SAPIF 5th meeting

Full membership

“How are we doing”

Tues 29 October 2019

robustdetails®

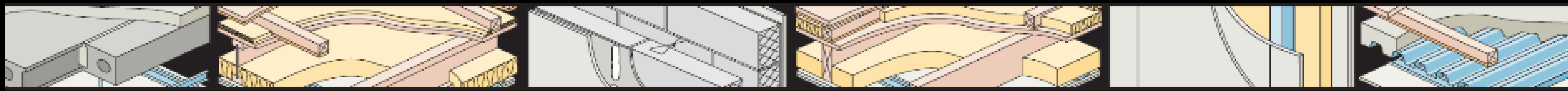
BEIS: Peter Noyce and Tone Langengen

BRE: John Henderson and Joshil Hirani

RDL: John Tebbit (Chair) and Nick Booth

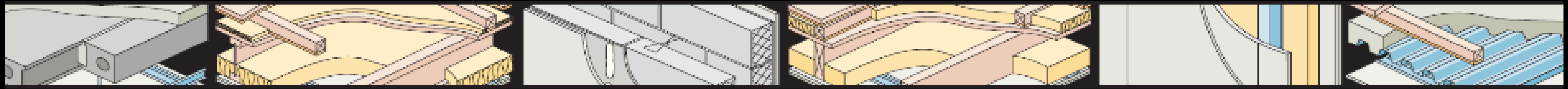
Open version – anyone can view

Agenda



10.00 – 10.30	Introductions etc BEIS policy update MHCLG Future Homes Standard Working Groups' and Meeting objectives
10.30 – 11.30	WGs presentations #3 (H.Energy storage), #1 (DHW) and #2 (S.Controls)
11.30 – 11.45	break
11.45 – 12.25	WGs presentations #4 (O/heating) and #5 (Vent +IAQ)
12.25 - 12.45	Summary, Meeting objectives, Data Store and Q&A session
12.45 – 13.00	Possible dates for next meeting in January and March

Introductions etc

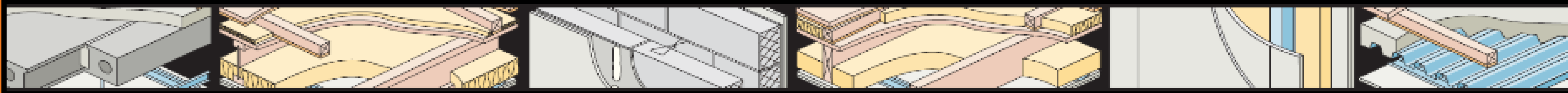


As a reminder:

- SAPIF is a joint RDL / BRE group
- This work feeds into SAP11 and for technologies that will be available in mid-2020s onwards
- 5 WGs Leaders / CoLeaders gave an update at last SAPIF 09 July 2019 meeting
- The work of the 5 WGs will contribute toward ‘The Building Mission’
- Timeframe is end Q1 2020 for submissions

- John Tebbit to meet with each Working Group in remainder of Q4

The next steps



What would you like ……

What is the timeline …..

What are the outputs ….

Future SAPIF meetings …………..		Objectives ….
January 2020	Open to all	"Last chance before handover"
March 2020	Leaders / CoLeaders only	Presentation of findings

BEIS – Peter Noyce and Tone Langengen

Policy context

Buildings Mission, to at least halve the energy use of new buildings by 2030 (England only)

Future Homes Standard by 2025: new build homes to have low carbon heating and world-leading levels of energy efficiency (England)

(UK-wide)

Improve the EPC of fuel poor and private rented households to Band C by 2030 (England only)

Commitment to bring the EPC rating for all homes to Band C by 2035 (England)

Phase out fossil fuel heating off the gas grid during the 2020s (territorial extent depends on policy levers)

Part L and SAP 10

SAP 11

SAP developments

- Adoption of the next version of SAP will be in line with Part L in 2020

SAP v10.0 spec → SAP v10.1 Available now - alongside Part L consultation → SAP v10.2 Officially adopted – subject to consultation

SAP 11 research and development, engagement with the SAP Industry Forum →

- We will also be working on enabling products to be entered in the PCDB and further developing our approach to new, innovative technology recognition to help support innovation.

MHCLG – Victoria Tink

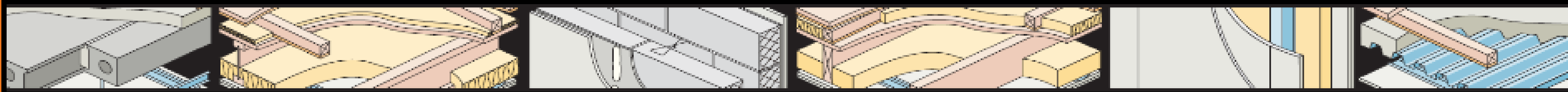
Ministry of Housing,
Communities &
Local Government

We would be very pleased if you would respond to the Future Homes Standard consultation.

It is open until the 10th January.

Questions?

Working Groups' overall objectives



The main objectives for the working groups set up by SAPIF are:

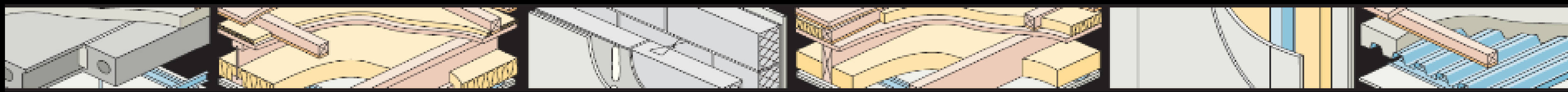
1. To establish the state of the art, sources of info. and basic explanations of the technologies/systems expected to be mature in the mid-2020s.

2. To propose some modelling criteria for the performance of the technologies; and secondly how compliance could be judged at both product and dwelling level.

3. If government decides to include recognition of the technology or system in SAP11, to work with government and the SAP contractor to develop the details. Note that the inclusion of any technology in a WG does not mean that it will necessarily be included in a future version of SAP.

- Detailed generic outputs (6 no.) for each WG issued
- Part L is not in scope

Meeting objectives



The overall objectives:

1. Publicise each WGs work + final opportunity to contribute.
2. Highlight WG overlaps and interfaces with other WGs

Key aspects:

- For SAP 11
- Assignment completes end Q1 2020
- Part L is out of scope
- New technologies - available in mid-2020s onwards
- Performance Modelling criteria and how judge compliance

Working Groups

Working Groups

#3 Home energy storage (heat and electricity)

Gill Kelleher (SPECIFC) and Hanae Chauvaud de Rochefort (Association for Decentralised Energy)

#1 Domestic Hot Water, heating and 1-day hot water storage

Steven Sutton (HHIC) and Jeff House (Building Alliance)

#2 Smart Controls, technologies & tariffs

Colin Timmins (BEAMA)

#4 Overheating incl prevention & cooling

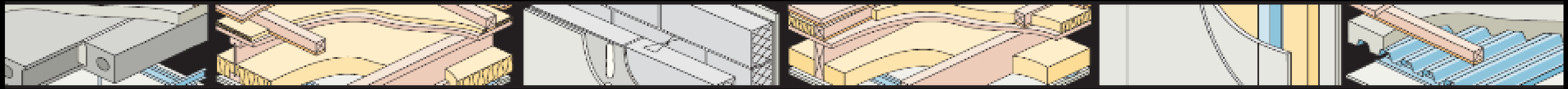
Dave Bush (BBSA) [Phil Brown (GGF) – apology for unable to attend]

#5 Ventilation and Indoor Air Quality (IAQ)

Adrian Regueira-Lopez (BEAMA)

[Nick Howlett (FETA) – apology for unable to attend]

#3 Home energy storage (heat and electricity)



CoLeaders:

Gill Kelleher

Hanaé Chauvaud de Rochefort

Active Building Centre

Gill Kelleher, Active Building Centre

Hanae Chauvaud de Rochefort, Association of Decentralised Energy

SAPIF Home Energy Storage Working Group

29th October 2019

INDUSTRIAL STRATEGY | UK Research and Innovation

Update

- Collecting Evidence/ Data from group
- Table circulated to group to list available products /methodologies for inclusion in final report
- Consolidating Barriers & Challenges:
    - **Technology advances and renewable cost reduction not limited to improving a buildings energy efficiency**
    - **How to determine compliance**
    - **SAP modelling stifles innovation**
    - **Conflicting government policies impede long term carbon reduction ambition, i.e.**
        1. **Buildings Mission (FHS, Building Regulations)**
        2. **Low EV mission (EV charge points etc)**
        3. **Electricity Market Reforms**
        4. **Planning/ Boundaries.**
        5. **Carbon Pricing**
    - **Lack of incentives**

- Members meeting in November to discuss technologies & final report draft.

For example:

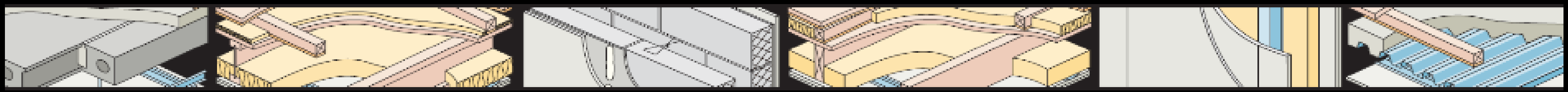
The FHS won't be a case of one-size-fits-all, other options than purely heat pumps and hybrid heat pump systems should also be modelled –where is energy storage?

