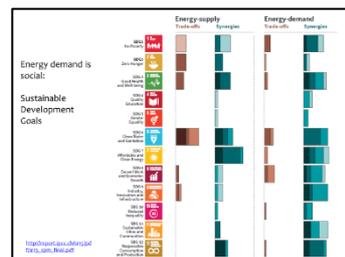


In developing an overall concept paper on what energy sufficiency is, we wanted to keep very firmly in mind two sets of ideas about what energy sufficiency is: sufficiency is about limits but it is also about the good life, about having enough.

In overall global policy terms, we should be thinking about the Paris Agreement and the Sustainable Development Goals together. In practice, when we are seeing these two sets of goals being negotiated, they are being negotiated in concert.



Whatever we are coming up with in terms of sufficiency, it is not going to succeed unless it is acceptable to most of the people, most of the time. These graphs here are from the IPCC scientific report produced last Autumn; the latest scientific information about pathways to bring down our climate risk to a level at which we have a fighting chance to stabilise the climate. From left to right, the scenarios become less ‘sufficiency friendly’. On the right, we have a scenario where we continue as we do now, and compensate with a large amount of Carbon Capture and Storage. Whereas on the left it is much more about adapting our way of living considerably so that we don’t need negative emissions technologies, which are largely untried and likely to be a good deal more expensive than prevention.

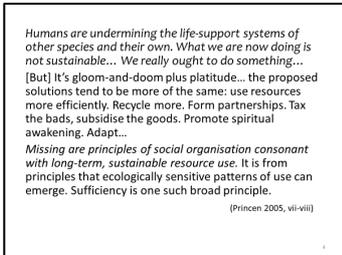


This slide shows how Sustainable Development goals interact with energy. It shows a selection of the 17 sustainability goals, and where there may be synergies and trade-offs. Trade-offs means that some advances - in decent work and economic growth for example - might have negative effects by increasing energy demand and hence climate impacts. For example, clean water and sanitation

seems to cause some big question marks in relation to energy supply and also some in relation to energy demand.

Looking at the energy demand side: you can see the large number of estimated synergies with the sustainable development goals. It is good to bear in mind the aspirations of billions of people to live better lives and what that means in terms of energy demand, energy supply and not just energy but also the associated materials, impact on land use and so forth.

Suggested reading for those new to the topic of energy sufficiency: Thomas Princen, *The logic of Sufficiency* (2005), MIT Press.



This slide is quoting from it: he is saying that we are in a crisis globally, we cannot keep on doing what we are doing. The solutions we are coming up with are all nice; all worth doing but they are not enough. So what can we do?

What Princen says is that we have to work out principles of social organisation, to think about how we organise ourselves as humans on this planet to make a decent life. He spends some time on three case studies:

- Lobster fishers in Maine, who clearly have a shared interest in managing their reserves sustainably;
- Toronto islands in Lake Ontario, with a lovely way of life and people want to hang to that and not have lots of cars and modern development spoiling it;
- Oregon, a forestry company managing on sustainable principles.

In this third case study the point is made that Europeans carved their way across the United States despoiling it as they went, acting as if there was no tomorrow. Then they reached the Pacific and there was no frontier any more and even so they laid waste to the forests there. We cannot go on acting as though there will always be a new frontier out there; as though there will always be more...

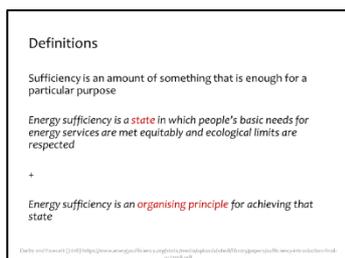
What he says in the third paragraph on this slide, those principles of social organisation, are really important for today, when we are thinking about planning in particular. How are we going to plan for a world within limits?



Looking next at Kate Raworth's ideas as set out in her book, *Doughnut Economics*¹. She is quite a contrary voice in the economics world, attempting to get economics rethought. Her idea can be visualised as a doughnut. On the outside: all the planetary limits. On the inside: the 'good life' limits – all the things we need to make life liveable. The space in between those, the doughnut itself, is the good place to be; what she calls the safe and just space for humanity.

The boundaries on the outside: we are told what they are by scientific experts and we have to assume they know what they are talking about. Whereas the inner ones are much more subjective and depend on how you make judgments on equity in a good life.

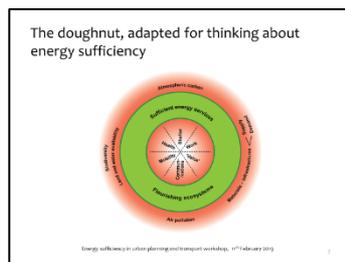
We think this is a powerful image and so we built much of our concept paper around this. We also used it to think about what the definition of sufficiency might be.



Sufficiency means enough for a particular purpose, so you have to think about what the purposes are. If you translate that into energy terms, we are looking at this in two ways: sufficiency is a state in which people's basic needs for energy services are met, whilst at the same time where

¹ <https://www.kateraworth.com/doughnut/>

ecological limits are respected. We are also saying, following on from Princen, that it is an organising principle for achieving that as well.



And so this is the ‘energy doughnut’; the translation into energy terms. We are thinking particularly in terms of pollution from energy related emissions, biodiversity and land-use implications, atmospheric carbon, and materials (which tend to be given less attention, but there are important materials issues, particularly when we start thinking about smart energy systems). On the inside, we have some of these important life quality issues as well.

Distinguishing between needs and wants

There are complex and long-standing debates as to whether there is a distinction between human needs and wants, and if so, how this can be defined.

Key themes:

- whether human needs have any universal or objective features;
- what an account of human need should look like, with different approaches to
 - material and non-material necessities
 - absolute and relative norms
 - expert and public/lay¹ judgement about what are necessities.

Distinguishing between needs and wants is a challenge. ‘Basic needs’ implies not everything that human beings want is equal; some things are more important and hence are considered basic needs. This leads on to the debate about whether you can distinguish between needs and wants, and this is a long-standing debate. Some of the debate is quite philosophical and some is focused around quite practical, policy development work, e.g. how to set benefits levels for unemployed people.

We cannot settle this debate in this work, but we can consider some of the key issues. One of the important themes in the debate tends to be whether there are some things that all humans want (that are universal). In the sustainable development world, people tend to say that yes, there are things that all people need. Another key theme is what would an account of human need look like? Should it talk about material necessities only, or also about non-material things, e.g. ‘voice’ – having a say in society. Also, can you have relative or absolute norms? For example, the need for warmth could be defined in terms of an absolute temperature, or in terms of maintaining health, or in terms of feeling comfortable. And then the question of whether you have expert or lay judgment about what is necessary; who says what’s necessary?

Empirical research on needs and wants

The ‘Minimum income Standard’² is calculated by specifying ‘baskets’ of goods and services required by different types of household.

“A minimum standard of living in the UK today includes, but is more than just, food, clothes and shelter. It is about having what you need in order to have the opportunities and choices necessary to participate in society.”

A participatory method is used to determine what is necessary for different groups in society, and this is revisited every two years. Most items regarded as ‘needs’ have been stable since 2008.

JRF

As a way to make progress on this, we looked at how people have considered this empirically. The Joseph Rowntree Foundation commissioned work from the University of Loughborough² to look at how we could set a minimum income standard. They have calculated this based on baskets of goods and services required by different types of household.

It is interesting to think about their definition and how it fits with our sufficiency definition. Their definition is that a minimum standard of living in the UK today includes, but is more than just, clothes, food and shelter. It is about having what you need in order to have the opportunities and choices necessary to participate in society; so it is a social definition as well as an individual one.

Using this definition, they worked out a participatory method to determine what is necessary for different types of household. They do it separately for single parent families, for two parent families, for retired households, for couples and single people without children. They get people within each of these groups to have a debate about what is needed and then they add it all together to come up with what is necessary for having your needs met and to participate in the things that are normally thought to be needed. This work is revisited every two years; and it is interesting to see that most of the things that are thought to be needs have stayed quite stable over the past 10 years. People are asked to talk about why they think things are needs or wants, and so you can see why they are making the distinction.

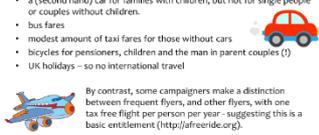
² For more information on this work, see here: <https://www.jrf.org.uk/report/minimum-income-standard-uk-2018>.

Transport needs

MIS discussions about transport identified the following as needs:

- a (second hand) car for families with children, but not for single people or couples without children.
- bus fares
- modest amount of taxi fares for those without cars
- bicycles for pensioners, children and the man in parent couples (?)
- UK holidays – so no international travel

By contrast, some campaigners make a distinction between frequent flyers, and other flyers, with one tax free flight per person per year – suggesting this is a basic entitlement (<http://afreeride.org>).



Looking at how people thought about transport in this minimum income standard. People thought of the following as needs:

- A second-hand car for families with children, but not for single people or couples without children
- Bus fares are needed,
- A modest amount for taxi fares for those without cars,
- Bicycles: only more recently included for older people – they seem to have become more ‘needed’, which could perhaps link to increasing concern about health. They are needed for children and for the man in family households... it seems that the woman is expected to drive the car and the man to ride a bike...
- UK holidays only. There was no international travel within their definition of need. It is interesting to contrast that version of need with the current campaigns about people flying less – people are talking about being ‘allowed’ to have one flight per year before prohibitive taxation would kick in – this is a different view of ‘need’. This is perhaps because the two have different perspectives: in the JRF work people are thinking about what society should support whilst in the other debate, the starting point is ‘how can we stop these rich people flying everywhere?’

From concept to implementation: some energy sufficiency issues for planners

How do needs for energy services (consumption differ in regions/areas with different ecosystems and social conditions, and what does that mean in terms of equity?)

At what scale(s) is sufficiency most effectively addressed – neighbourhood, city region, nation, continent? How do answers vary according to whether we are talking about built environment, supply or transport infrastructures, social norms or appliance standards?

What timescales does sufficiency operate on? Some energy-consuming and generating activities are more time-sensitive than others.

How might sufficiency policy address dynamism and uncertainties of product and system development?

This research is about the idea of sufficiency, but it needs to be turned into something more concrete if we are going to act on sufficiency. These are some of the things we might want to think about:

- If you have a general overview, how does this differ between regions and areas, both in terms of the environmental impact and in terms of the social conditions, and what does that mean?
- At what scale is sufficiency most effectively addressed. With the doughnut we have this radical scale difference – the centre is individuals and the outside is the whole planet. Clearly policy has got to find ways of doing things while operating on many different scales – it can’t just be individuals or the whole planet. So, how are we going to go about doing this?
- The next theme is timescales. Some activities are more time sensitive than others, and there is lots of concern at the moment about flexibility, particularly as we think about integrating renewables into the electricity system. Does that have implications for sufficiency at all?
- Finally, how might sufficiency policy address dynamism and uncertainty affecting product and system development? It relates in some ways to timescales, in the sense that the products and processes within the system are all evolving at different paces, giving the dynamism aspect which in itself generates uncertainties. You have to add political uncertainties to this too.

One aim of the paper is to think about whether, and how, is sufficiency different from sustainability. There is quite a degree of overlap and we should consider whether we are saying anything new. We think that we are. We think that there are new things that sufficiency opens up, and this slide is to illustrate this.

Towards a flowering of energy and planning policy

Energy sufficiency in urban planning and transport workshops, 17th February 2019

The centre is the main elements of sustainable energy policy. The petals around the edge are the new elements that we think sufficiency brings in to the picture, including things like non-energy policy; changing the use of time and

therefore the energy implications of how we go about living; sufficiency actions – living differently, perhaps voluntary simplicity.

But we think this is very open for discussion. We are interested in what people think about the degree to which energy service sufficiency really does bring in a broad set of ideas. Are we talking about the right things, and are there other things that you would bring in to the discussion?

Discussion 1

Would a focus on needs be consistent with meeting climate goals?

Modelling at the University of Surrey suggests that people whose lifestyle is focused on meeting ‘needs’ have carbon emissions 38% lower on average compared with people with ‘standard’ lifestyles. This is interesting, but note that it is nowhere near enough to meet the Paris Agreement target.

There is work by Julia Steinberger³ at the University of Leeds that looks at the resources needed to support different levels of development around the world. At some level of development, there is a saturation level that is approached.

What does the work on minimum income standards tell us about sufficiency?

It is interesting that the work on the minimum income standard in the UK came up with the idea that a car was needed. This is about the technology, but isn’t sufficiency about the level of mobility that is needed to get to work, for example? And about whether or not overall mobility needs to be limited. Isn’t this the main quantitative element of sufficiency: how much overall mobility is allowed per household to answer all the different types of need?