Where is flexibility? •Arbitrages in terms of the user's energy demand AND the energy source availability at this time (renewable or cost incentive of running a CHPs vs simple boiler)

•The work should tie in with the electricity grid charging reviews and Time of Use (ToU) tariff reforms to consider these in modelling alongside an appropriate winter heat demand profile –without considering these reviews the model will limit innovation in energy storage and create impractical suggestions

•Consider technologies cost curves –where policy support helps grow the supply chain there should be cost reductions/economies of scale to make a viable solution on the long term

#1 Domestic Hot Water, heating and 1-day hot water storage



CoLeaders:

Jeff House

Steve Sutton

HEATING & HOTWATER INDUSTRY COUNCIL

SAP IF HEATING AND HOTWATER

29th October 2019

HEATING & HOTWATER INDUSTRY COUNCIL

SAPIF Group

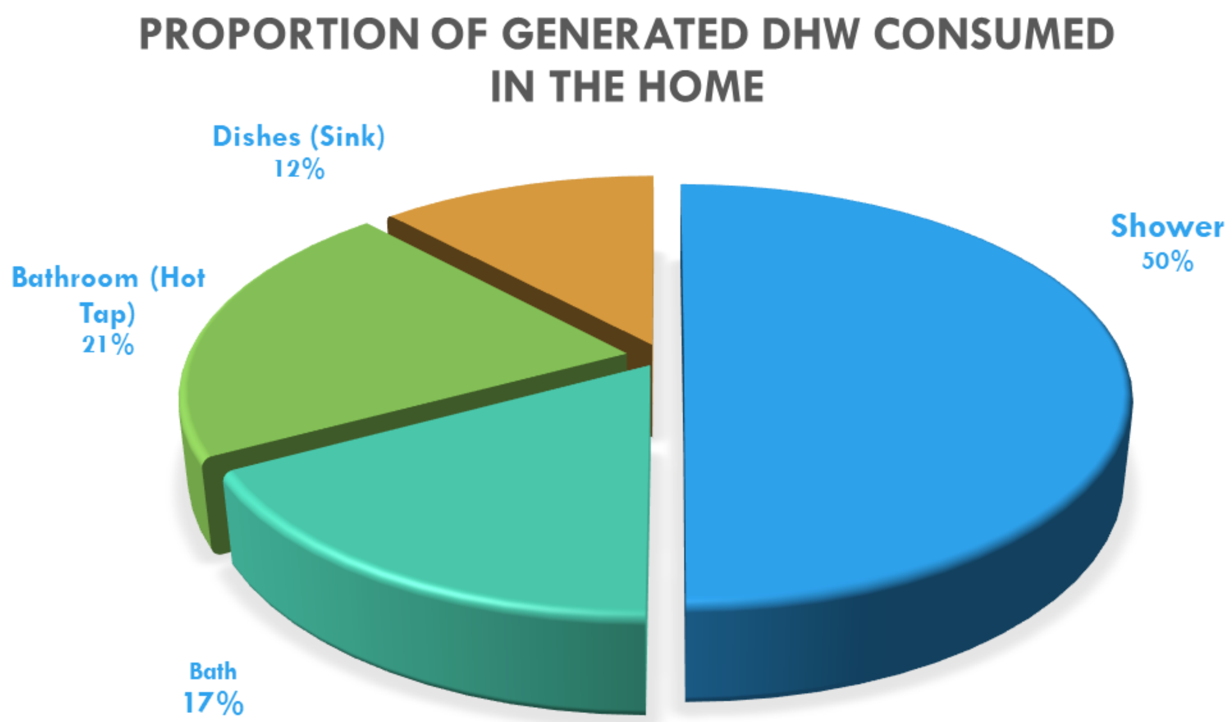
Baxi Heating UK	Jeff House
Worcester Bosch	Ewan Sutherland
Beama	Adrian Regueira-Lopez
Ideal Boilers	Andrew Keyworth
Enertek	Paul Needley
Recoup Energy	Ian Steward
Vaillant	Martin Butcher, Ian Johnson
Alpha Heating	Darran Smith
Thermaq	Tony Staniforth
Glen Dimplex	Tim Altham
Advance Appliances	Geoff Egginton
Mixergy	Peter Armstrong
Sav systems	Beata Blachut, Silas Flytkjaer
Ariston	Derek Warren
HWA	Martyn Griffiths, Alan Clarke
MEHNA	Pete Mills
STA	Richard Hall

Key Topics - General

- Flexibility & ToU – Smart Grid
- Dynamism of model
- DHW usage assumptions
- System boundaries
- *Evolution or revolution of modelling?*
- *Barriers to entry – App. Q*

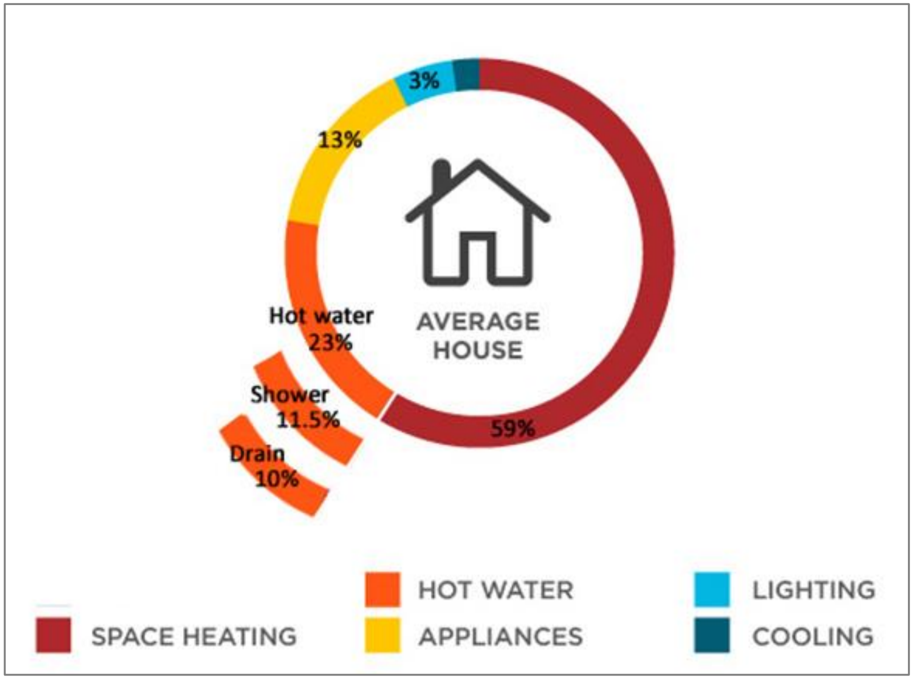
HHIC HEATING & HOTWATER INDUSTRY COUNCIL

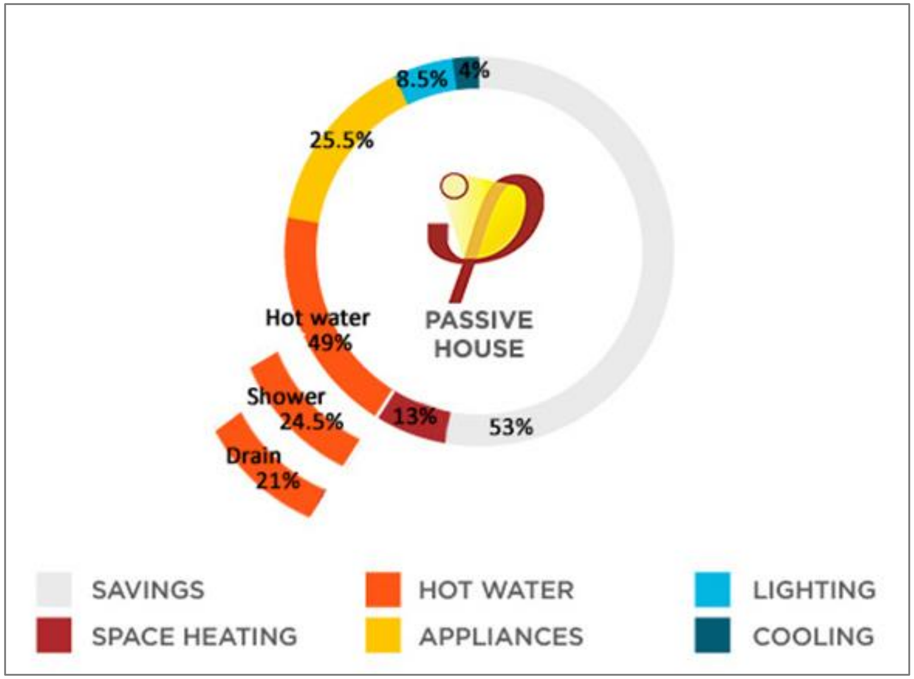
Key Topics – DHW



*SOURCE ENERGY SAVING TRUST: "AT HOME WITH WATER REPORT," 2013 – SURVEY OF 86,000 HOUSEHOLDS

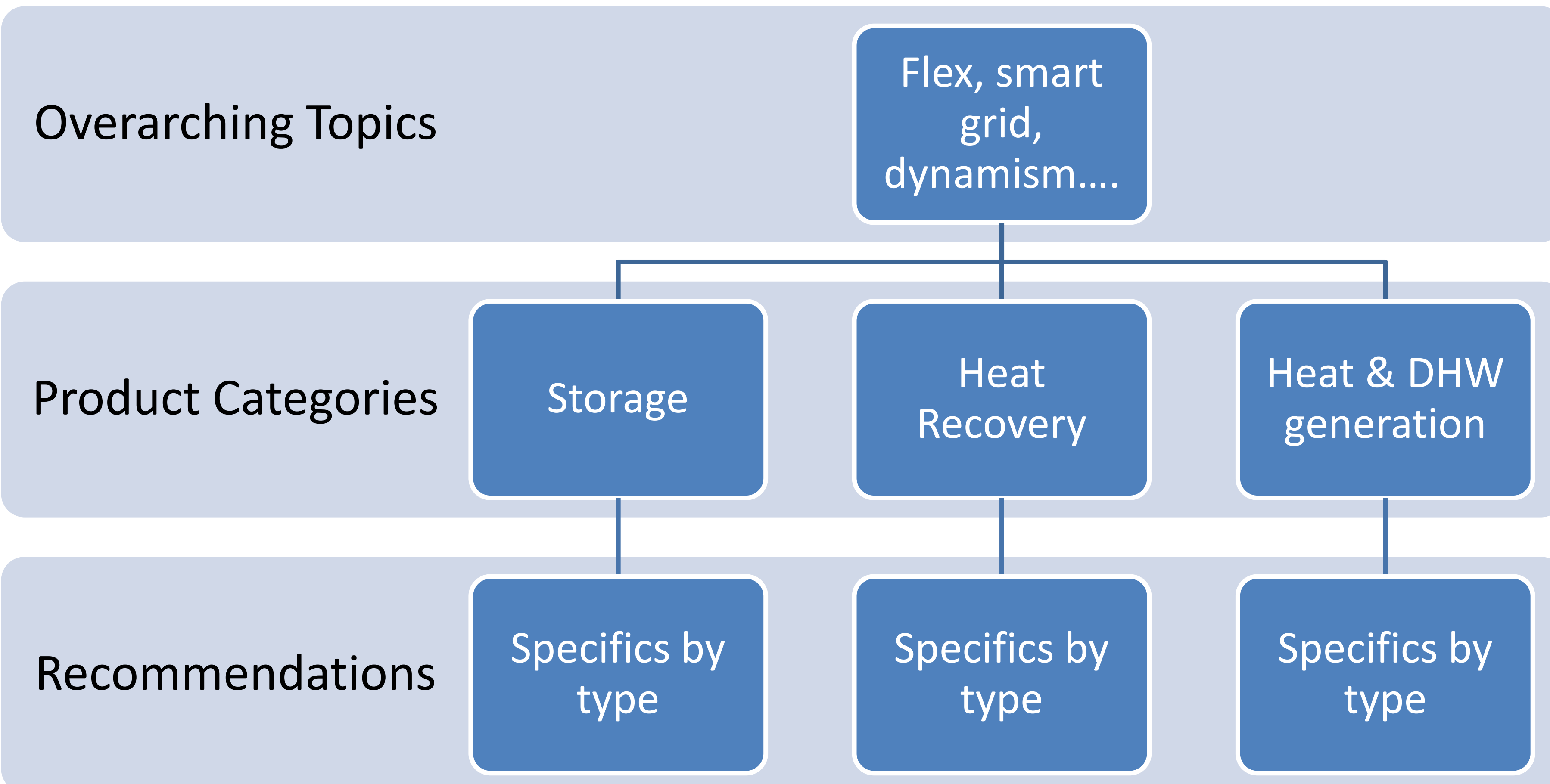
Key Topics – DHW





*SOURCE: RECOUP

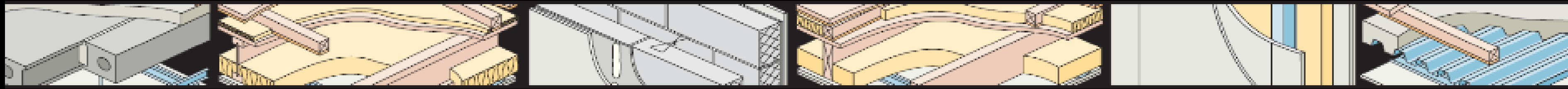
Report Structure



Next Steps

- Work on first draft report - target for WG input by year end
- Discussion on overlaps and synergies between other working groups
- Iterative drafts and refinement Q1 2020
- Next WG meeting in Jan (tbc)

#2 Smart Controls, technologies and tariffs



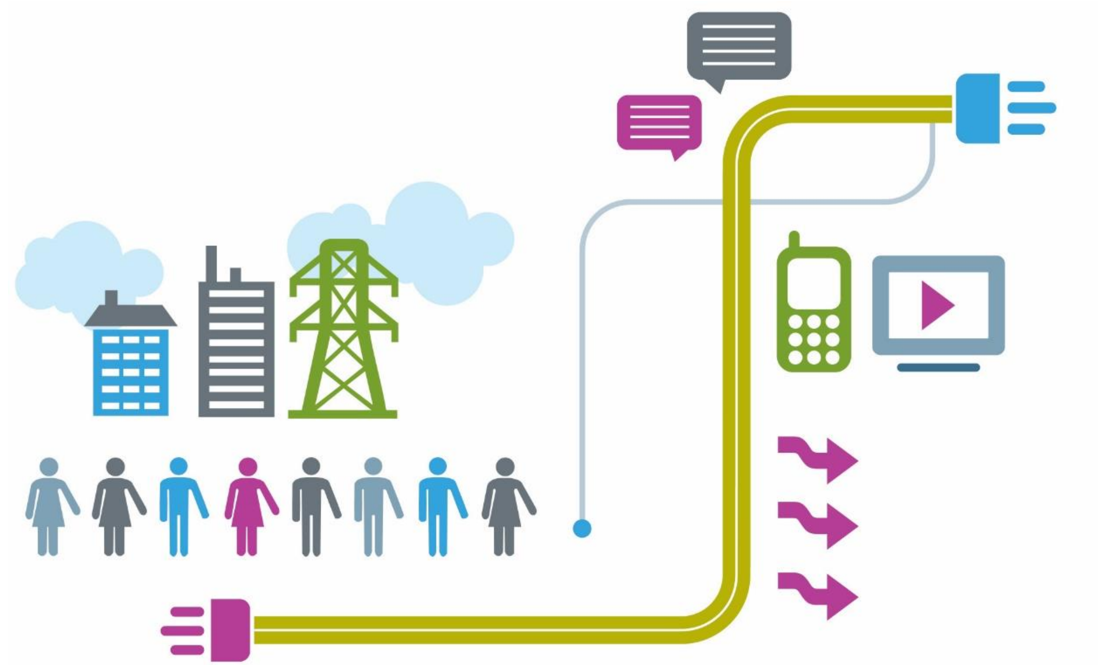
Leader:

Colin Timmins

SAP 11 Working Group

Smart controls, technologies and tariffs

Update – 29th October 2019



Scope

- **Three technology areas:**
- Smart controls
  - Group preference moving toward a single metric for a smart thermostat
- Demand side response technologies
  - ‘Smart readiness’ might be the best measure for compliance
- Tariffs
  - Might be impractical to include because of variability, rate of change and dependence on customer choice

beama

Our complication with SAP

- "The (SAP) calculation is independent of factors related to the individual characteristics of the household occupying the dwelling when the rating is calculated, for example:
  - household size and composition;
  - ownership and efficiency of particular domestic electrical appliances;
  - individual heating patterns and temperatures"
- Objective 2 from the ToR:
  - To propose some modelling criteria for the performance of the technologies and secondly how compliance could be judged at both product and dwelling level.

Table 9: Heating periods and heating temperatures

Living area		Elsewhere		
Temperature T_{h1} (°C)	Hours of heating off t_{off}	Heating control type (Table 4e)	Temperature T_{h2} °C	Hours of heating off t_{off}
21	Weekday: 7 and 8 [a] Weekend: 7 and 8 [a]	1	21 – 0.5 HLP	Weekday: 7 and 8 [a] Weekend: 7 and 8 [a]
		2	21 – HLP + HLP² / 12	Weekday: 7 and 8 [a] Weekend: 7 and 8 [a]
		3	21 – HLP + HLP² / 12	All days: 9 and 8 [b]
	From PCDB [c]	From PCDB	If control type 1: 21 – 0.5 HLP If control type 2 or 3: 21 – HLP + HLP² / 12	From PCDB [c]

[a] heating 0700-0900 and 1600-2300

[b] heating 0700-0900 and 1800-2300. The first (daytime) off period is instead taken from the applicable database record for communicating or programmable TRVs.

[c] the length of the off periods is taken from the applicable PCDB record for the control (applies for control type 2113 and 2209)

If HLP > 6.0 use HLP = 6.0 for calculation of T_{h2}

"Other control in PCDB"

HLP = Heat Loss Parameter, (40)$_m$ (W/m²K)

Mains gas	Efficiency adjustment for various control and emitter temperature options (% gross points)			
Design flow/return temperature (°C)	80/60 or 70/60	55/47.1	45/38.6	35/30
On/off boiler				
Class I or IV (Room thermostat or TPI)	0%	2.3%	5.2%	7.2%
Class III (Weather compensator)	0.9%	3.5%	6.0%	7.7%
Class VII (Enhanced weather compensator)	2.3%	5.4%	7.2%	8.7%
Modulating boiler				
Class I (Room thermostat)	0%	2.4%	5.5%	7.8%
Class II, V and VIII (Weather compensator or Enhanced load compensator)	0.7%	3.4%	6.1%	8.0%
Class VI (Enhanced weather compensator)	1.8%	5.0%	6.9%	8.4%

Table D1 - Efficiency improvement values for main gas condensing boilers with various control and design flow temperature options