The UK minimum income standard discussion is about what is needed to do socially normal things at a point in time. A car wasn’t included previously, they came in more recently for family households because there is a perception that bus services are not good enough any more to achieve these socially normal activities (e.g. for children to be taken to a swimming class after school) and that if a family did not have a car, children would miss out on these socially normal activities. Whilst the research is carried out in one specific area of the UK (the Midlands), the perception of the people involved was that this was something that was generally needed, in all areas of the UK.

So, this is not normative. It is about how society is currently organised. The policy response could be ‘what do we need to do so that you don’t need a car’. And the research in the UK is about what people judge is required in the current situation to meet needs. It is not about how things should be, ideally. But it is a nice way to illustrate that people can have a discussion in which they do distinguish between needs and wants.

Questions about definition and scope

From the implementer point of view, what is the difference between energy sufficiency policy and energy efficiency policy? The criteria outlined in the presentation could apply to energy efficiency or energy sufficiency.

It is really hard sometimes to differentiate between sufficiency and efficiency: can we think about light and daylight in this respect? We don’t think about whether or not we need the lights on, unless someone says, ‘OK, let’s switch off the lights’. A building is a system: if this allows for daylight, then that system allows for the service for us to be sufficient, in terms of

³ <https://environment.leeds.ac.uk/see/staff/1553/professor-julia-steinberger>

artificial light. But if the building does not allow this, then we probably don't even realise that there is this alternative available. So it is a matter of system design.

One question we have thought about in the sufficiency project is what we mean by 'energy services'. All goods and services require energy, but what should be in the scope of what we think about? For example, if you change your diet this could have significant environmental implications, but that is not within the scope of what we are doing here, at the moment.

There are trends that lock in energy demand and carbon, for example new buildings are being built that will be intolerable to live or work in without the use of air conditioning. Once the system is there, it will be used. It is happening even in countries like the UK, where it might be totally inappropriate. But is this a matter of sufficiency, or simply of poor system design? There is an overlap, but you do have to have an idea of what is a thermally comfortable space. The idea of sufficiency can perhaps help us to think through things like this.

Can we talk about limits?

To what extent are we talking about limits? Is this a limit on the services we demand or on the energy we use to meet those demands? Or is it a limit on the carbon that can be emitted? Talking about limits is very difficult politically, as it runs counter to the logic of capitalism. But as soon as you move from discussing efficiency to discussing sufficiency, you do get in to politics. It is easier to focus on sufficiency actions than on limits.

There may be times when we can talk about limits. For example, if we think about the 'slow' movement: there is a growing sense that our assumption that it is always better to go further and faster is actually having a negative impact on a lot of people's lives. And that life is both more sustainable and more enjoyable if we can slow things down. If you are travelling in London, you don't just have to think about cars, buses and trains once you start getting serious about getting cycling and walking infrastructure in place. There are social capital and quality of life spin-offs from this that people are interested in and will vote for. And this is where we come to the discussions we have been having in the project about the nature of the energy service that is being demanded. Should we be measuring a need for mobility? You don't really need to move, you need to get access to the activities you want to take part in.

Thinking about the gilets jaunes in France: they are demanding access to cheap fuel; but this demand is actually the result of a failure in land-use planning. In delivering services close to where you live. Or a deliberate choice to move services away from homes.

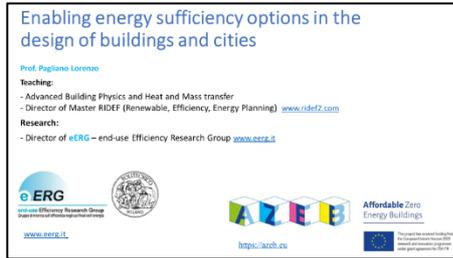
When we think about limits, perhaps we can look at examples of people who are taking action which implies that they recognise limits, but are perhaps doing it without explicitly thinking about this: for example, people who participate in online food marketplaces which are set up such that none of the food comes from more than, say, 100km from where the buyer lives.

We have an ability to understand that sometimes we are given an oversized service. But to do this, we need to question things that we are routinely given. The system sometimes blocks us from seeing what sufficiency could be. We assume we need things because that is what we have always had. Also, if we haven't got the option to do things differently, we are constrained in our choices. So, we need to think about much broader policy than just energy policy.

This implies we need to think about timescales for how we can make the transition, given that our infrastructure will need to change, as will the way we live. We have to understand whether what we are asking for is realistic, but at the same time we have to be challenging.

Enabling energy sufficiency options in the design of buildings and cities

Presentation from Lorenzo Pagliano, Politecnico di Milano



Thesis:

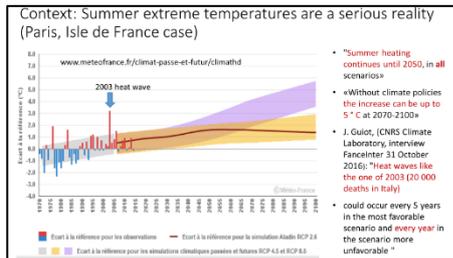
- Sufficiency (efficiency) actions by individuals are possible ONLY if options / infrastructures / legal frameworks for those actions are created by a collective choice (City, national governments, regulators, standardisation bodies)
- Sufficiency (efficiency) actions in buildings are strongly connected with enabling/hindering conditions in cities

The presentation addresses two issues: how do we define needs associated with comfort? And how do we respond to needs technically and culturally?

Sufficiency actions by individuals are possible only if the options, the infrastructures, the legal frameworks, created by collective choice are in place. I am very much in favour of individual actions and choices (I personally have not taken

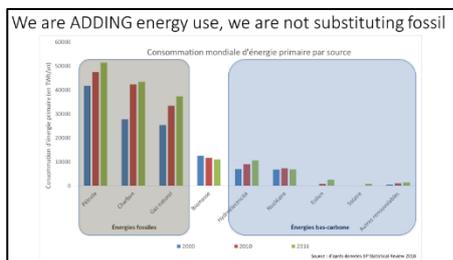
an aeroplane in the last 20 years) but I think that is not enough.

Linked to this infrastructure point, I suggest that sufficiency (and efficiency) actions in buildings are strongly linked to the city conditions that surround the building.



Looking at the use of air-conditioning: this slide shows data from Meteo France, showing the departure from pre-industrial temperature levels in Paris, including the heat wave of 2003. Whatever we do to 2050, temperatures will continue to increase. So, we have a choice: we can do something, bend the curve and stabilise the climate or, without policies, there will be an even greater temperature increase.

Heatwaves like the one of 2003 do a lot of damage to people, across Europe. In the best case, these could happen every 5 years; in the worst case, every year. The way we plan cities and buildings should take this into account.



Alongside this, despite the rapid growth in the use of renewables, fossil fuel use is still growing much more quickly. Every year we are adding new energy consumption, both fossil and renewable, to the total energy use.

The whole issue of sufficiency needs to be framed by these two boundary conditions: the rapidly changing climate and the fact that despite all the technological and cost advances in low carbon technologies, we are not yet decarbonising.

So, interactions between buildings and cities...

Sufficiency actions in buildings →	Summer night ventilation (vs. AC Conditioning)	Summer night ventilation (vs. AC Conditioning)	24°C/22°C per capita (vs. 22°C)	Adopt "sufficient" mobility modes (e.g. walk, public transport)	Line drying and water (vs. water saving)
In order to perform sufficiency actions, inhabitants would need:	Climate at night: clear sky	External air temperature > 22°C	Personal comfort (no need for artificial cooling)	Easy access to services (shops, work, independence for children and elderly)	Well designed spaces for line drying (water saving devices)
Presently cities create conditions:	noise, mainly from cars and motorcycles; PM2.5, PM10, pollution and other air contaminants	asphalt, city canyons	inhospitable districts, obligation for car parking spaces in buildings, free car parking on streets	distance between functions: unsupportable risks for cyclists, pedestrians, handicapped	Dust in air
Cities should offer inhabitants:	24°C/22°C residential activity zones at 20 or 30 km/h	white/cool surfaces; Geometries facilitating air movement; Water surfaces	walkable, cycleable districts; green spaces; spaces for playing, spaces in the building for common activities	Available access to green spaces, water, pedestrian routes	Information campaigns on water saving devices, and on the high quality of drinking water from the tap
Legislation and Regulation should ensure:	Objective and flexible standards for energy use (e.g. in Switzerland)	Minimum requirements for green spaces of common spaces for meetings	EPBD (and National Built codes)	Water saving devices for toilets, showers, washing machines, etc.	

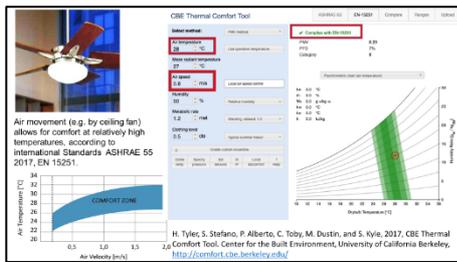
There are a lot of connections shown here; I will focus on the red ones.

So, let's say we need sufficiency actions in buildings: for example using ceiling fans rather than air conditioning; using night ventilation; reducing the space per capita; and a range of other things like line drying (drying a kg of clothes uses 5 times more energy than washing it).

For night ventilation in summer, I must open the windows. This means I need a city which is quiet; I need clean air and so maybe I need cities and national regulators to help me to have these. For example with car free residential districts. And legislation could also help me to understand what is a comfortable environment.

We are often pushed to overdo the technical conditioning of spaces. This has to do with how we define the need for comfort. As well as silence and clean air, we need cold air at night. So we need cities that are not 6 degrees hotter than the surrounding areas. So we need to define what surfaces there should be in the city.

For mobility, we need the possibility to ride a bike without being a hero; and we need a space for keeping the bike in the building. We also need devices and spaces to enable line drying.



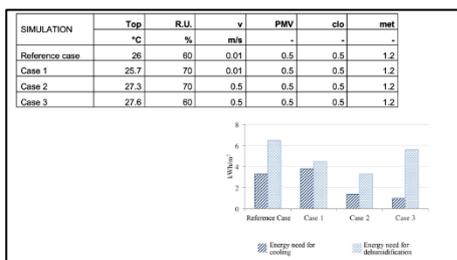
Coming back to comfort: we now have a number of standards that we have been working on for the past 10 years. The aim is to open up the discussion, when in the past comfort has been codified in only one way.

You get one set of standards from interviewing people in a laboratory setting, but we have newer standards of adaptive comfort, which come from interviewing people in real buildings.

I do not have time to explain the detail of how this standard is derived, but let us look at some examples. Air velocity: we know, but perhaps the public and the designers of buildings do not know or accept, that if you change air speed using a ceiling fan, a higher temperature will be within the comfort zone for people. This is a long-standing, accepted comfort model. And it is what we find when we interview people. But it is not what we find in design and operation of most buildings today.



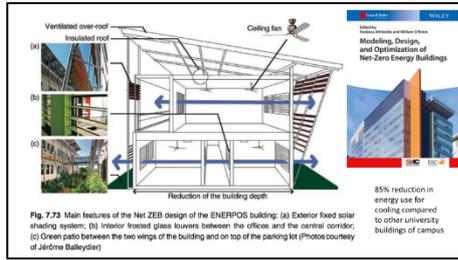
Then we have the issue of humidity. ISO 7730 tells us that humidity has almost no impact on comfort across a wide range of temperature and humidity levels. Yet, we often condition space to achieve close to 50% relative humidity because we assume that this is really important for comfort. This assumption is wrong, and we have known this for a long time.



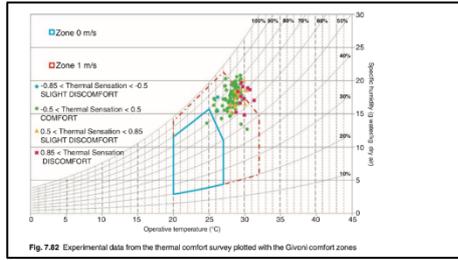
What are the implications for energy use? Taking the reference case of a PassivHaus – an already very efficient building with solar protection, so the energy need for cooling / humidifying is already very small (10 kWh/m²/yr).

If we move to higher temperature, humidity and air velocity, we can maintain comfort and cut energy use for cooling in half, even in an already very efficient building.

So, if we redefine the need for comfort we can change greatly the way we use energy and indeed the way we design the system – if I change the way I control humidity, then all the equipment will be smaller, less costly and so on.



This is one example of how this can be done. It is a university facility in La Reunion, in a warm and quite humid climate, close to Madagascar. There is cross ventilation and there are ceiling fans, so air velocity is part of the concept. There is solar shading and there are green surroundings with no cars.



The interviews with students showed that at a temperature between 28 and 30 degrees, most students report comfort according to the standards, with some reporting slight discomfort and some reporting discomfort once the temperature exceeds 30 degrees.



So, how do we plan for these things in the different contexts of various European cities.

You need to protect from insects – which is not difficult! You need quiet and you need clean air. Here is the River Seine in Paris, and how it is developing.



This is a residential area in La Reunion again. All the apartments are designed with solar shading and cross-ventilation and, again, no cars. This is nothing new.



And we have had solutions for ventilation whilst maintaining security, also for a long time. But we seem to have forgotten this.

- Swiss regulation (SIA):
- Winter: high thermal insulation levels, high performance windows...
- Summer: active air conditioning systems are authorized only after verification that building envelope has been done right (thermal insulation, thermal mass, solar protections, night ventilation)
- City of Zurich verifies (via the public energy utility) the peak summer demand and compares with AC authorization

In Switzerland, you can only have a permit to install an air conditioning system after you confirm that the thermal performance of the building envelope is correct. That you have thermal insulation, thermal mass, solar protection to a certain level and the possibility for night ventilation. Only if this is not enough for the way the building is used, then you can install some air conditioning.

The less than optimal things are possible because there is no framework for guiding architects to a different kind of architecture. And architecture is a challenge with limits.

You design a building for a given space, for a given use, etc. Within these limits, the architect applies their creativity.

The city of Zurich verifies, via the public utility, the peak summer demand of every building and compares it with the authorisation that the building has. If there is a high peak electricity demand in the summer, do you have the authorisation to have air conditioning installed or not? So, I think, after 20 or 30 years of market-based policies, we have to go back to regulatory policy, designed through a democratic process, through collective choices and with a policy choice on what are the things that we should do.



Solar protection of public spaces for outdoor comfort and for enabling ventilative cooling

We can install solar protection on individual buildings by ourselves, but public spaces can be protected also if there is a public choice to do so.

Public spaces can be occupied by cars or can be cool places for playing and so on.

Sometimes there is an argument that this thinking is doing away with technology and innovation, it is a regression to a place where there is no technology.



ENERGY STAR Most Efficient 2018 — Ceiling Fans
Haiku K3150-X2-PW-04-03-C

- Passive Infrared presence sensor turns off the fan when room unoccupied
- Remote control via smartphone
- Aerodynamic design (10 times less energy use than a conventional fan, already low)
- Accurate mechanical balancing of blades ensures silent operation

That is clearly not the case. It depends on how we want to apply our intelligence. We can put it into simple devices with a lot of sophistication in how we design them.

This fan will turn on when the room is occupied; you can use your smart phone to control it; the design includes energy use reduction through aerodynamics, based on aircraft design.

Note also the multiple benefits of such design. Noise is minimized: compare this with a lecture theatre that is air conditioned where the lecturer has to have a microphone and speakers, otherwise they cannot be heard over the noise of the system.



Reduction of insulation around the body, as evaluated by ISO7730 e EN15251

- Flexible clothing code (i.e. Japan, ONU, Turin Bank...)

- Chair with low thermal resistance (ISO 7730)

We also need to think about the clothes we wear, but this has cultural elements (for example, in Italy, you should wear a tie...). But you can also design furniture so that the insulation it provides to the body is lower.

We could also have air conditioned chairs (being tested at UC Berkeley now), so you have local ventilation.

Going back to the city level. I have said that we need clean, quiet cities, with low temperatures.

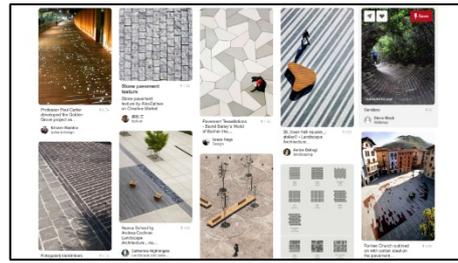
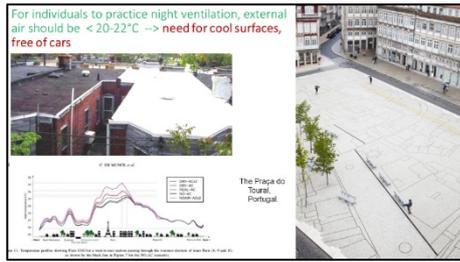


Milano to add 3 million new trees by 2030

- current green canopy in Milano is just 7% of the urban area.
- Frankfurt at 21.5%, Amsterdam at 21% Paris at 9% (World Economic Forum's Green View Index).
- By 2030, Milan hopes to increase that green canopy number to > 17%.
- This aims at lower temperatures in a city where the night-time temperature can be 6°C higher than in the surrounding area. City statistics show Milan endures 35 tropical nights (> 20°C) a year.
- Is this sufficient, timewise?

Taking the example of Milano. The city is claiming that it will add 3 million new trees by 2030. There are abandoned spaces that will be converted into offices and residential areas with green spaces. But probably the biggest intervention like this in the next 30 years will add 15,000 trees...not 3 million...

How can we go from 7% to 20% green areas; and will it be enough to counter the increasing number of tropical nights in the city? We will need to reduce the space given to cars.



We also probably need cool surfaces, like this white piazza. Surfaces that don't warm up with the sun. We can have these on roofs, but it does also need space. Space which is now occupied by asphalt and cars. I don't see a solution for cities that does not involve getting rid of perhaps 80% of the cars we have now. And we can do beautiful things in spaces liberated from this mass of metal.

Technologies are emerging that are changing cars – they will be electric and it is assumed that they will not pollute. But from what I know this is not true.

Table 6: Comparison between conventional PM₁₀ emissions, EVs, gasoline and diesel ICEVs.

Vehicle technology	Engine	Type wear	Brake wear	Road wear	Exhaust emissions	Total
ICEV	0 mg/kWh	2.2 mg/kWh	6 mg/kWh	8.2 mg/kWh	61.6 mg/kWh	78.0 mg/kWh
Conventional BEV	1.1 mg/kWh	6.1 mg/kWh	9.1 mg/kWh	7.5 mg/kWh	0 mg/kWh	34.8 mg/kWh
Conventional ICEV	2.4 mg/kWh	6.1 mg/kWh	9.1 mg/kWh	7.5 mg/kWh	61.6 mg/kWh	87.7 mg/kWh

Table 7: Comparison between conventional PM_{2.5} emissions, EVs, gasoline and diesel ICEVs.

Vehicle technology	Engine	Type wear	Brake wear	Road wear	Exhaust emissions	Total
ICEV	0 mg/kWh	2.7 mg/kWh	6 mg/kWh	3.2 mg/kWh	11.6 mg/kWh	23.5 mg/kWh
Conventional BEV	1.8 mg/kWh	2.9 mg/kWh	2.2 mg/kWh	1.1 mg/kWh	0 mg/kWh	8.0 mg/kWh
Conventional ICEV	2.4 mg/kWh	2.9 mg/kWh	2.2 mg/kWh	1.1 mg/kWh	11.6 mg/kWh	20.2 mg/kWh

Presently, electric vehicles emit around the same amount of PM₁₀ and PM_{2.5} as conventionally fuelled vehicles designed to the latest standards, because these emissions come from tyres, brakes, and dust from all sources on the ground that is resuspended by the movement of cars on the road.

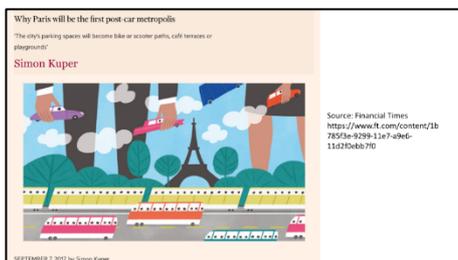
And of course the occupation of space is the same.

These sources of emissions are proportional to the

mass of the vehicle and the mass of vehicles is going up – which is also leading to a rise in pedestrians killed in accidents.

We have a unique, historical opportunity to discuss the car dominance and car dependence in our cities and territories. We should not give up this challenge for a slight improvement in emissions with no change in the amount of space occupied, with no change in the major cause of teenage deaths.

Of course there is also the issue of how we manage renewables and the fact that energy can be stored in car batteries. But more electric cars will mean more fossil fuel electricity generation for the next 20 or 30 years. Given the urgency of what we are facing, I don't think they are the solution. We can store energy in the thermal mass of buildings if we insulate them, then we don't need batteries. And we don't need to carry 500kg of batteries around the city for that. The strong push for electric cars as a magic bullet from some in the environmental movement is very worrying in this respect.



It is good to see a city like Paris changing slowly. The space for cars in some public places is being reduced, and the amount of parking in the centre is being reduced. The newspapers are saying that Paris will be the first post-car metropolis. Whether or not this will happen is debatable, but there are positive changes. For example, the 'Plan Velo', progressing on time and developing new bike lanes, in some cases taking more space than what remains for cars.



We have to learn to use this new type of city. But it can be done, and it requires quite low investment. In the 60s, the idea was to cover La Seine with a highway, and now La Seine is part of the pleasure of being in Paris. And the Place de la Republic is a pedestrian space.

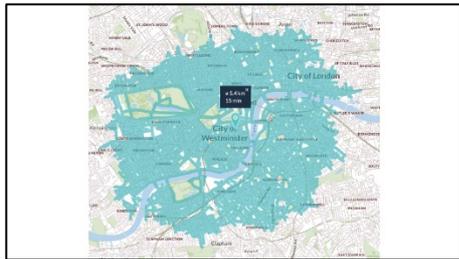
»Sufficient« mobility actions require infrastructure

- Proposed Amendment 405 to EPBD:
- «a Member States shall ensure that in all new buildings and in all buildings undergoing major renovations, at least a space for bicycles, cargo-bicycles, e-bikes, pedelec, walking frames, wheel-chairs and push-chairs is created: the space shall be common, covered, theft-protected, free of architectural barriers and proportional to the number of users of the building.»
- Rejected at the ITRE meeting on October 11, 2017, included in milder form in recitals

The recast EU Energy Performance of Buildings Directive for the first time includes a reference to mobility, in particular it specifies that each building should have a charging infrastructure for electric cars. This is not a technology neutral choice, as it specifies one way of decarbonizing mobility and one way of meeting mobility requirements.

The alternative proposal made was to include space for bicycles and wheelchairs, which was rejected by the Industry Committee, and the recitals include something more vague.

Space for the infrastructure for sufficiency actions needs to be there from the beginning and throughout the system. Many cities are still requiring car spaces in new developments. This is being abolished even in some US cities and I hope it will in Europe also.



There are data from the UK on how many young people have a driving licence, and this is going down. It seems it is not needed so much any more, it is not so much the dream, because you can be independent differently. For example, this slide shows where we are now, and where you can get within 15 minutes by bike.

In Switzerland, faucets and shower-heads with low water flow (with the same apparent volume as it is mixed with air) are certified by laboratory measures with labeling.

Low flow is e.g. mandatory in Portugal.

Class	Standard water volume
Class A	4 to < 6 litres/minute
Class B	6 to < 8 litres/minute
Class C	8 to < 10 litres/minute
Class D	10 to < 12 litres/minute
Class E	12 to < 15 litres/minute
Class F	15 to < 18 litres/minute
Class G	18 to < 21 litres/minute
Class H	> 21 litres/minute

Soffione da doccia con aspiratore d'aria.

Air intake due to Venturi effect

Regolazione e limitazione di flusso, con risparmio fino al 50%.

Category	Percentage
Miscelatori	50%
Sistemi doccia	40%
Termostatici	50%
Sistemi di stoccaggio	50%
Rubinetteria speciale	70%

Primary Energy for SHW [kWh] - two scenarios	
Zone	Standard building
School	6337
College	2527
Minimum solar panel area [m²] - two scenarios	
Zone	Standard building
Entire building	0.1
Service	Standard building
Boiler	2381
Solar Panel	3350
Water tank	3360.8
TOTAL SAVING	10185 €

Finally, I can choose to have my low flow shower-head, because there is a label that allows me to know what I am buying. In Ecodesign, we focus on things that use a lot of energy, but forget some things that can save energy.

Line drying requires infrastructure and clean air

- E.g. Venice
- E.g. Pereira building from Gaudi

Sometimes these devices are part of the architecture, like line drying in cities such as Venice.

Sufficiency actions at building →	Summer night ventilation (e.g. open (back) conditioning)	Summer night ventilation (e.g. back conditioning)	Minimum 2 per capita floor space	Energy efficiency (bicycle, walk, public transport)	Low drying (no water / hot water saving)
In order to perform sufficiency actions, inhabitants would need	Choice of night, clean air	external air temperature <20°C (night)	Residual common area (e.g. shared bicycle)	Fair access to services (work, independence for children and others)	Well designed spaces for (re)drying. Water (re)use (district)
Preventy Cities create constraints	noise, mainly from cars and motor cycles PM10, PM2.5 pollution and other air contaminants	asphalt, city canyon	inhospitable districts, obligation for car parking places at buildings, free car parking on streets	distance between facilities, unacceptable roads for cyclists, pedestrians, handicapped	Dust in air
Cities should offer incentives	Low floor speed zones at 20 or 30 km/h	walkable/cyclable, green spaces, green roofs, green facades, water movement, water surface	walkable, cyclable districts, green spaces, places for playing, sports in the building for common activities	minimum 2 per capita floor space, local initiatives, public spaces	Information campaigns on water saving devices, and on the high quality of drinking water from the tap
Objective and indicators	Energy efficiency (kWh/m²/year)	Minimum requirements	EPBD (and National)	Minimum requirements for	

Bent Toderian
Ghel
Shady Kahn
Tim Jackson, Piketty

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Back to the interactions: there are many and it is complex.