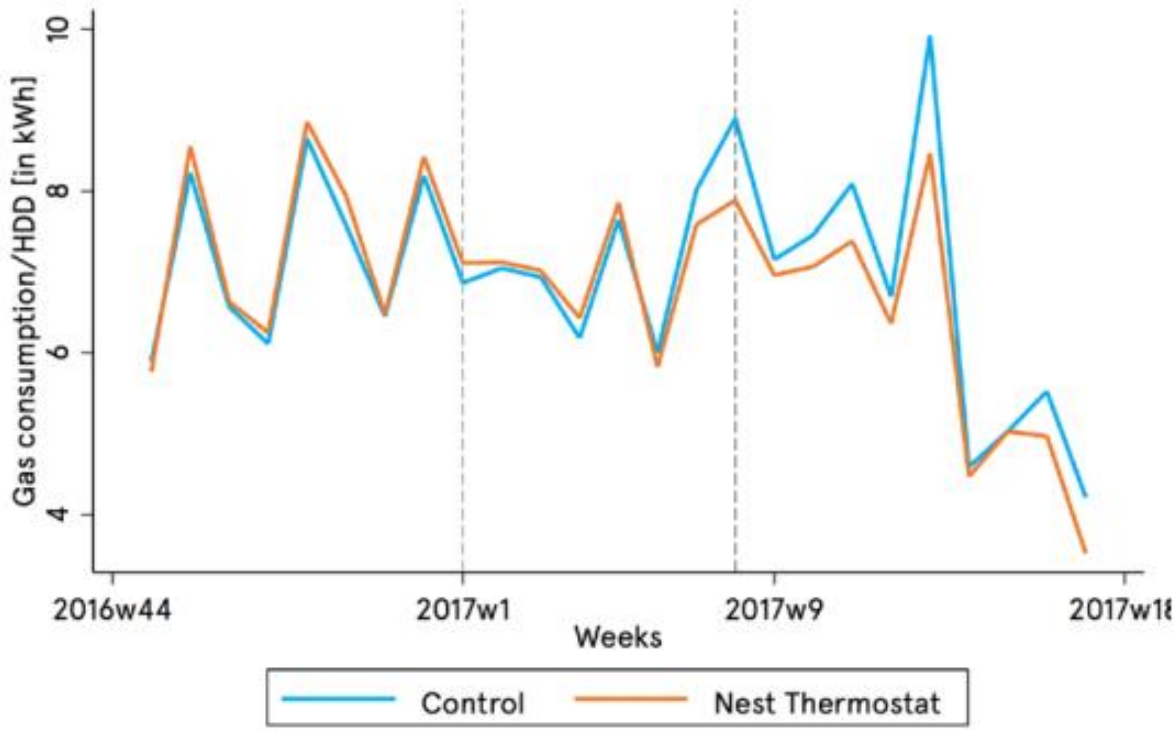
Meeting 4th July – Evidence review

- **Green Energy Options (GEO)**, using operational data from their smart thermostats
- **Nest**, presenting data from a large-scale trial showing energy savings in dwellings with smart thermostats.
- **Climote**, using data from installed smart thermostats.
- **Carbon Free Group** on their Corby project work looking at trials of smart homes.
- **Salford University** with data on some of their research.
- **Schneider Electric** on trials of smart controls to cover both laboratory tests and field trials.

- Primarily focussed on research by the Behavioural Insights Team
- Their proposition is that smart heating controls employing sensors and learning algorithms may provide a solution to consumers failing to set the most efficient schedules on their heating controls.
- Main study is a randomised control trial from 2016/17 comparing 139 houses randomly allocated a Nest Learning Thermostat with a control group of 139 who didn't. All homes had a programmer, thermostat and TRVs to begin with.
- States that *"these results represent the most robust studies of smart heating controls in the UK to date*."

Nest evidence submission

Figure 2: Gas consumption per heating degree day across winter heating period



Note: The first vertical line denotes the week of the first and the second vertical line denotes the day of the last Nest installation.

- Winter household gas saving 5.6%
- Heating system saving estimated at 6.7%

Smart controls – conclusions to date

- **SAP 11**
- Pragmatic approach may be to broadly agree a standard savings figure for a generically defined ‘smart thermostat’.
- A generic definition will need to be agreed.
- SAP could incorporate this as a reduction on assumed operating period of the heating and/or a reduction on assumed average temperature.
- The savings figure could potentially be adjusted for individual products based on data collected from installed products and submitted/analysed.

Smart controls – conclusions to date

- **SAP 10**
- The new version of SAP includes an option to adjust the assumed hours of heating in Table 9, based on a control record in the PCDB.
- The working group identified the opportunity to utilise this for smart thermostats from next year; ahead of the development of SAP 11. This would need a standardised test and a defined process, probably on an individual product by product basis for their individual scores, but there could be the potential for industry to define a single smart thermostat score.

- **SAP 10**
- The new version of SAP includes an option to adjust the assumed hours of heating in Table 9, based on a control record in the PCDB.
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Smart Readiness Indicator flexibility functions

domain	Electricity
	Amount of on-site renewable energy generation
level 0	None
level 1	Limited amount of PV or CHP production
level 2	PV or CHP capacity able to cover average needs
	Storage of locally generated energy
level 0	None
level 1	Limited: small scale storage (batteries, TES,...)
level 2	Storage which can supply self-consumption for > 3 hours
level 3	Dynamically operated storage which can also feed back into the grid.
	Optimizing self-consumption of locally generated energy
level 0	None
level 1	short term optimization
level 2	long term optimization including predicted generation and/or demand
	Services for integration of renewables into the building energy portfolio
level 0	None
level 1	local control
level 2	local optimization based on pricing
level 3	grid based optimization
level 4	VPP integration
	Services for integrating battery storage systems into energy portfolio
level 0	None
level 1	local control
level 2	local optimization based on pricing
level 3	grid based optimization
	Support of microgrid operation modes
level 0	None
level 1	local battery usage
level 2	autonmous energy consumption control
	Integration of smart appliances
level 0	None
level 1	local control
level 2	building based assets optimization
level 3	price based optimization
level 4	grid based optimization
	Flexible start and switch off of home appliances
level 0	None
level 1	tarif based
level 2	grid condition based

domain	domestic hot water
	Control of DHW storage charging (with direct electric heating or integrated electric heat pump)
level 0	Automatic control on / off
level 1	Automatic control on / off and scheduled charging enable
level 2	Automatic control on / off and scheduled charging enable and multi-sensor storage management
level 3	Automatic charging control based on local availability of renewables or information from electricity grid (DR, DSM)
	Control of DHW storage charging (using hot water generation)
level 0	Automatic control on / off
level 1	Automatic control on / off and scheduled charging enable
level 2	Automatic on/off control, scheduled charging enable and demand-based supply temperature control or multi-sensor storage management
level 3	Automatic charging control based on signals from district heating grid (DR, DSM)
	Control of DHW storage temperature, varying seasonally: with heat generation or integrated electric heating
level 0	Manual selected control with charging pump on / off or electric heating
level 1	Automatic selected control with charging pump on / off or electric heating and charging time release
level 2	Automatic selected control with charging pump on / off or electric heating, charging time release and demand-oriented supply or multi-sensor storage management
level 3	Automatic selected control with heat generation, demand-oriented supply and return temperature control or electric heating, charging time release and multi-sensor storage management
	Control of DHW storage charging (with solar collector and supplementary heat generation)
level 0	Manual selected control of solar energy or heat generation
level 1	Automatic control of solar storage charge (Prio. 1) and supplementary storage charge
level 2	Automatic control of solar storage charge (Prio. 1) and supplementary storage charge and demand-oriented supply or multi-sensor storage management
level 3	Automatic control of solar storage charge (Prio. 1) and supplementary storage charge, demand-oriented supply and return temperature control and multi-sensor storage management
	DSM control of equipment
level 0	Not present
level 1	Domestic Hot Water production subject to Demand Side Management

domain	Electric vehicle charging
	Charging with local, building system based control (price signal based charging)
level 0	None
level 1	dumb charging on single tariff
level 2	adaptive tariffs structures with remote access
	Charging with aggregated control (EV responsible party as VPP balancing responsible party)
level 0	None
level 1	local optimization
level 2	local and grid optimization
	Charging with aggregated control (EV responsible party under a balance responsible party)
level 0	None
level 1	local optimization
level 2	local and grid optimization
	Grid connected heating for EV in winter time
level 0	None
level 1	no grid sensor based charging
level 2	grid-sensor based charging
	Providing system services to DSO operations
level 0	None
level 1	grid optimized operations
level 2	grid and battery lifecycle optimized behaviour
	Charging for optimisation of the EV battery life-cycle
level 0	None
level 1	car-lifecycle otpmization
level 2	car and grid lifecycle optimization
	Charging based on DSO price tags - "local wind storage"
level 0	None
level 1	storage
level 2	storage and feed-in to grid
	Vehicle to grid operation and control
level 0	None
level 1	exists
	EV Charging Grid balancing
level 0	Not present
level 1	1 way (controlled charging)
level 2	2 way (also EV to grid)
	EV charging information and connectivity
level 0	No information available
level 1	Reporting information on EV charging status to occupant
level 2	Communication with a back-office compliant to ISO 15118