There are others who are part of this new urbanist movement, some of whom are listed here.

And some who think about where the money can come from. Well, 1/3 of GDP in Italy is lost in fiscal evasion. It is not a problem of finding the money, it is about using it well.

Discussion 2

Urban design

Perhaps in buildings, the most important aspect of sufficiency is m² per person. Perhaps the most important element in enabling people to live in homes with much less space is to have homes in areas with gardens and lots of interesting social activities. If the city is nice, people don't need a lot of volume within their own home; if the city or the district is ugly, then maybe people will feel they need, for example, space for children to play inside their own home.

We still need to take a wide view, in that if you have vegetation you can stop particulate pollution having as much effect on humans; there is a lot of work being done on that. It is true that we can't continue to have all these cars around, but we do need to take account of these other options. We need to make sure that we place the additional trees in the right places to have the best effect.

Sufficiency in cooling

There are inequities associated with air conditioning: the heat gets pumped out of the building into the street and it increases the urban heat island effect, making the situation worse for anyone who does not have it. To date, this may have been a minor effect, and has been mainly during the day. But there is analysis from San Francisco showing that, during the night, it is starting to be enough of an effect that it is changing the temperature, which is surprising.

Another inequality aspect is the noise. Those who choose not to have air conditioning and to ventilate naturally may be disturbed by the sound of other people's air conditioners. This is perhaps a more widespread effect than problems with the heat from air conditioners.

Do we know of surveys on what sort of limit could be set in terms of the number of days that air conditioning is really needed? If for example there are only five days per year when it is considered necessary, we should not allow the installation of air conditioning. Sufficiency could be setting a limit on the number of days that you can use air conditioning. But we must recognise that there is a difference, in health effects, between five consecutive days of really high temperature, which can be deadly, and five well-spaced days which could be tolerable.

This links to the evolving discussion of our definition of sufficiency. Perhaps we have to fight for creating the conditions that allow people to 'do without' (rather than imposing limits, which would be unpopular and could in some cases even be dangerous). The Swiss approach seems positive – you have to get the building right and use passive systems before

you can think about using air conditioning. Of course, active air conditioning could become a necessity in the future if we do not get our buildings right.

Sufficiency in transport

From the perspective of a buildings person, when we start to look at transport, it feels like the changes needed for sufficiency in buildings are the low hanging fruit. Because when you start discussing transport and the freedom of movement, it is an amazing challenge; perhaps this is why we have not looked at aviation much as yet. Most of the emissions discussions have focused on other sectors, because how are you going to tell people that they are not going to fly. But there are some gaps there: thinking about the Zurich example of having to prove that you need air conditioning, can we not talk about 'proving that you need a car'? Proving that you have to travel a certain distance and there are no alternative ways to do it. If you can prove that you need it, then you can have a car. But first you only get a light vehicle; you have to prove that you need an SUV...there could be steps that could start us along the way, even if they did not take us fully to a state of sufficiency.

We need to think about technologies that are fit for purpose and also are fit for the situation they are introduced into. The situation now is an emergency in climate terms, and a wonderful opportunity to start using our bodies and feeling good. Many young people are willing to experience this if there are conditions that enable them. Taking Milano as an example: it is empty at the weekend because people go to the lakes and the mountains. There are no trees in the city; it is a place you work and then you go away. This is what we have to change, and then the need to travel will be much less, if we have what we need in place. Yes, it is a huge transformation, but if we don't talk about that now, when will we talk about it?

If you take the Netherlands and Germany: the Netherlands we hold up as this place where they have got it so right, particularly for cycling, yet car ownership and use is higher in the Netherlands than in the UK. What happens in the Netherlands, and in Germany, is that people do more of everything; they have wonderful integrated transport systems in a lot of urban locations, but in terms of overall land travel, the energy use and emissions per capita from travel is higher in both these countries. Of course the journey distances in those countries are longer, and there are land borders to other countries, which the UK doesn't have.

Leisure travel: in Britain it accounts for half of all the distance that is travelled. It is all very well if you set up your integrated transport system for commuters, but this is only ever about 1/5th of the distance that is travelled. It is actually the discretionary travel, the stuff that perhaps does not come under basic needs, that actually contributes most to energy consumption from travel.

How do we find an acceptable replacement for car use?

All the discussion, whether about transport or about buildings, assumes that we can develop alternatives that are just as good as the options that we have now. In mobility, in transport, can we create something that is just as good as the car? That is the essential question; essentially what we are up against. I'm not sure that we can, in terms of something that is acceptable. There are different modes of transport that can bring other types of benefits to people, health and fitness and so on, but at the moment there is no conceivable form of transport that fulfils the liberties, freedoms, sense of autonomy, flexibility etc that the car brings (to those that have and can drive a car).

The car also brings dis-benefits that those who do not have one / cannot drive, and we need to look at these rather than focusing on the benefits that they are supposedly bringing.

But, in terms of making something acceptable, is that enough?

As long as the car is so attractive, for so many people, the arguments on equality will be hard to fight, because there is such a strong group who are not willing to give up even if it makes sense from a societal perspective. It is the same with income distribution: theoretically we would perhaps all be better off if we had a more equal income distribution,

but it is very hard to make those who have too much give it up. But transport is easier than income, because at least there are modes which involve the car but don't require that everyone owns their own vehicle.

What language should we be using? Is looking for something that has the same advantages as the car actually the way to start? We need something that is much better than cars, which are presently giving us a lot of problems. These problems are often hidden, although sometimes they are brought to the surface.

In the Netherlands in the 60s and 70s, mothers – concerned about cars killing children – led a revolution. They blocked the streets against cars. We don't look at this danger at the moment even though it is still there. We simply accept that children don't play in the streets. Of course we will find a lot of opposition, but those who are willing to propose an alternative should speak of that alternative in terms of the positive that it brings.

It is interesting when people have experimented with, for example, closing a town centre or a street to cars for the weekend, and just letting people experience the positives. It's about letting them experience them, because they can't necessarily imagine them. If you let people live them for a while, this could make the arguments more persuasive.

You could also look to bring home to people the negative impacts they are having. As the driver, you don't tend to see the negatives. How do you show drivers the impacts they are having? Should we have a 'number of people killed by pollution from your car' meter next to the fuel use meter? Or perhaps something less extreme but equally illustrative of the negative impacts.

There is the issue of countryside vs city. There are many people living in the city who can do without a car and really love the creation of new green spaces in the city. But if you live outside the city and have to travel in and the alternatives are difficult, then the car is still seen as very attractive. And even more so if you live in very rural areas. We need to be realistic about the formidable challenge of presenting alternatives that really work for people. In Sweden, as in the UK, there is a reduction in the numbers of young people getting their driving licences, but this is primarily in the cities: in the countryside, people continue to get their licence just as they have done in the past.

Switzerland: there are a lot of cars, but the integrated public transport system brings you to the top of every valley in time. Train, bus and cable, in an integrated system take you everywhere you need to be, and it seems – to some at least – to be as convenient as the car. But this takes national planning and consent. There was a referendum in Switzerland which moved incentives away from company cars to other ways to commute.

In China, there is a lottery and you have to wait years until you get a car. In Singapore, they have limited the number of cars that can be owned, and you have to wait to be able to own one. A smaller example: in Japan, you can only have a car if you can prove that you have somewhere to park it that is off the public highway. We need to collect up some of these approaches that do try and understand what the limits are. Maybe there are angles we can use to bring this subject into the discussion more: in Japan, the reason may have been a lack of space; in London it is more likely to be air quality.

We must recognise the strength of the car manufacturers lobby: a study in France tried to evaluate the employment created by €1 million invested in cars, compared with the same investment in public transport. More jobs are created by the public transport option. This is a very strong argument but even with this one, we lose against the car lobby.

The key thing about the car is that it is multi-purpose. We can have some regulation on commuting but the private car is good for all sorts of other things. The electric bicycle is a good alternative, but it is not multi-purpose. If you need multiple technologies to replace the car, each for a different purpose, this is difficult.

But perhaps there are superior technologies. For example, you may consider the Brompton a superior technology; it allows the rider to go on public transport and so enables you to go where you would have previously by car. An inter-urban trip by rail can be more productive or relaxing than driving and then at the destination your bike is there for you to go

wherever you want. You can put a trailer on the bike to carry goods, and you can now get electric versions of the Brompton.

The role of Electric Vehicles

There was discussion about the comparative emissions from different types of cars. Electric vehicles do not emit any NO_x, and so are better in this respect, particularly compared with diesels. But you will always have particulate emissions from any form of motive transport.

There are plans in France for 10 million new electric vehicles. Each 1 million is equivalent to the need for one new nuclear power plant. And there are potential environmental issues with this.

There has been opposition this morning between sufficiency and electric vehicles. That does not seem helpful – we may need both; we can progress further, quicker by improving the fuel efficiency of vehicles than we can by encouraging modal shifts of the sort of magnitude we are talking about. Given the political difficulties that we have talked about getting people out of cars, then EVs have a lot to offer. And also in terms of a renewables-based grid.

Perhaps it is the decisions of the policy makers that are putting them in opposition to one another (e.g. the European Commission decision to focus on the infrastructure for electric vehicles seemingly to the detriment of infrastructure for bicycles).

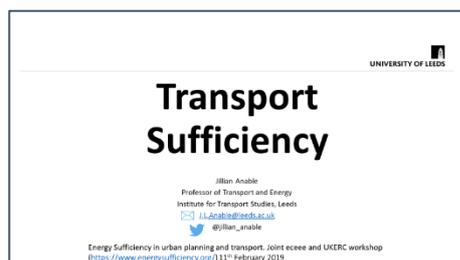
However, the more you develop car-oriented solutions, the more you can have car-based solutions. There are vicious circles. So, to this extent they are in fact in opposition.

Aviation

Aviation: there are studies showing that urban, affluent people might have a low carbon footprint from their transport within the town, but they have enough money that they can fly more than others. So, you need to have an integrated policy and we have to reform the whole economic system because people have so much money that they are going to fly all over the place. Simply to do things in the urban environment is just not going to be enough.

Transport sufficiency

Presentation from Jillian Anable, University of Leeds



Thinking about transport sufficiency is a new thing for me; and I find that there is something really interesting to think about here. The fact that I have not previously thought about it does not mean that others also haven't, although I only came across one academic paper that actually used the term. There are lots of people who have thought about injustices in transport, about basic needs, social and environmental justice, but

perhaps not necessarily bringing those things together very well.

Energy efficiency has had some success: things would be a lot worse in transport if we had not had it, but transport is the only sector where absolute energy use has increased, by quite a large margin against an economy-wide decrease in the UK. And likewise with carbon emissions. Since 1990 there has been zero change for transport emissions, against a 44% reduction for the economy as a whole. There has been huge technological progress over this period, and if that hadn't happened we would potentially have been in a worse situation, although I do have some caveats about that, in terms of a car-centric vision that we have followed.

Why energy efficiency is not sufficient

- UK Transport sector since 1990:
 - energy use increased by 16.1% against an economy-wide decrease of 4.1%
 - ZERO reduction in net carbon, against -44% reduction for whole economy
- Yet huge technological innovation over this period
- Electric car-focussed carbon strategy isn't enough - we also need to cut miles driven by **20-60% by 2030** in order to meet climate targets (FoE January 2019¹)
- Thus, **in addition to efficiency and fuel switching, limits to usage must be applied** to achieve environmental sustainability

¹Tricketts, L. and Haines, S. (2019) Carbon and Urban Transport Project. Paper 7. <https://www.foe.org.uk/sites/default/files/2019-01/Carbon%20and%20Urban%20Transport%20Project%20Paper%207.pdf>. Report Produced for Friends of the Earth, November 2018.

What we are seeing now, in the wake of the Paris Agreement in particular, is lots of studies that have modelled the whole transport system or the whole energy system and really pushed on the apparent potential for technological progress. These scenarios have been unable to get anywhere near what is required in the transport sector to meet the carbon budgets implied by the Paris Agreement.

There is a recent study by Friends of the Earth (NGO). Although it is more a 'back of the envelope' calculation rather than a big modelling study, it does mirror what we have found: in order to be in line with the carbon budgets for 1.5 degrees, the implied reduction over the next 10 years, could be as *little* as 20% reduction in car-kilometres (if we get a very fast transition to electric vehicles) and as much as 60% car-kilometres reduction (with low electric vehicle uptake). That sort of figure in transport is so far from current progress that you just tend to stop listening when it is put forward. So, whatever pathway we are taking, we are talking about limits to growth. We can't just talk about efficiency. If that is what sufficiency means, then that is absolutely what is being talked about even if that language is not being used.

But transport policy – only one principle applied in practice: efficiency

- Transport policy is predicated on the assumption there will be major take-up of Ultra-low emission vehicles
- This gives little attention to reducing travel by powered vehicles
- This efficiency-based approach will fail because it:
 - will sustain existing conditions involving reliance on cars
 - falls to address mobility injustices
 - actually ends up limiting people's choices**
 - and is leading to 

¹Tricketts, L. (2018) *Conscience-Car Address to Rightful Road Users*. Identifying Road Behaviour Impacts on Air Quality. Transport Focus, 2018, pp. 46-50.

We do not currently have a transport White Paper at the national level. But when you look at what we do have in terms of transport policy you can see that, locally as well as nationally, there is still this idea that the problem will be solved through ultra-low emissions vehicles, mainly electric vehicles. That mindset means that those making the decisions are largely happy to sustain the conditions that involve relying on cars. That is

what they are planning for; they are planning to reduce emissions and other transport problems by electrification of cars. This then fails to address mobility injustices; i.e. those people who do not have a car, or who are unable to take up electric vehicles in the early stages.

Effectively, that policy limits people's choices – everyone's choices, including people who can use a car, because cars cause problems of traffic, congestion, cost and so on. And as funding, policy time and analytical time is spent on car-related policies, they are not being spent on other things. So, actually, it is limiting everybody's choices, not just those without a car.

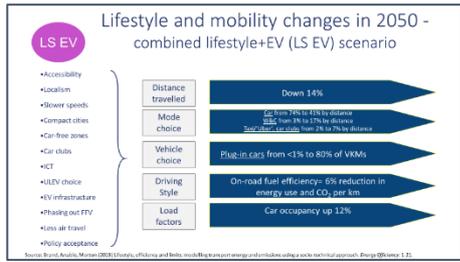
The picture on the slide above is from some time ago, but it has been proved to show some foresight, because lots of attitudinal studies are showing that there is a huge and growing segment of the motoring population who are unhappy with their car-dependent lifestyles. Thinking about acceptance and how to change the conversation, we need to really identify those people properly because a lot of policy is made for the 'die-hard' drivers who are only about 15-20% of the population but are the ones that shout the loudest and are apparently the 'voting public' when politicians are thinking about being elected.

Table 3-1: Progress against the Committee's recommendations in the 2017 Progress Report

Recommendation	Assessment
Transport (26% of 2016 emissions): Emissions to fall by around 44% between 2015 and 2030 with options developed to allow near zero emissions by 2050	
Sketching standards for new car and van CO ₂ beyond 2020, that require increased electric vehicle sales, are independently enforced and use real-world testing procedures	Partially met
Policies to deliver a high uptake of electric vehicles, of around 60% of new car and van sales by 2030, including time-limited financial support, preferential tax rates and effective roll-out of charging infrastructure	Partially met
Implementation of policy to deliver 8% of sustainable biofuels by energy by 2020 and maintain the biofuels volume after 2020	Met
Policies to support emissions reduction from HGVs, including new vehicle efficiency standards requiring electric options for smaller trucks, more efficient logistics, increased uptake of eco-driving measures, and a shift to lower carbon modes (e.g. rail)	No progress
National and local policies to reduce demand, to deliver car-km reductions of at least 5% below the baseline trajectory	No progress
A plan to limit UK aviation emissions to the level assumed when the 60th carbon budget was set around 2005 levels by 2050, implying around a 90% potential increase in demand, supported by strong international policies	No progress

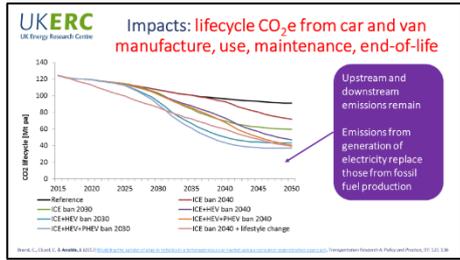
This slide shows our Committee on Climate Change's recommendations from a couple of years ago. Each row is an area of policy that the Committee identified to reduce emissions from the transport sector as a whole. This is from the 2017 progress report where they identify what is on track and what is not. Only 2% of the whole calculated potential emissions reductions from the transport sector by 2050 were going to come from

demand reduction anyway (i.e. by reducing the number of car kilometres) but we have made no progress towards even this target.



This is from an academic study that UKERC carried out – as is the next slide. This is similar to the sorts of results that the Friends of the Earth study came out with. It takes the transport sector as a whole; with lots of detail about different technologies and a strong push with implementing these. It shows that there is still a need to try and reduce the amount of distance travelled, whilst also increasing the occupancy rates of vehicles

(which have been going down), and increasing the driving efficiency. Progress requires us to really pull all the available levers. This study looked at making the changes by 2050 whereas some of the modelling coming out now is looking at making the changes by 2030.



This slide shows the sorts of results that you get when you look at the government targets of phasing out conventionally fuelled ICE vehicles by 2040.

The black line is the current trajectory; the red line is meeting the government's target, which gets us nowhere near what is required to reduce CO2 emissions from cars and vans. You need to bring

the target forward whilst allowing plug-in hybrid vehicles to carry on.

Transport 'poverty' versus 'excess'

- High impact households responsible for very large share of the total: 20% of emitters producing 61% of emissions (Brand & Preston 2010¹)
- Transport emissions are more unequally distributed than domestic energy emissions and more strongly associated with income
- Transport typically explains most of the differences in direct emissions between groups at the high and low ends of the spectrum

• One question for the concept of transport sufficiency would be whether quality of life is necessarily improved by greater mobility

Thinking about sufficiency took me to literature around social exclusion in transport, linked to car access, and what this means for quality of life. In transport, there are some really stark contrasts between the 'haves' and the 'have-nots', in terms of access to all forms of transport. In terms of emissions, there are lots of figures that we could look at; but the high impact households are responsible for a very large share of the total, and I

think that that sort of unequal distribution is greater in transport than in domestic emissions. And I think in transport the explanation is that the role that income plays is also much greater. There is lots to think about in terms of basic needs versus excess for transport. Is quality of life actually necessarily improved by greater mobility?

Minimum transport needs are increasing

- Car dependence definition: when car use is essential to be able to travel to access services, opportunities and social networks and/or to undertake practices which are essential for the satisfaction of human needs
- A product of motorisation and increasing distances between residences and essential activity destinations
- Government cuts to bus funding since 2016 have further increased car dependence – likely that carbon and energy intensity needs in the UK will further increase?
- Slowed down in recent years? (see 'Peak Car' – below)

Thousands of bus routes 'at risk' of being scrapped, warn councils

This links to the findings from the Minimum Income Standard work that was mentioned earlier by Tina. There is a theme running through the social exclusion and minimum income literature that suggests that minimum transport needs are increasing and car dependency is increasing. Needing a car is essential for access to social networks etc. That increase is a product of motorisation itself.

The car – from 'want' to 'need' satisfier

- Car travel was initially aimed at 'want' satisfaction
- But were also from the outset used to improve need satisfaction (eg doctors to rural areas)
- Thus practices aimed at want satisfaction have triggered a long process of change in social, spatial and technological structures which has progressively turned the car into a need satisfier

There is a vicious cycle where increased ownership meant that the destinations that people could travel to were further away, which meant that things were built further away. This meant that public transport became less viable, and meant that people needed a car. So the norms and expectations changed; for example people started living further away from where they worked. It is

a vicious cycle that occurs because of the car itself. It is interesting to think that when the car initially was introduced, it was about satisfying 'wants' – an aspirational thing. But it quickly became, to some extent, a 'needs' satisfier... becoming very useful for things like getting out to rural areas for healthcare for example. It started a whole process of social

change which meant that it has now become a needs satisfier. And this is now happening with aviation as well.

Mobility as a need satisfier (Mattioli 2016¹)

- **Mobility not a need in and of itself – it is a derived demand**
- Assume a hierarchical chain of needs satisfaction
 - Goods/services (eg mobility) are required for undertaking activities which in turn contribute to the satisfaction of some overall need
- **Over time, satisfiers have become more travel and carbon intensive through unintentional structuration processes**
- Needs might be universal but satisfiers are culturally/ context specific as different places satisfy their needs in different ways – this can lead to a defence of the status quo
- **Overall, big tension between (i) satisfaction of human needs becoming more carbon intensive and (ii) working towards environmental justice**

¹Mattioli, G., 2016. Transport needs in a climate-constrained world. A novel framework to reconcile social and environmental sustainability in transport. *Energy Research & Social Science*, 18, pp.118-128.

Mattioli makes the argument that mobility may be a needs satisfier, but mobility itself is not a need. There is a hierarchy of needs satisfaction. You need mobility in order to undertake other activities which are themselves contributing to the satisfaction of a need (for example, you need mobility to get to work to earn an income, which helps you satisfy basic needs). Needs have become more travel intensive and more carbon intensive

because of the vicious cycle mentioned earlier. And whilst this vicious cycle is made up of lots of individual choices and desires to own a car, it is actually the product of structural process whereby institutions, and labour and housing markets have built themselves around people’s ability to be hyper-mobile.

The other problem with thinking about this is that, whilst we can make a distinction between needs and wants, actually they differ by place, by all kinds of contextually specific variables. It is very difficult to identify needs versus wants when they change from place to place. For example, in rural areas the travel intensity of needs satisfaction is much greater; and that argument can self-perpetuate. It is a fact that people need their cars in rural areas – you create this situation that cannot be touched. Overall because you have some people who have and some who do not have access to a car, you have a tension between satisfying needs and working towards environmental justice. They are going in opposite directions in many respects.

Role of the car in need satisfaction has changed over time

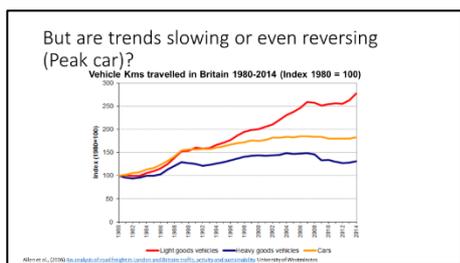
- MIS1 identifies minimum transport needs of UK households
- In 2008 Druckman and Jackson found transport responsible for 26% of GHGs needed for an acceptable standard of living
- Since then, **‘entitlement’ to car ownership has been steadily increased in MIS due to increased cost of public transport**
 - 2008 – most h/hold types living in rural towns
 - 2016 – all families regardless of residential location
- Increased need to travel long distances using powered modes
- So GHG to meet basic needs have increased
- **THIS MAKES IT VERY DIFFICULT TO RECONCILE REDUCED CO2 WITH THE STANDARDS OF LIVING DEEMED ACCEPTABLE IN THE UK**

¹ Joseph Rowntree Foundation: Minimum Income Standards <https://www.rjf.org.uk/report/minimum-income-standards-uk-2018>

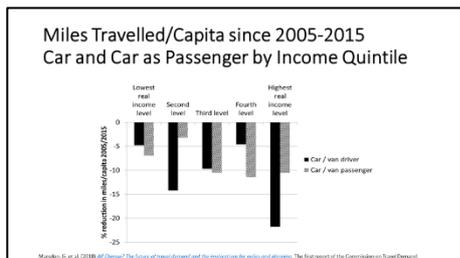
Transport intensity of needs satisfaction has increased over time, and the minimum income survey has identified this, as we saw earlier.

Transport is responsible for just over a quarter of the greenhouse gases needed for an acceptable standard of living (analysis based on 2008 data). Since 2008, the need for a car has grown, and the income standard says that all families ‘need’ a car.

It is difficult to reconcile reducing CO₂ on the one hand when you have living standards that increasingly need to be supported by potentially energy intensive modes.



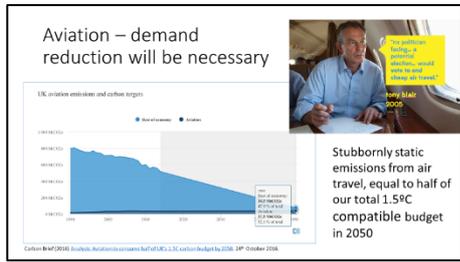
But the UK reached peak car just before 2008, and the rate of growth of car use started to reduce considerably already before the 2008 recession. This is a very important aggregate picture; it is a change in trend that was not predicted. This suggests that it is possible to reduce the demand for cars while sustaining the same level of economic activity.