domain	Monitoring and control
	Heating and cooling set point management
level 0	Manual setting room by room individually
level 1	Adaptation from distributed / decentralized plant rooms only
level 2	Adaptation from a central room
level 3	Adaptation from a central room with frequent set back of user inputs
	Run time management of HVAC systems
level 0	Manual setting (plant enabling)
level 1	Individual setting following a predefined time schedule including fixed preconditioning phases
level 2	Individual setting following a predefined time schedule; adaptation from a central room; variable preconditioning phases
level 3	Control of run time management by artificial intelligence
	Remote surveillance of building behaviour
level 0	Not present
level 1	Remote control of main TBS
level 2	Remote control of main TBS with centralised occupancy detection
level 3	Remote control of main TBS with centralised occupancy detection, automatic non-occupancy default settings and user alerts
	Central off-switch for appliances at home
level 0	None
level 1	simple off switch
level 2	off switch with ability for remote operation
level 3	secquence of deactivation for load optimisation
	Power flows measurement and communications
level 0	None
level 1	local use of sensor data
level 2	use of sensor data in microgrid operations
level 3	DSO based use of sensor data
	Energy delivery KPI tracking and calculation
level 0	None
level 1	local optimisation
	Fault location and detection
level 0	None
level 1	local based detection of errors
level 2	DSO optimised operations
	Neighbourhood energy efficiency calculation
level 0	None
level 1	local optimization
level 2	data exchange for local swarm and optimization
level 3	data exchange for local swarm and optimization for DSP vpp control
	Demand prediction
level 0	None
level 1	local optimization
level 2	adaptive load forecast
	Information exchange on renewables generation prediction
level 0	None
level 1	local optimization
level 2	adaptive load forecast
	DSM control of a device by an aggregator
level 0	None
level 1	microgrid operations (energy based)
level 2	VPP operations (price based)
	Energy storage penetration prediction
level 0	None
level 1	local forecast
level 2	microgrid based forecast
	Smart Grid Integration
level 0	None - No harmonization between grid and building energy systems; building is operated independently from the grid load
level 1	Building energy systems are managed and operated depending on grid load; demand side management is used for load shifting
	DSM control of equipment
level 0	Not present
level 1	Smart appliances or DHW subject to DSM control
level 2	Heating or cooling subject to DSM control
level 3	Heating and cooling subject to DSM control
level 4	Smart appliances, DHW, heating and cooling subject to DSM control
	Connecting PV to DSO grid
level 0	none
level 1	simple feed-in
level 2	CLS interface
level 3	DSO controls
	Reporting information regarding DSM
level 0	None
level 1	Reporting information on current DSM flows and controls
level 2	Reporting information on current, historical and predicted DSM flows and controls
	Override of DSM control
level 0	No DSM control
level 1	DSM control without the possibility to override this control by the occupant
level 2	Manual override and reactivation
level 3	Scheduled override of DSM control and reactivation
level 4	Scheduled override of DSM control and reactivation with artificial intelligence

domain
Electricity
domestic hot water
Electric vehicle charging
Monitoring and control

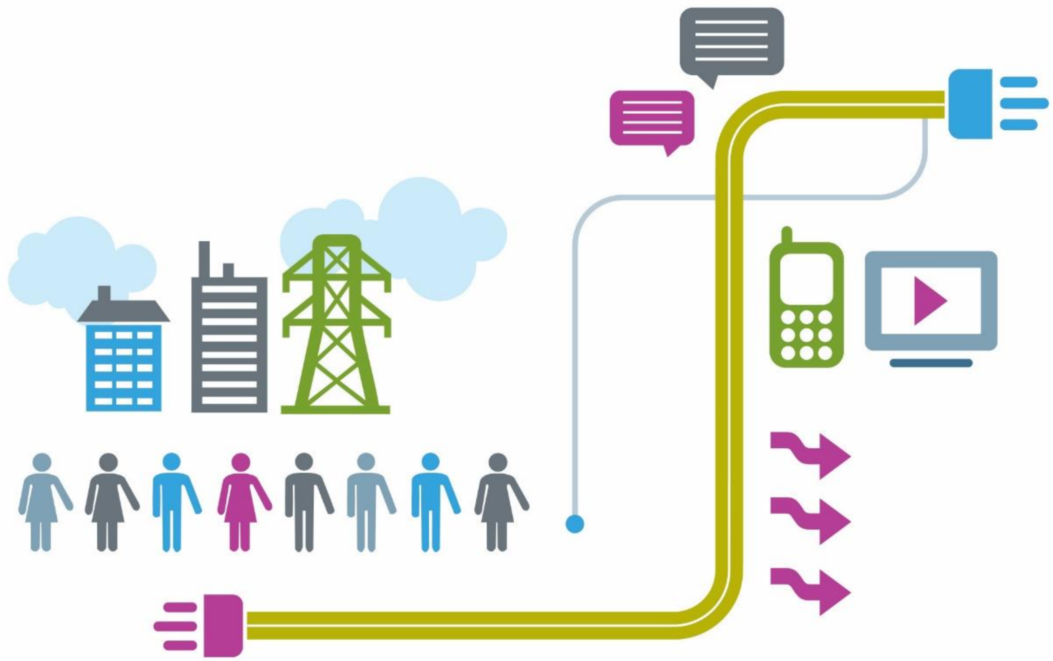
	DSM control of equipment
level 0	Not present
level 1	Smart appliances or DHW subject to DSM control
level 2	Heating or cooling subject to DSM control
level 3	Heating and cooling subject to DSM control
level 4	Smart appliances, DHW, heating and cooling subject to DSM control

	Storage of locally generated energy
level 0	None
level 1	Limited: small scale storage (batteries, TES,...)
level 2	Storage which can supply self-consumption for > 3 hours
level 3	Dynamically operated storage which can also feed back into the grid.

	Control of DHW storage charging (with direct electric heating or integrated electric heat pump)
level 0	Automatic control on / off
level 1	Automatic control on / off and scheduled charging enable
level 2	Automatic control on / off and scheduled charging enable and multi-sensor storage management
level 3	Automatic charging control based on local availability of renewables or information from electricity grid (DR, DSM)

Smart tariffs

- Decision to be taken on whether these are practical to include
- Engagement from energy suppliers has been difficult to get but should be presence at next meeting
- Problems of inclusion in a compliance calculation:
  - Variability of products and application
  - Rate of change of offerings
  - Dependence on customer choice



#4 Overheating including prevention and cooling

CoLeaders:

David Bush

Phil Brown (apology for not attending)

SAPIF:
Working Group #4 Overheating

David Bush – British Blind and Shutter Association
Phil Brown – Glass and Glazing Federation

Working Group Members

Phil Brown

Dave Bush and Zoe De Grussa

Matthew Hurd

Neil Freshwater

Jodie Evans and Owen Gallagher

Joe Miles and Kate Brown

Barny Evans

Silvio Junges

Andrew Mitchell

Steven Montgomery

Progress this Quarter…

- Two meetings held between members.

- No new members added to the group this quarter.

- Group members have started uploading evidence documents to the group Dropbox. This information is also being disseminated into a simplified ‘Lead Evidence Document’ which will cover all technologies.

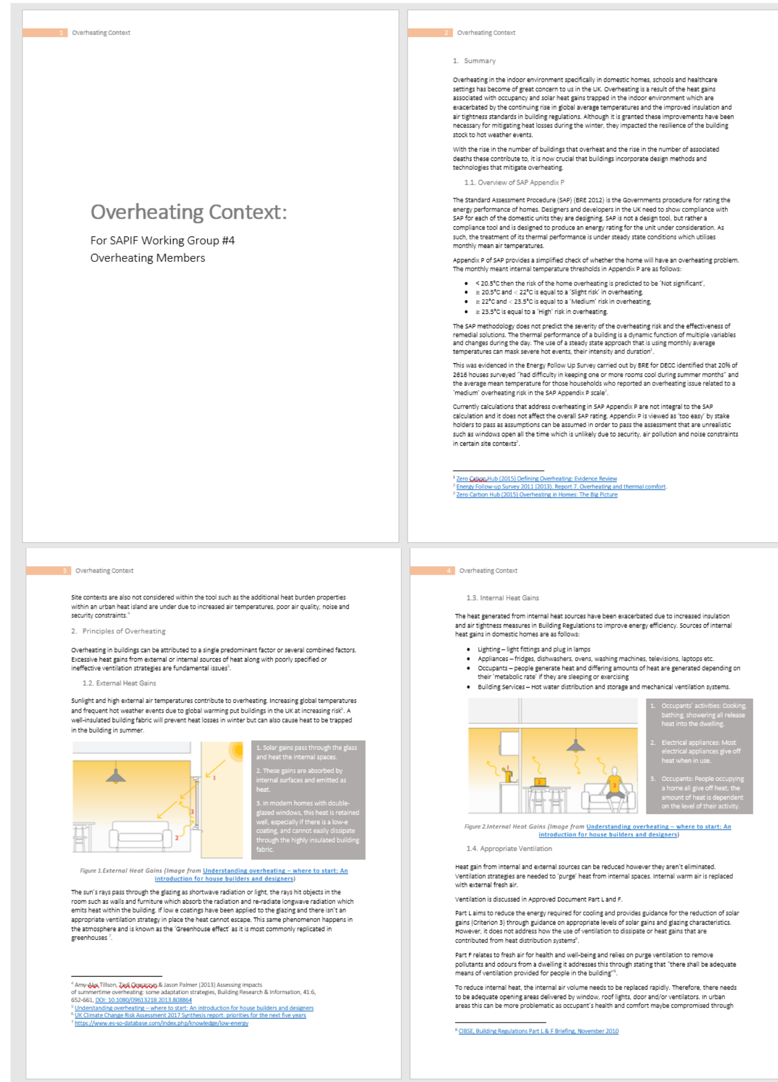
- Each Technology area has been appointed a leader to compile the evidence and produce the content for the ‘Lead Evidence Document’.

- The technology areas covered by the group are:

    - Thermal Mass
    - Glazing
    - Shading
    - Ventilation
    - Energy Generation (TBC)

Overheating Context Document

A condensed version (1 – 3 paragraphs) of the previously produced context document will set the context for the 'Lead Evidence Document'.



Aim

Improved Assessment of Overheating

Application

Technologies in SAP

Affected by…

- Occupant Behaviour
- Control
- Building Modelling
- Building Design
- Air Quality and Acoustics

Shading

- New Fabrics with validated data for improved Gtot.
- Automated and Motorised Control Systems
- New EU Standards for thermal assessment of fabrics.

Glazing

- Suspended Particle Device
- Thermochromic
- Polymer Dispersed Liquid Crystal
- Electrochromic

Thermal Mass

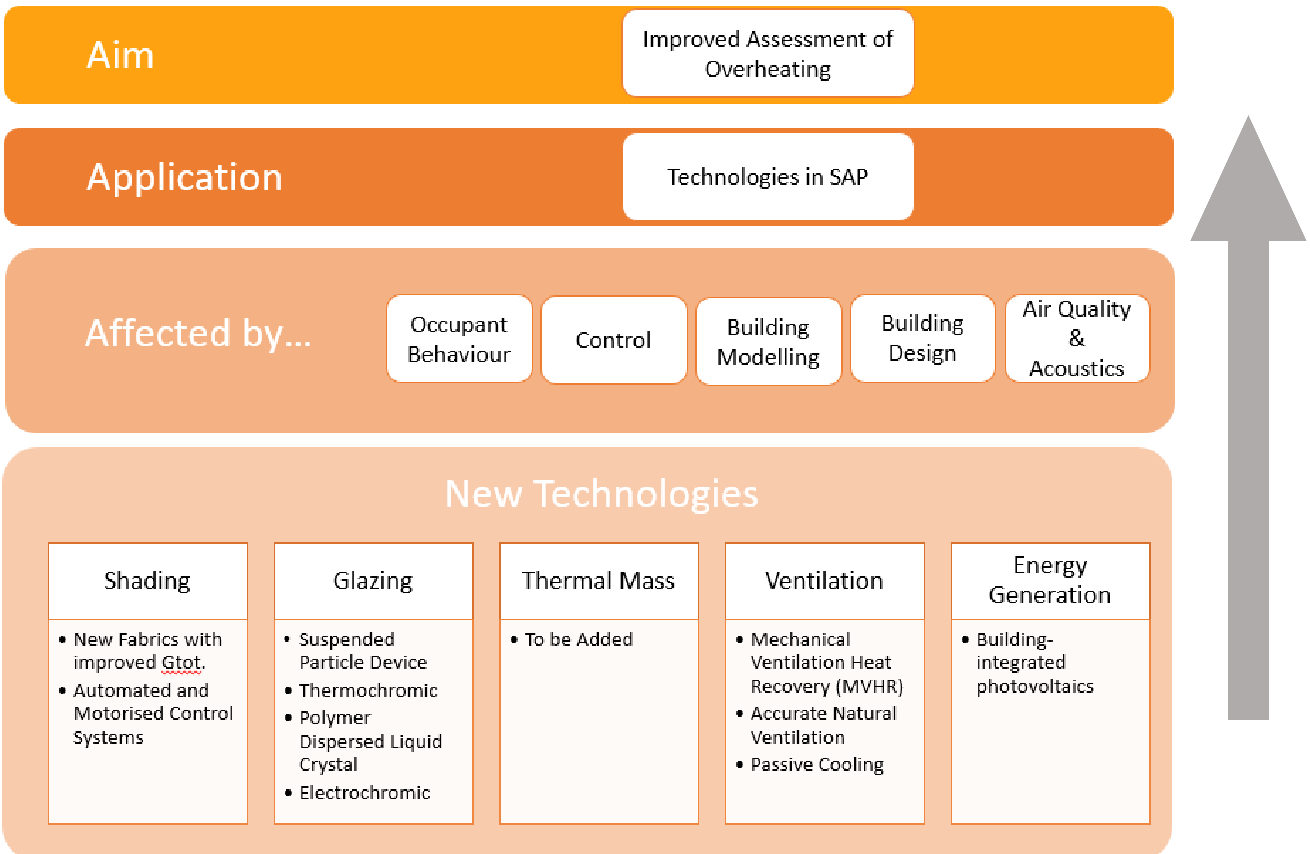
- TBC

Ventilation

- Mechanical Ventilation Heat Recovery (MVHR)
- Accurate Natural Ventilation
- Passive Cooling

Energy Generation

- Building-integrated photovoltaics



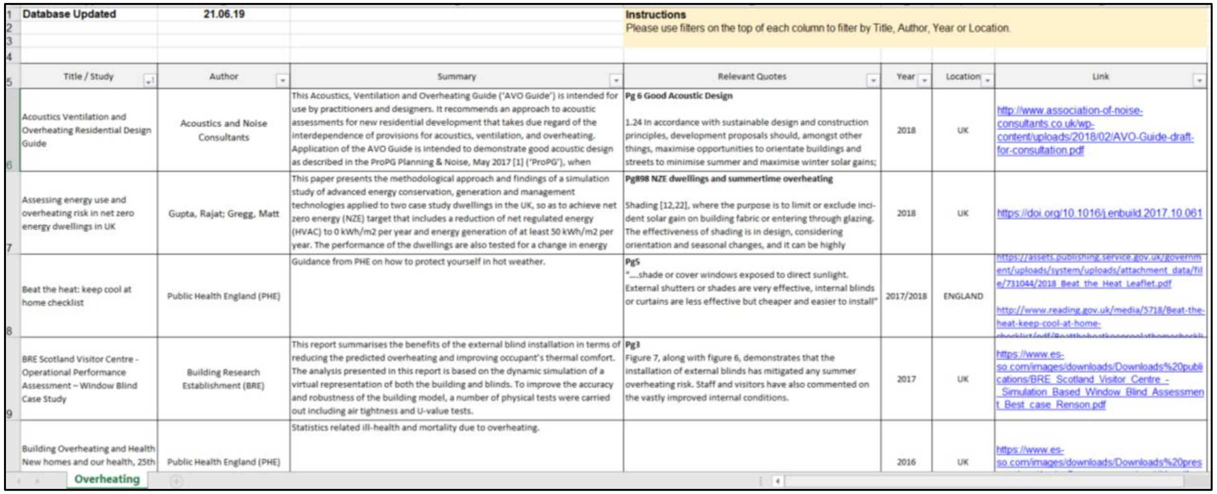
Each Technology Area will **produce an Overheating** **'Evidence Section' within the 'Lead Document'** considering the elements that may **affect them** and **how they are applied in SAP.**

They will also **review how the technologies effect each other**.

Shading Progress

Last Quarter:

- Overheating 'Shading' Database Produced
  - Sorting Literature with Shading Relevance for Evidence
  - Simplified Literature to Title, Author, Summary and Shading Specific Quotes and Links to Resources for other Members.
  - 62 Documents Added



Database Updated 21.06.19

Instructions
Please use filters on the top of each column to filter by Title, Author, Year or Location.

Title / Study	Author	Summary	Relevant Quotes	Year	Location	Link
Acoustics Ventilation and Overheating Residential Design Guide	Acoustics and Noise Consultants	This Acoustics, Ventilation and Overheating Guide ('AVO Guide') is intended for use by practitioners and designers. It recommends an approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics, ventilation, and overheating. Application of the AVO Guide is intended to demonstrate good acoustic design as described in the ProPG Planning & Noise, May 2017 [1] ('ProPG'), when	**Pg 6 Good Acoustic Design** 1.24 In accordance with sustainable design and construction principles, development proposals should, amongst other things, maximise opportunities to orientate buildings and streets to minimise summer and maximise winter solar gains;	2018	UK	http://www.association-of-noise-consultants.co.uk/wp-content/uploads/2018/02/AVO-Guide-draft-for-consultation.pdf
Assessing energy use and overheating risk in net zero energy dwellings in UK	Gupta, Rajat; Gregg, Matt	This paper presents the methodological approach and findings of a simulation study of advanced energy conservation, generation and management technologies applied to two case study dwellings in the UK, so as to achieve net zero energy (NZE) target that includes a reduction of net regulated energy (HVAC) to 0 kWh/m2 per year and energy generation of at least 50 kWh/m2 per year. The performance of the dwellings are also tested for a change in energy	**Pg898 NZE dwellings and summertime overheating** Shading [12,22], where the purpose is to limit or exclude inci-dent solar gain on building fabric or entering through glazing. The effectiveness of shading is in design, considering orientation and seasonal changes, and it can be highly	2018	UK	https://doi.org/10.1016/j.enbuild.2017.10.061
Beat the heat: keep cool at home checklist	Public Health England (PHE)	Guidance from PHE on how to protect yourself in hot weather.	**Pg5** "....shade or cover windows exposed to direct sunlight. External shutters or shades are very effective, internal blinds or curtains are less effective but cheaper and easier to install"	2017/2018	ENGLAND	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/731044/2018_Beat_the_Heat_Leaflet.pdf http://www.reading.gov.uk/media/5718/Beat-the-heat-keep-cool-at-home-checklist/pdf/
BRE Scotland Visitor Centre - Operational Performance Assessment – Window Blind Case Study	Building Research Establishment (BRE)	This report summarises the benefits of the external blind installation in terms of reducing the predicted overheating and improving occupant's thermal comfort. The analysis presented in this report is based on the dynamic simulation of a virtual representation of both the building and blinds. To improve the accuracy and robustness of the building model, a number of physical tests were carried out including air tightness and U-value tests.	**Pg3** Figure 7, along with figure 6, demonstrates that the installation of external blinds has mitigated any summer overheating risk. Staff and visitors have also commented on the vastly improved internal conditions.	2017	UK	https://www.es-so.com/images/downloads/Downloads%20publications/BRE_Scotland_Visitor_Centre_-_Simulation_Based_Window_Blind_Assessment_Best_case_Renson.pdf
Building Overheating and Health New homes and our health, 25th	Public Health England (PHE)	Statistics related ill-health and mortality due to overheating.		2016	UK	https://www.es-so.com/images/downloads/Downloads%20pres

Overheating

This Quarter:

- Further 15 documents added.
- Ranked 'Importance' of publications in Database.
- Produced a Word Document Index of all Publications.