Breaking down this overall picture: there are lots of theories of why the trend is changing, linked to social and economic trends, and lots of questions. What this graph shows is that the reduction in car use has mainly come from the highest income group (and then the second lowest). We don’t know yet what it is about the higher income groups that is driving this trend. But it shows that some people are reducing their car use, so it can be done; it can be talked about.

Across all journey purposes, except education and ‘other leisure’, the number of journeys per person has actually reduced. This reinforces the point that policy cannot be all about dealing with commuting journeys. Although looking at commuting is important: the

average distance travelled to work has increased, and you also have trends such as the ‘gig economy’ where people are unsure where their work will be located and therefore need to own a car to ensure that they can get to work. And once they own the car, they will use that car for many of their trips.



The graph here shows that if aviation remains steadily increasing, taking into account projected growth in passengers and some efficiency gains, plus some biofuels use, aviation will have to take up 50% of all the carbon we are allowed to be emitting in the whole economy by 2050. However, there is no political will to reduce cheap air travel

For transport, the concepts we are discussing today have mainly been discussed through the lens of social exclusion.

- Social Exclusion research agenda**
- Reaction to dominance of utilitarian approaches where goal is to maximise utility and not needs – e.g. welfare economics & cost benefit analysis –
 - Social exclusion agenda:
 - Prioritises the needs of individuals whose ability to travel is limited because of lack of access to car or PT and so are more at risk of social exclusion
 - Leads to the argument that interventions to prioritise accessibility should be prioritised over other transport investments
 - Social exclusion research generally focuses on transport and access to services/opportunities without taking account of transport externalities and their justice implications
 - **Therefore, in some areas, we may need NEED MORE carbon intensive travel options**

It is a reaction to the idea that the more travel there is, the better off we are – and how this is factored into our cost benefit analyses.

The social exclusion agenda is saying, ‘but there are all these people who can’t do what they want because they don’t have access to a car, or to

public transport’. And this leads to an argument that interventions need to prioritise accessibility, not mobility.

- Can we reconcile the tension between transport justice and climate justice?**
- Studies are now consistently showing that reductions in travel demand are an essential part of CC mitigation
 - **increasing tension between social and environmental goals in transport**
 - If car is (increasingly) needed to access essential services, measures restricting its use or increasing costs potentially threaten social exclusion and may be unfair towards already disadvantaged groups
 - Also, environmental concerns make it taboo to promote car-based measures to increase well-being
 - **Can we make progress on both fronts at the same time?**
-

There is a disconnect between the carbon reduction agenda and the need to increase travel for certain parts of the population who are travelling less than they would wish to.

And the environmental arguments make it difficult for the policy-makers to talk about and address the needs of these people. There are some public policy actions, such as concessionary travel

for retired people in the UK, but these may largely generate additional trips amongst people who also have access to the car. In terms of people who are struggling to get out and about, it is generally left to communities to organise their own schemes, which are generally quite poorly funded.

- Distinguish between ‘needs’ and ‘needs satisfiers’ (Mattioli 2016¹)**
- Social exclusion research emphasises the nature of the goods and services required to achieve transport inclusion but does not reflect the underlying universal human need
 - Often looks at differences in trip rates, travelled distances and travel time to support claims of inequality
 - Assumes that the high levels of travel currently observed are inherently required to be able to access essential opportunities
 - **This means implicitly assuming that car is required**
 - **But there are different ways in which need satisfaction could be achieved with less travel if the distribution of activities were different**
- ¹Mattioli, G., 2016. Transport needs in a climate-constrained world. A novel framework to reconcile social and environmental sustainability in transport. *Energy Research & Social Science*, 18, pp.118-128.

Despite all the work on accessibility, the system still assumes that the high levels of travel that are currently needed will always be needed. The system needs to change so that it is not so much about servicing needs through mobility. We need to have the conversation about whether there are different ways to satisfy needs. And land-use planning is central to this. We need to really focus on accessibility as the energy service.

- Accessibility is the energy service, not mobility**
- Shift the potential from *actual travel* to the potential for *access to the activities that matter*
 - i.e. from lower order satisfier to a higher order one (Mattioli 2016)
 - **Big question for transport sufficiency: Is quality of life improved by greater mobility? Or is transport not a need *per se* but a means to an end just like any other energy infrastructure?**
 - **Transport/ mobility is not the energy service or need – access is**
 - Ensure essential services are within reach of all
 - **But this needs more imagination on how to satisfy these needs with the least possible energy and carbon emissions**



The demand for mobility is catered for by the transport system, but it is generated by how much money people have in their pocket, where they can afford to live in relation to where they work, labour market changes and changing patterns of retail, and so on.

We need a Curative & Preventative agenda (Mattioli 2016⁴)

- Not just about imagining a life within sustainable boundaries – also have to ensure the satisfaction of universal human needs
- But, needs satisfiers are liable to change
- In short term – easier to bring about change in lower order elements in chains of needs (e.g. mode shift)
- In longer term – modify higher order ones such as socio-spatial structures

BUT ALSO NEED A PREVENTATIVE AGENDA

- *If needs become conflated with excessive use of any resource a Pandora's box of justice dilemmas is opened up (Mattioli 2016)*

⁴Mattioli, G., 2016. Transport needs in a climate-constrained world. A novel framework to reconcile social and environmental sustainability in transport. *Energy Research & Social Science*, 18, pp.118-128.

When we think about all of these things, we need to understand what is generating these demands. Perhaps part of the sufficiency idea is that we imagine a way of life that can be lived within sustainable boundaries and also satisfies human needs. In the short term, from a mobility perspective, it is easier to achieve this by thinking about things like efficiency and modal shift. In the

longer term, it would be really good if we could think about the whole socio-spatial structure that we are trying to do this within. We need to have a new conversation about how we prevent the demand getting out of hand in the first place.

Excess travel

- Travel that does not arise from needs satisfaction
- **Curtailing travel for wants would not result in 'serious harm'** (but try telling the welfare economists that!)
- **Currently a major taboo** in transport policy 'where there is a general notion that all transport is necessary'

BUT

- Curtailment might be the only way of achieving emissions reductions while allowing for increased demand among the disadvantaged
- **Social welfare approach: A redistribution of car travel from privileged to disadvantaged households!**

¹Holman, T. and K. J. Blumhagen, 2011. *Excess travel: The hidden costs of mobility and transport disadvantage through the lens of social justice*. *Transportation Research Board 90th Annual Meeting*, 18-22 Jan 2011.

We need to think about what excess travel really is. This is very difficult: there is ongoing work on this within CREDS⁴ at the moment. It is difficult not only to define basic needs but also to think about what is then excessive. You could argue that curtailing a lot of 'wants' would not actually result in serious harm to people, but how do you tell welfare economists this? It is also a major political taboo.

Context and scale

- The circumstances that make a trip essential for need satisfaction are often highly individualised and context specific
- VAST proportion of mobility is generated by businesses – this is a problem because individuals and businesses use much the same infrastructure so separately assessing need is problematic

See:
 • Martens, K., 2016. *Transport justice: Designing fair transportation systems*. Routledge
 • Simcock, N. and Mullen, C., 2016. Energy demand for everyday mobility and domestic life: Exploring the justice implications. *Energy Research & Social Science*, 18, pp.1-6
 • Mullen, C. and Martens, K., 2016. Mobility justice in low carbon energy transitions. *Energy Research & Social Science*, 18, pp.109-117.

The other question is what is the context and scale. Satisfaction of basic needs is context-specific.

Also, if you try and divide mobility down into the different needs it satisfies you run into problems because so much of the infrastructure is shared.

But projecting business as usual is the business as usual

Martens, G. et al. (2016) *Change? The choice of travel demand and the implications for policy and planning*. The final report of the Commission on Travel Demand.

This chart is from a Leeds City Council workshop. Leeds is a dynamic and growing city. You can see that up to 2014 the chart shows what happened, i.e. peak car. Then the modellers simply assume that expected future growth in population and economic activity will lead to a massive increase in travel demand. Yet this isn't what has been happening: there has been a decoupling between economic growth and travel demand. The

conversation in the Council is not about sufficiency, it is about catering for some demand that has not even happened yet. They are not thinking about how they could maintain the trends that have been seen recently.

They are aware of the figures, but reluctant to 'believe' them. There is public authority anxiety about having enough infrastructure in place to meet future demand. There is not enough thinking about how we want the city to look, rather than how we accommodate growth. (These sort of scenarios are also seen in national transport planning.) Even though

⁴ <https://www.creds.ac.uk/transport-mobility/>

there is an explicit conversation in the city about the types of jobs that are expected in the future being not very travel intensive in themselves, there seems to be no thought about the composition of the demand that they are projecting.

We keep recreating the past that we are trying to avoid

Car dependent developments
See <http://www.transportsustainablehomes.org.uk/>

No growth in traffic
Norway: zero growth objective for car traffic in urban areas. But many road expansions are still planned in cities across Norway.

Each regional jurisdiction is allocated housing growth forecasts and targets. Planning permission for new developments is then given for places in the middle of nowhere, with no connectivity to existing commercial centres, so we are locking in car dependency. And siloed policy making, in which housing planners do not think about transport, makes it difficult to challenge.

How we think about demand defines how much agency we think we have to tackle demand

Wardell, G. et al. (2018) 100 Years? The future of transport from the challenges of policy and practice. The final report of the Commission on Road Investment

We need to think about the extent to which thinking about demand is a legitimate part of the policy toolkit. The different world views illustrated on this slide can all be found in transport somewhere. At the top demand is completely endogenous to transport policy, at the bottom they are completely integrated. What do these differences actually mean for the policy toolkit?

What does this mean for decision-making?

- What kind of futures **should** we plan for?
 - At what scale(s) is this best done?
- In what ways does this all challenge Business as Usual?
- Should we adapt our toolkit and if so, how much and for what types of decisions?
- Can we adapt our toolkit? Are we really open to uncertainty?
- What would the consequences of continuing a focus ONLY on Energy EFFICIENCY be?

This slide shows just a few concluding ideas about what this could mean for decision-making. How we can think about the future and what living within the boundaries actually means.

Encouraging mode shift in London

Presentation from James Ingram, Transport for London

Overview

- London's challenges and the Mayor's Transport Strategy
- Mode shift: MTS targets and recent trends
- Themes of the MTS
- Increasing levels of cycling and walking
- The London Plan – mode shift in new development
- Moving to zero emission road transport

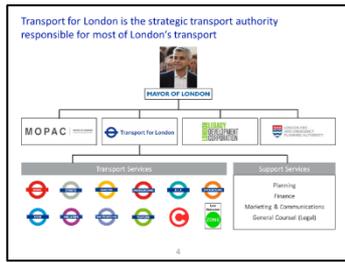
The presentation will cover the transport strategy that defines where London is wanting to go with modal shift and where we've been in the last 20 years or so. I will look at a few examples around cycling and walking, look at the spatial planning and land use element and talk about the London Plan and what that aims to achieve. And I will talk a little about electrification, the move to Ultra Low Emissions Vehicles, and some of the challenges around that.

London faces significant challenges

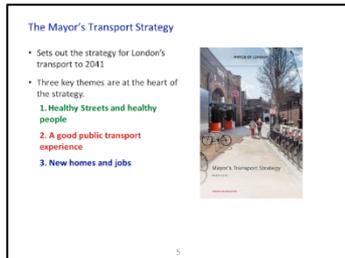
<p>Streets and cars</p> <p>Overdependence on cars, causing congestion, pollution and road danger</p>	<p>Public transport and quality of life</p> <p>Rail crowding, slow buses caused by congestion</p>	<p>Future growth</p> <p>Population to reach 10.8m by 2041, housing shortage, 65,000 new homes needed each year</p>
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This slide shows the general challenges faced by London, looking at what might happen in the coming years. We have anticipated population growth, passing 10m residents in the late 2020s and expected to reach 10.8m by 2041, a 2m growth on today's level. This in turn will lead to increased crowding on rail services, bus services slowed by congestion

and over-dependence on cars. And this brings the inherent problems of road dangers, increased pollution and so on.



This slide shows how the Mayor of London and Transport for London (TfL) relate. TfL has been around for 20 years or so. It is a wholly owned subsidiary of the Greater London Authority, along with a range of other organisations. We operate a lot of the transport services in London (Underground and buses), manage strategic road networks and road user charging and emissions based charging, and have a range of ‘back-office’ functions including planning.



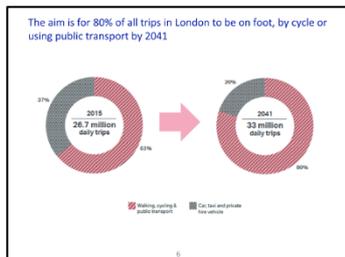
Sadiq Khan was elected London's Mayor in 2016. He is required to produce a Transport strategy, along with an Environment strategy and a Spatial Planning strategy, which are also relevant here. The Transport Strategy looks out to 2041; it was published for consultation in 2017 and published in full in 2018. It is based around three key themes, as shown on the slide.

1. Healthy streets and healthy people; looking at the use of transport and the way people get around and how this can support health. It is looking at active travel, the streetscape environment, good air quality and social inclusion. This underpins all of the strategy and is also a key theme in its own right.

2. Public transport experience.

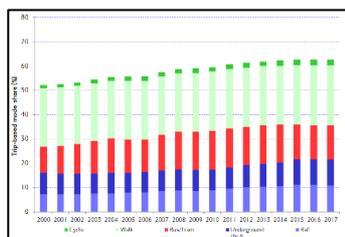
3. Transport as a support for new housing and access to jobs.

In terms of the environment, the Mayor's Transport strategy is there to support key environmental targets that the Mayor has set, in particular compliance with limits for NO₂ and particulate matter (and, as noted earlier, much of this is linked to tyres and brakes and so you have to reduce vehicle km to tackle this), and reaching a zero-carbon city by 2050. For London, this last target pre-dates the Paris agreement and so we have done some work on setting trajectories for London that are compatible with reaching 1.5 degrees.



The main central target of the Mayor's Transport strategy (shown by this pie chart) is to reach 80% of daily trips made by walking, cycling or public transport by 2041, from 63% today. So, there will be a growth in population and a growth in the number of trips, but a far greater proportion by these modes. This would reduce total car kilometres, but not by the 20-60% level by 2030 as we discussed in the last presentation. Also, in 2041, 20% of journeys are still going to be made by car, even in this ambitious scenario, so we

still need to remove the emissions from these journeys, which is likely to come through electrification. But that is secondary. First we must reduce the demand for travel, second we must increase active travel and also public transport's share; and then take away the remaining emissions through electrification and perhaps also hydrogen.



The data behind this chart are available in an annual ‘travel in London’ report that TfL publishes. It shows that there has been a steady growth of public transport and active travel, with perhaps a slight plateauing in recent years. This has been supported by sustained investment, increasing capacity and quality of public transport. There has been a lot of inward migration into London, an increase in the number of people born outside the UK, people who are younger, who are more likely to live in the centre of the city and move about without a car.

During this period there was the beginning of an integrated planning strategy aiming to move away from car dependency, and the introduction of a congestion charge to manage traffic congestion and overall car use. There has been a reduction in public finance as a

result of austerity and so there hasn't been the same increase in public transport capacity in the last couple of years. We are also seeing people beginning to migrate out of the centre of London as there has been slightly more economic growth in outer London, where people are more likely to make journeys by car.



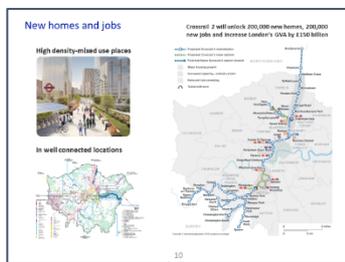
So, what does the 'healthy streets' target mean for car trips? We are looking for 3 million fewer daily car trips; and a reduction in car ownership in London. We are looking to achieve zero road deaths, to increase active travel and to make better and more efficient use of the street network. And to remove emissions from remaining vehicles.



We need a range of improvements to public transport: better accessibility for people with specific needs; improved use of our waterways, in particular the Thames; reduction in crowding on the Underground; improved bus speeds to drive increased use.

Overground. This is built on national rail services and the assets and infrastructure are nationally owned, but TfL specifies service frequencies and takes the revenue risk rather than the rail company and the Department for Transport as is the case for most of the national rail network. TfL found that increasing the frequency of the Overground (which caters to a lot of orbital journeys in outer London), from one or perhaps two trains an hour to one every 15 minutes, unlocks a lot of latent demand. It is closer to a metro service and so you don't have to plan your journey in advance. The extent of this service is however still limited by the infrastructure that the Mayor has been able to take control over.

We are also looking at expanding metro frequencies to parts of London that are not served by the Underground, significantly improving access to metro style rail services in parts of South London, as has already been done in some other parts of the city where there is the London

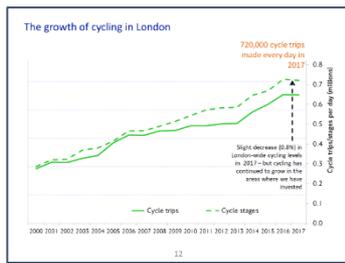


Moving on to large infrastructure investment: Crossrail 2 is looking to increase rail capacity in the North-East/South-West corridor and join up with existing rail infrastructure and services from outside London. This is all about using transport to support the vision of new homes and access to new jobs. There is a need for this new line in terms of overall capacity and demand. Through central London it will run in a very similar path to existing Underground lines that are capacity constrained. And at the northern end it will unlock new housing development.

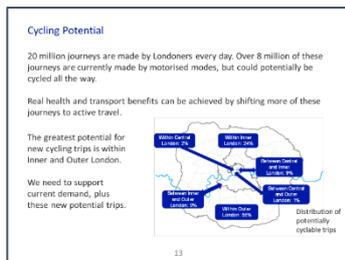


In terms of how to pay for all of this, TfL gets travel fares, a contribution from London local authorities and some Business rates. TfL is increasingly looking to greater funding through non fare activities. Can we look at contributions from developers? Where else can we look in future to fund major infrastructure and support 'good' growth? Can TfL capture the land value that new transport infrastructure allows for? Further devolution for national government taxes? Also, in terms of paying for roads: there

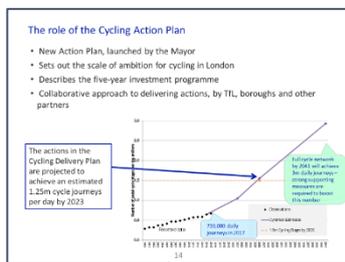
has been the Congestion Zone for about 15 years, the Low Emission Zone for heavy vehicles for about 10 years. The Mayor is about to introduce the Ultra-Low Emission Zone, which is emission-based charging of vehicle travel in central London.



Looking at cycling and walking (active travel), this chart shows the growth in cycling in central London. There has been significant investment in cycling infrastructure (in dedicated cycle routes: cycle ‘super-highways’), which improved the accessibility of London by bike. The Transport strategy sets out continued investment in cycling infrastructure and growth in the cycling mode share.



Studying journeys in London, there is good data available in terms of length of trips, modes and where journeys may be switchable. 8 million journeys are made by motorised modes but car journeys are comparatively short in London. In outer London, an estimated 55% of journeys could be cyclable. What interventions do we need to switch some of these journeys to the bike? Where is the potential; how do we start reducing road space for cars and unlock some of this potential for switchable journeys?



The Mayor very recently launched a cycling action plan which sets out the scale of ambition for London’s cycling and a programme of investment over the next five years. It is looking at how to work with the 23 London local authorities⁵, given that TfL only owns and operates a small proportion London’s road network with the majority controlled by the local authorities. TfL is responsible for the strategic road network, which makes up about 5% of the total kilometres and 30% of the traffic. There is a

collaborative relationship between the regional and local government, with local authorities receiving transport-related funding from the Mayor and, in turn, producing plans which are consistent with the Mayor’s Transport strategy.



Walking: the modelling we do includes understanding where the potential is across the city for increases in walking. The healthy streets approach is about street design that makes walking more attractive – making the environment pleasant.



This slide shows some examples of events to promote walking – car free events. We will probably look to promote these, working with the London Boroughs. As well as these temporary interventions, we will be looking at promoting the health benefits of walking (which is perhaps unusual for a transport authority). We are looking at the overall picture, trying to deliver the best access and the best overall outcomes.

In terms of spatial planning and how we plan out demand, the London Plan is the overarching document to the other strategies and plans that the Mayor has to produce, including the transport and environment strategies. It sets out the overall spatial development strategy and gives planning directions to the Boroughs. It is a way to embed the aims of the transport strategy, and is one of the reasons we are starting to see changes in

⁵ London’s local authorities (London Boroughs) are independent from the Greater London Authority, with separate funding and political control. They are required to have certain policies and plans that are consistent with those of the GLA (for example in land-use planning) and a portion of the local taxation collected by the Boroughs is allocated to fund GLA areas of activity.

What is the London Plan?

- The Mayor's spatial development strategy for London
- Statutory document that sets a framework for new development in London over 20-25 years
- Offers three main things:
 - Strategic direction for development in London
 - Direction to boroughs in Local Plan preparation
 - Direction for individual planning decisions
- It allows us to embed the vision of the MTS and further any strategic thinking to influence new development in London



mode shares in the city. The most recent Plan is currently in a final draft state and going through a formal, detailed legal examination in public before it is finalised. It allows governance in an integrated way of how London is developing, and from that transport, housing etc.

The draft London Plan steers new development towards transport corridors...



The draft plan looks at housing densification in certain areas, including opportunity areas and central activity zones, and how this links to accessibility via existing transport corridors.

It also looks to increase cycle parking and restrict car parking



In terms of parking, the plan incentivises bicycle parking and restricts car parking. The draft plan sets quite tight limits on how much car parking new developments can have, which is again linked to the overall accessibility to public transport; in areas with the best access, car free developments are expected. There is also an expectation that the parking that is permitted is equipped for future provision of electric vehicle charging: new developments are going to be around well beyond 2050, so we have to allow for the zero-carbon transport of the future. If developers suggest that the costs are prohibitive, then TfL might suggest reducing the amount of car parking. TfL is attempting to look at demand-side reduction through planning and through how London develops, while still maintaining access to jobs, leisure activities and so on.

Moving towards zero emission road transport

Key targets:

- TfL rail services powered by zero carbon energy by 2030
- TfL buses fully zero emission by 2037
- All taxis and private hire vehicles to be zero emission capable by 2033 at the latest
- Ultra Low Emission Vehicles across the GLA group fleets
- All road vehicles in London zero emission by 2050 at the latest

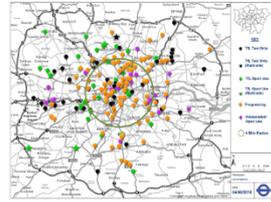


The 2050 zero-carbon target for the city means that every journey has to be done in a zero-carbon way. There are limits to what London's government can do (for example they have no control over the national electricity generation fuel mix) but TfL can lead by example, looking at where they are getting energy to power rail services and how to increase low-carbon generation given that they have a large, structural demand for services. It can make its entire bus fleet zero-carbon emission, looking at hydrogen and

electrification. The 2037 target for this is quite challenging for a fleet of 9,000 buses.

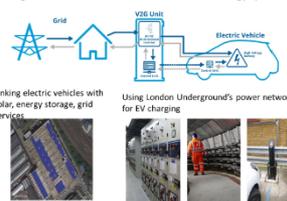
TfL sets and regulates the taxi and private hire vehicle licences and, as of January 2018, every new taxi registered in London has to be zero emissions capable. The model that is coming in at the moment is a hybrid vehicle, but we will need to be fully electric in the future. Similar regulations are coming in for private hire vehicles.

Installing a London-wide network of rapid charge points



For the remaining journeys that are not shifted to other modes, we need to support electrification. TfL is supporting and undertaking a programme of developing charging infrastructure, investing in rapid charge points in London. The green and black pins show the locations are live rapid charge points (the black ones are for taxis only). There is a question as to whether this will have an effect of locking-in road space and car journeys, which is a challenge. But for now we have to support this kind of shift.

Exploring how electric vehicles will fit into a smart energy system



We are looking at where TfL can integrate different energy uses and energy efficiency: for example, can TfL enable vehicle charging from the tube network, as there is a lot of power capacity. Can TfL link electric vehicle-charging to renewable energy or energy storage in buildings? For example a major London Underground maintenance depot is being retrofitted with solar panels. In terms of vehicles being energy storage, can they be used to help

decarbonising the national grid in terms of balancing overall supply and demand for grid

electricity? What does that mean in terms of overall economics of car ownership? If an electric vehicle becomes a revenue generator, what does that mean in terms of their overall cost of ownership versus public transport.

A lot of what TfL is trying to do probably fits within the framework of sufficiency, without explicitly being labelled as such. But of course we also still have to deal with efficiency to meet our overall aims.

Discussion 3

Defining transport sufficiency

There are a number of elements that can be considered when defining transport sufficiency.

It is about limits: how much is enough? But that does involve understanding ‘enough for what?’ (see ‘transport services’, below, for more on this).

Managing carbon emissions is one way of defining limits, but there are also lots of other ways of thinking about limits. Linked to this, is discussing things like car electrification and cycling a good idea when thinking about a transport sufficient lifestyle? You could argue that car electrification is technology substitution and that cycling, or greater use of night trains, is modal shift, so none of them relates directly to sufficiency. If the definition of sufficiency is linked to carbon emissions reduction, and then it is logical to include modal shift within sufficiency, but you can link sufficiency to an obligation to change one’s mobility choice – to alter either the nature or the quantity of mobility. Sufficiency is not always linked to carbon emissions; there are also other reasons to argue for it.