Shading Progress – Application in SAP

		% Closed	Shading Factor & Blind Use
SAP 2012	**Shading Factor (Z_{blind})**	**Recommended f % for Daytime**	**Final Shading Factor ($f \times Z_{blind} + (1 - f)$)**
Internal Dark Blind (Base Line)	0.85	100%	0.85
Internal Light Blind	0.6	100%	0.60
Dark Shutter, Window Closed	0.27	100%	0.27
NEW SAP 2010.1			
Internal Dark Blind (Base Line)	0.9	75%	0.93
Internal Light Blind	0.74	75%	0.81
Dark Shutter, Window Closed	0.53	75%	0.65

In SAP2012 (OLD) blinds were assumed closed 100% of the daytime hours. In SAP 10.1 they are now assumed closed 75% of the time. This makes shading **less effective** as found in the above values. As these original values are based on old data there is a need to update them and set higher specification requirements for shading that is installed.

Glazing Progress

This Quarter:

- Sorting Literature with Glazing Evidence
- Simplified Literature to Title, Author, Summary and Glazing Specific Quotes and Links to Resources for other Members.
- 16 Documents Added

Database Updated 03.10.19

Instructions
Please use filters on the top of each column to filter by Title, Author, Year or Location.

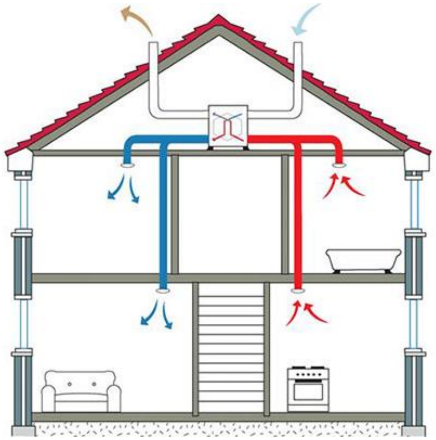
Title / Study	Author	Summary	Relevant Quotes	Yea	Locatio	Link
Smart Windows Markets: 2016-2025	n-tech research	This report presents an analysis of the latest developments in the smart window space, which this research believes will fundamentally transform the opportunities available from this space.		2016	USA	https://www.businesswire.com/news/home/20161114006348/en/Smart-Windows-Markets-2016-2025---Total-Revenues
Solar Leaf	Arup	The world´s first bio-reactive façade generates renewable energy from algal biomass and solar thermal heat. The integrated system, which is suitable for both new and existing buildings, was developed collaboratively by Strategic Science Consult of Germany (SSC), Colt International and Arup.				https://www.arup.com/projects/solar-leaf
BIPV in Norway	Building Integrated Photovoltaics for Norway	The BIPVNO project objective is to identify and develop robust BIPV-solutions that are suitable for Norway and to provide a scientifically founded knowledge-base for future developments of new materials, components and solutions that can be tailor-made for the Norwegian climate and solar irradiation conditions.		2019	Norway	http://bipvno.no/
Ubiquitous Energy Demonstrates First Large-Area Window FaçadesIncorporating Truly Transparent Solar Technology	Business Wire	The leader in transparent solar technology, has produced thefirst demonstration commercial window façades using over 1 square meterof the company's truly transparent solar technology,		2019	USA	https://www.businesswire.com/news/home/20190130005222/en/Ubiquitous-Energy-Demonstrates-Large-Area-Window-Fa%C3%A7ades-Incorporating
Continuing Education - Building Integrated Photovoltaics.	Cockram, M.	A diverse set of projects demonstrates that a building's skin can be transformed into a solar power plant		2016	USA	https://www.architecturalrecord.com/articles/11590-continuing-education-building-integrated-photovoltaics
Self-sustainable electricity production from algae grown in a microbial fuel cell system.	Gajda, I., Greenman, J., Melhuish, C., & Ieropoulos, I. (	This paper describes the potential for algal biomass production in conjunction with wastewater treatment and power generation within a fully biotic Microbial Fuel Cell (MFC).		2015	UK	https://www.sciencedirect.com/science/article/pii/S0961953415300052

Leaders for Contribution to Lead Evidence Document

- **Glazing -** Phil Brown (Glass and Glazing Federation)
- **Shading** - David Bush and Zoe De Grussa (British Blind & Shutter Association)
- **Ventilation** – Neil Freshwater (Velux)
- **Thermal Mass** - Jodie Evans and Owen Gallagher
- **Reviewing Application of Technologies to SAP** – Matthew Hurd
- **Energy Generation** – Unappointed

Gaps in Working Group

- Ventilation and Acoustics Solutions
  (e.g. External Façade Panelling combined with Ventilation (See Image Right))
- Ventilation and Air Quality
- Building Simulation Methodologies
- Impact of Controls / Automation
- Application of Technologies in SAP
- Case Studies of buildings where all or a combination of outlined technologies have been considered.



Questions from Working Group

- Impact of new Building Regulations on overheating to SAP Technologies?

Ministry of Housing,
Communities &
Local Government

The Future Homes Standard

2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings

October 2019
Ministry of Housing, Communities and Local Government

Overheating in new dwellings

1.25. In 2018 the Environmental Audit Committee (EAC) held an inquiry into heatwaves and their impact on the UK. Within the final report the EAC recommended that the government should create a new regulation to stop buildings being built which are prone to overheating.

1.26. The government responded to this recommendation by committing to consult on a method for reducing overheating risk in new homes.[8] the consultation will address this commitment and include proposals to reduce the risk.

Timetable for introduction of changes

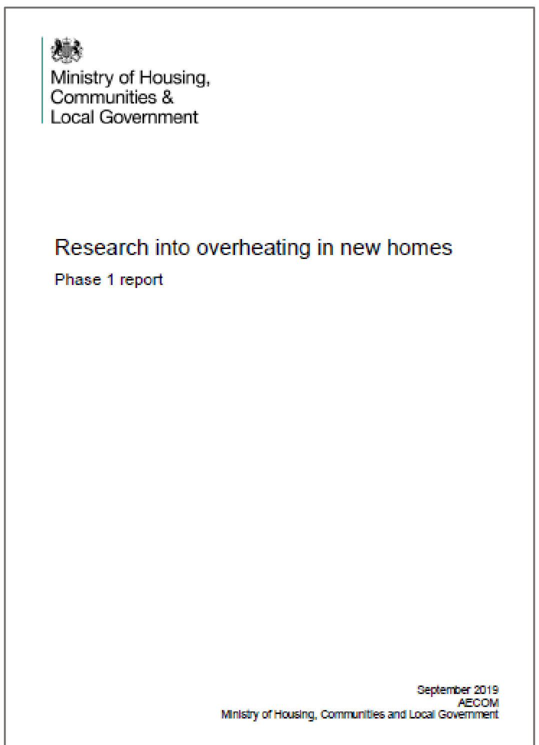
1.27. The dates corresponding to the government's preferred option are set out below.

Date	Government's preferred option on timing
Late 2019/early 2020	Subsequent consultation on: • Overheating in new dwellings • Energy efficiency standards for work carried out in existing dwellings • Energy efficiency standards for new buildings other than dwellings • Energy efficiency standards for work to existing buildings other than dwellings
Early/mid 2020	Publication of new Part L, Part F and overheating regulations, associated guidance and supporting analysed consultation response document.
Mid/late 2020	Part L, Part F and overheating regulations come into force.

[8] Tenth Special Report Appendix: Government Response (2018)
https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1671/167102.htm

Questions from Working Group

Currently the research published MHCLG alongside the 'Future Homes Standard' is being disseminated by the research group. The 'Risk mitigation packages' laid out in Section 4.1.2 of the Phase 2 report are being considered within the SAPIF group.