Does sufficiency relate to mandatory rather than voluntary changes? In the case of transport, is it fewer kilometres travelled? Perhaps we are talking about quotas of kilometres per household, or per person. But how would this relate to the speed of travel? Slower travel over a given distance is less harmful, but would be viewed as the same as faster travel within this quota. And it also does not link travel, and travel speed, with other activities. If you travel faster, you free up time to do other things that could also result in environmental damage.

Sufficiency should not be confused with behaviour change. Behaviour changes alone are reversible, whereas sufficiency is meant to be a long term change. It requires infrastructure changes to deliver this.

Transport services

In terms of leisure journeys, are accessibility and mobility the same? (For example, the only way to have a holiday in New York is to travel to New York). In this case, are we talking about restraint; about the need to forego a transport service? If we think in terms of accessibility, then perhaps you don’t need to go to New York for the holiday; to achieve the same benefits in terms of wellbeing. There is a conversation to be had with people about what the service is that they are looking for: for some people, the trip to New York is because that is the place they want to be; for others, there may be elements of the experience that they could have closer to home.

The cheapness of aviation fuel is a real issue here, driven by the globalised nature of the sector. Aviation started as a luxury good, but then it supported globalisation and changed patterns of trade and global social networks. So, at what point does the luxury become a need, because you may now have family in another country and this generates travel that is perhaps linked to a basic need? In the past, if family members moved to another continent, there was an acceptance that they would not travel to see family very often, if at all, but this is not the case now.

There is a narrative that relates between freedom and air travel and a suggestion sometimes that restricting the amount of air travel is contrary to freedom. But night train services are being reduced, which is limiting people’s ability to travel by train, and this is not generating the same objections about loss of freedom. Can we argue that the train must be made the

preferred way for people to travel to other places, at least within Europe? This may be possible as, in some cases, the train is already a very popular option: the ‘ski trains’ direct from London to the French Alps are one good example.

When we think about transport services, we should think about the human appetite for mobility, and the urge to explore. Perhaps we want to go as far as we can, but there are two constraints involved in a mobility decision: budget and time. People optimise both constraints, which leads them to prefer speed, and faster modes consume more. This is sometimes referred to as the Zahavi Law, and provides a theoretical explanation for why car and plane mobility can be attractive over other mode of transports, such as trains or bicycles.

Sufficiency and equity

We talk about people choosing faster options for travel because they do not have time to spare. We have huge inequalities in time availability, like we have income inequalities. We have people who are very ‘time poor’, for example the single parent family; and those who are time rich, for example the unemployed. So, there are not the same drivers for everyone; it is very complex.

Speed creates inequality⁶; it disadvantages those that are not able to access that speed. For example the study “Predict and decide”⁷ suggests that increasing trips by those with higher incomes is driving an increase in air travel; increased aviation is not opening up the door to people on low incomes.

This is a very relevant issue; sufficiency and slowing down can be done in such a way that it decreases inequality.

Speed is not the only equity issue linked to transport trends. The goal of fully autonomous vehicles may only be achieved if we change the streets as well as the cars. We would need an environment that is clean and simple enough for the vehicles to operate this means nothing unpredictable on the streets – no children playing. So, this kind of technological development is a big danger for democracy, equality and access to public space.

We need to consider the economic and distributional impacts of sufficiency. Do we understand well whether sufficiency will increase inequities or reduce them? If sufficiency actions will reduce inequities then this message can be used to sell the idea. Such messages could highlight, for example, that efficiency subsidies in transport support production of smaller cars, which are an economic good bought by people with lower incomes. In this way, transport is perhaps different from household energy use.

Car dependency

Thinking about the Joseph Rountree Foundation (JRF)’s Minimum Income Standard study suggesting that everyone needs a car, you could argue that this is contradictory to energy sufficiency. Average car use has fallen over the same period as we are seeing people say that we have become more dependent on the car, but public transport prices have really increased during that time as well, and incomes have fallen, relatively. The methodology for the JRF work is based on perceived needs: to what extent are these real needs?

What proportion of socially excluded people actually need a car? It could be a large proportion. Some of the areas where there are the biggest issues are in the peri-urban areas; just outside areas where there is good public transport but where journey lengths are quite difficult to do with non-motorised modes. These are the areas where we see traffic levels increasing.

The way that the wider mobility system is currently constructed creates and reinforces car dependency. If you don’t do something about that car dependency and you try and limit the amount that the car is used, you will then by definition impact on people without cars.

⁶ See, for example, Illich I, 1974, *Energy and Equity*, Marion Boyars: Ideas in Progress

⁷ <https://www.eci.ox.ac.uk/research/energy/downloads/predictanddecide.pdf>

These sorts of consideration are central to whether or not you can have sufficiency and at the same time address inequalities.

As car use decreases there will be fewer people who own a car. This will make car use a more exclusive thing but perhaps this is not a problem. There are always people who will seek or in some cases need this exclusivity...it is not about creating something equal as such, it is about making sure that enough people feel that they can live a good life without having to have a car.

Activities that promote wellbeing

Well-being is about being with friends and family, being active, doing challenging things. It is about being in a state of flow, in which time flies by, which contributes to short-term fun and long-term well-being. There are different ways of doing these activities: the closer they are located to people, the better for carbon emissions. Which means we need more community infrastructure to facilitate this.

We can tend to talk about some of these issues in quite an individualistic way. If we think in terms of capabilities, it is about having a collective ability to achieve a 'good life'. In terms of a negative example, we can look at the Chicago heat wave of 1995, when about 700 people died from overheating. They were almost exclusively poor people who were socially isolated, in a city that had no capacity for addressing their need to be cared for and to be kept cool. From a sufficiency standpoint, having the capacity socially to address needs is very important. We have touched on this a little, for example in terms of questions like 'does everyone need their own washing machine in an apartment block, rather than a shared laundry room'. If you have access to shared facilities, and you feel confident that the people around you have noticed that you are there and will look out for you; that in itself will make you feel like your life is more sufficient. So, it is about collective ability, not about individuals having access to services etc.

Collective ways of meeting needs are perhaps most effective in the transport sector. For the example of clothes washing facilities, it is not clear whether the individual machine or the collective machine is more efficient, certainly in terms of in-use energy use. But it is more often clear for collective transport, at least in high density areas.

Infrastructure to support transport sufficiency

The European rail system is a good example of the need for collective investment in infrastructure to support behaviour change. For example, in Sweden the recent large increases in use of services (rail card sales increasing by 100% in 12 months) is causing problems because there is not enough capacity to cope with the increased number of passengers. On the other hand, in Austria for example, night train services are beginning to be expanded and it does seem that there is some willingness in many countries to begin the massive level of infrastructure investment that is needed.

It is not only about transport infrastructure: there is also a need for infrastructure that reduces the need for travel, such as local leisure infrastructure (for example, nice parks within cities) to encourage people to spend time closer to home.

Avoiding unnecessary journeys requires getting the land use and infrastructure planning and governance systems right. We have to move away from the assumption that traffic will inevitably increase. Are we able to look at things more holistically at the city region level, as is being done in London? In the UK, city region Mayors do have the powers needed, but there remains a question over whether the governance structures are in place. In many local authorities, the transport and land use planners are still in separate teams that do not talk to each other enough. We also need to ask whether the incentives structures within decision-making bodies are right, and whether the models used to appraise development plans are based on the right assumptions.

Modelling and transport projections

It is interesting to contrast transport projections with what is happening, for example, in electricity. Until a couple of years ago, the national grid operator in the UK would assume increasing demand in all its future planning scenarios, whereas now they have a range including scenarios in which demand is decreasing. But it took almost 10 years of decline in electricity demand before this happened.

Some of the policies we are talking about could lead to degrowth, and we have not modelled these well yet. But the models we do have can be used as one useful way to look forward via ‘what if’ scenarios.

Transport of goods

Our discussions today have largely been framed around how we move ourselves, but we must also think about how things are transported to us. The rise in home deliveries could be having a significant impact on transport levels. If people can access things virtually, they may satisfy their needs without having to travel, but they are generating transport in a different way and in some cases this can be quite extreme (for example, ordering insignificant small things that are then air-freighted from halfway around the world). We also need to think about the wider implications of these sorts of changes: shopping from home may in some cases be more energy efficient, but there is a loss of social interaction and perhaps a negative impact on the liveability of cities.

Electric vehicles

Emissions

Will electric cars support the decarbonisation of the economy as a whole or will they would only take emissions away from transport and displace them to other areas, such as electricity generation?

Electric vehicles are not zero-emissions vehicles – they emit particulates from brakes and tyres, they involve the use of materials and land, and at the moment a lot of the electricity is still fossil-fuelled. And indeed some of the generation sites pollute nearby cities causing negative local air quality issues.

Infrastructure

Longer, inter-city journeys by electric vehicle require rapid charging, which implies the use of high power (100kW) chargers. (This is equivalent to powering a school or large retail outlet.) The development of these, often in areas at some distance from population centres, is a significant infrastructure project. There is some evidence of planning for this, for example National Grid (owner of the high-voltage electricity transmission network in England and Wales) is looking to build rapid charging point infrastructure so that the vast majority of the population in England and Wales is located less than 50 miles away from a rapid charging point, which will probably be transmission network connected.

On the one hand, electric vehicles may be a good use of renewably generated power, on the other they will require significant infrastructure investment and will not address many key issues in transport sufficiency.

At the present time, the economics of using electric vehicles do not reflect capacity costs. We need to consider who will / should pay for the infrastructure investment required. There is modelling that suggests the impact of electric vehicles on grids, setting aside the rapid charging requirements on long journeys, may not be that great as much of the routine charging may happen overnight. Time of day charging for electricity is well understood and people who require rapid daytime charging should be charged a price that reflects the true costs of that charging.

Electric public transport vehicles can be better managed, for example so that they are charged when there is available renewable generation capacity.

Modal shifts

Is the growth in cycling taking away from the bus network at all? There are some studies of this and there may be an element of this switch. So, every cycle journey is not replacing a car journey.

The earlier presentation mentioned that 55% of trips in outer suburbs are potentially cyclable, but we can't think about all trips as separate journeys. People tend to plan whole days, and this may include several very different trips. The mode that they take first thing in the morning might actually depend on what they need to do much later in the day. The number of 'potentially cyclable' journeys needs to take into account this daily planning.

Public acceptability

Cycling

We need to consider whether bicycles are publicly accepted above a certain level of penetration (e.g. 5-10%). Is there general public support for a higher level than this? It is not accepted by all at the planning stages, with concerns about the amount of investment and about the reduction in road space for other vehicles. And the construction works to deliver separated space for cycling can cause disruption and be unpopular. However, just because something isn't widely accepted now doesn't mean that norms can't change as experience grows. Because London has historically not been cycle-friendly, we need to go through a stage of significant investment and disruption before we can see lots more people using bicycles and the acceptability growing.

Concerns about safety and security can negatively impact acceptance of cycling, as perhaps do perceptions about the weather.

The overall level of cycling accidents in London is not high and there is a downward trend, but they are high profile, particularly when people have been killed (for example by HGVs with visibility issues). TfL is targeting zero deaths, as any level is not acceptable. Cycling crime levels are also not too high. In some other UK cities, some of the bike sharing schemes that don't use cycle docking stations have had to give up, but whether or not crime has driven this is a debatable issue: there perhaps were issues with business models. The London hire scheme is still ongoing.

The weather is used as an excuse for why people do not cycle in Dublin, and yet the levels of rainfall there are similar to those in Copenhagen, where cycling is a cultural norm.

Sufficiency and transport sufficiency policies

People are looking for something new and sufficiency could be this new thing. There are lots of positives associated with it, which we can put forward. We need to be creating the positive visions and talking about them. It can't just be about saying 'get on your bike and leave your car at home'.

Public acceptance of transport policies and programmes: the London Transport Strategy goes through a process of public consultation, and many of the proposals were originally put forward in the Manifesto of the recently elected Mayor. So we can assume that there is a degree of acceptance of the policies.

What are the economic implications of changes in lifestyles and mobility patterns? Being able to discuss these will be important when putting forward the arguments for the need for such changes.

In relation to the timescale, we need to consider whether sufficiency is best promoted on a medium or long-term timescale. There is an approach which suggests that sufficiency will become more relevant with time. This is because if climate change is real, the constraint to reduce carbon emissions will increase a lot over time. Therefore, addressing sufficiency through a carbon tax or subsidies would not be appropriate because the carbon tax would be very high and would not be accepted by people and businesses. We need to consider whether regulation is the best policy instrument in the long term to implement sufficiency.