Ministry of Housing,
Communities &
Local Government

Research into overheating in new homes

Phase 1 report

September 2019
AECOM
Ministry of Housing, Communities and Local Government

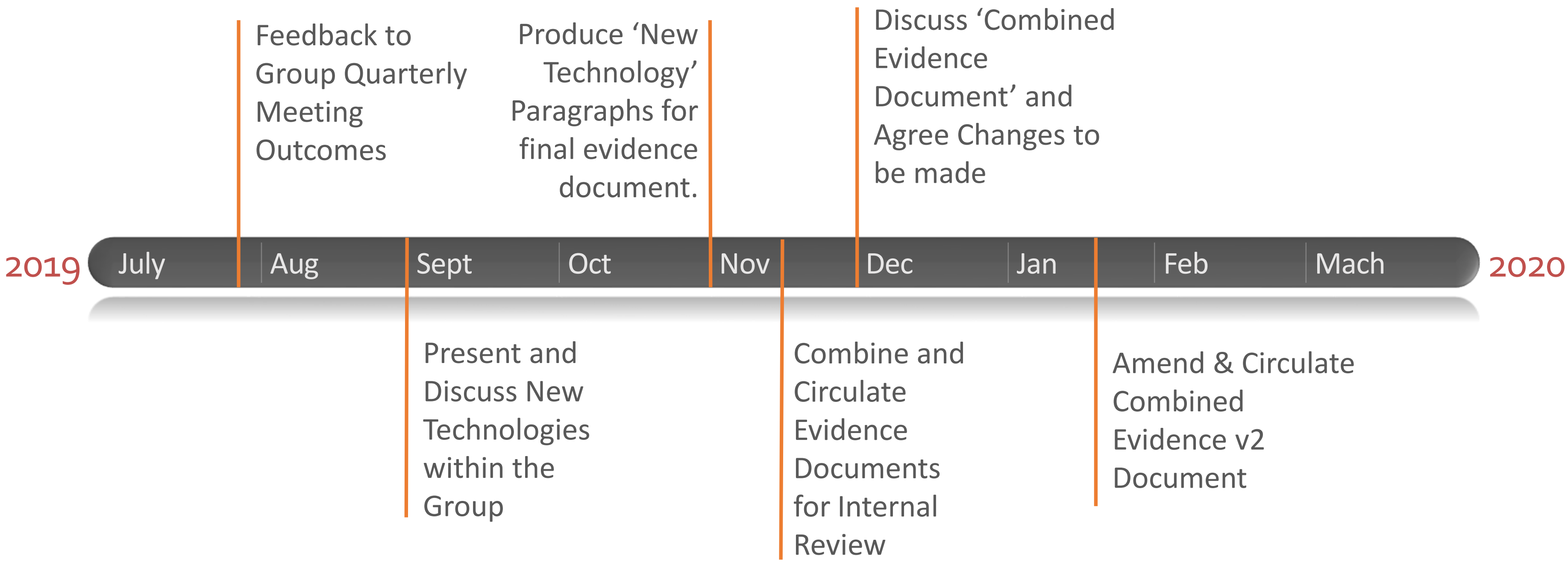
Ministry of Housing,
Communities &
Local Government

Research into overheating in new homes

Phase 2 report

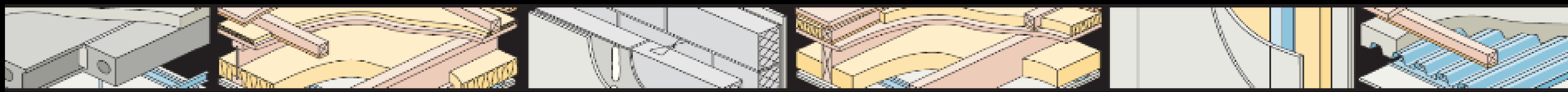
September 2019
AECOM
Ministry of Housing, Communities and Local Government

Timeline of Work



Thank you for Listening

#5 Ventilation and Indoor Air Quality (IAQ)

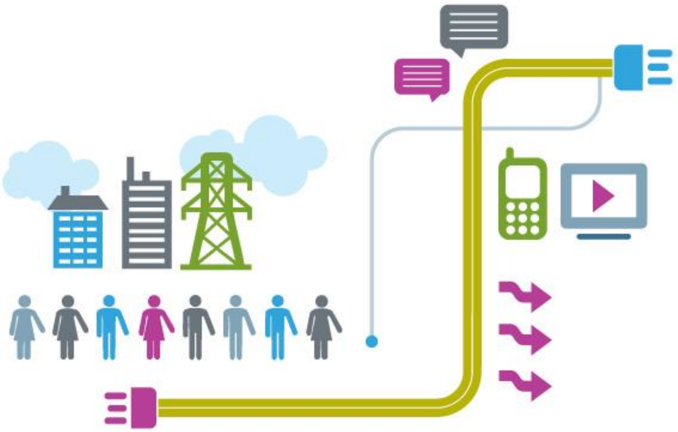


CoLeaders:

Adrian Regueira-Lopez

Nick Howlett (apology for not attending)

SAPIF MEETING
VENTILATION AND IAQ
OCTOBER 2019



- Members
  - AERECO
  - AIRFLOW
  - ATAMATE
  - BEAMA
  - ENVIROVENT
  - FETA
  - NUAIRE
  - TITON
  - VOLUTION
  - WEST ENERGY
- Meetings
  - February 25
  - April 16
  - July 23
  - TBC

- New control systems that directly address air quality e.g. VOCs, CO, CO2, NOx, humidity are within scope.
- Do not conflict with Part F!

SAP Factors

Unit energy efficiency ($WL^{-1}s$)

Air density (kgm^{-3})

Dwelling air volume (m^3)

Mech. throughput (ach)

Ventilation system:	
Mechanical extract ventilation h)	IUF × SFP × 1.22 × V
Balanced whole house mechanical ventilation fans h)	IUF × SFP × 2.44 × n_{mech} × V
Positive input ventilation (from loft space)	0
Positive input ventilation (from outside) h)	IUF × SFP × 1.22 × V

- Group working on a high-level description and classification of ventilation controls:
  - Type of control
  - Description of control
  - Impact on SAP
  - Control Parameter
  - Ventilation System “Compatibility”
- Barriers still a challenge

SAPIF IAQ & Ventilation - List of Ventilation Control Ty				
No.	**Categories of control/optimisation/visualisation**	**Control Parameter**	**Description**	**Impact on standard SAP profile/assumptions**
1	Manual on/off controls	Switch, cord	Manual input by the user to turn unit on or off. This does not include fans isolation as a form of control. Typically used for intermittent fans in wet rooms	
2	Manual boost controls (single or multi-speed)	Switch, cord	Manual input by the user to increase minimum ventilation rate to boost	As SAP currently only models minimum ventilation rates, the effect of these controls would not have an impact in the energy use by the ventilation unit. In reality, these controls can save energy by reducing the amount of time that ventilation units are unnecesarily running at higher rates than the background ventilation rate, particularly in winter time (when heated air is extracted from the property).
3	Manual boost controls (single or multi-speed) with timer	Switch, cord	Manual input by the user to increase minimum ventilation rate to boost, limited to a certain amount of time	
4	Fixed Boost Controls	A control parameter indicative of occupancy or demand	A control parameter triggered by user demand/occupancy automatically increases ventilation rate to the maximu	
5	Variable Boost	A control parameter indicative of occupancy or demand	A control parameter triggered by user demand/occupancy automatically increases ventilation rate in a variable manner in accordance with the control parameter.	
6	Background ventilation controls	A control parameter indicative of occupancy or demand.humidity/pressure controls, bidirectional control	A control parameter triggered by user demand/occupancy automatically regulates the intake or output of air through the background ventilator	

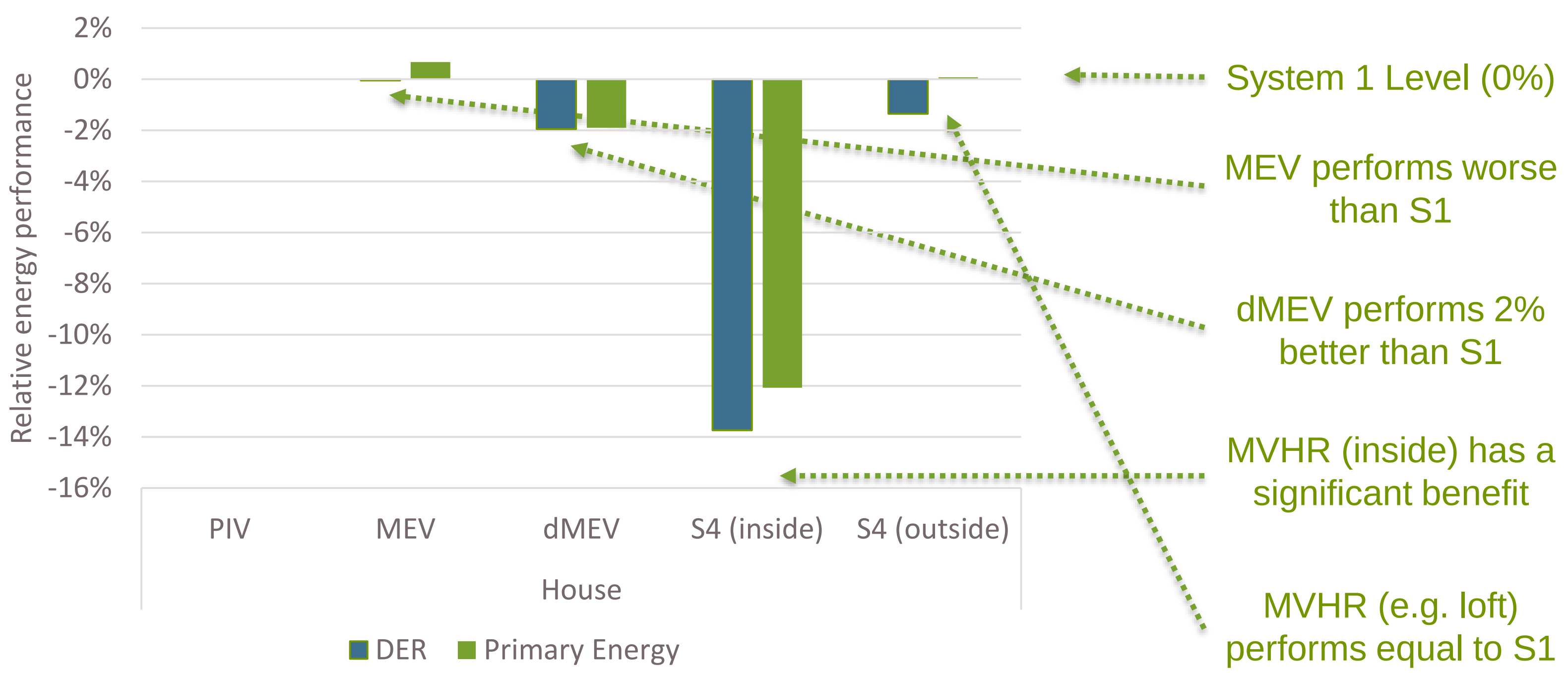
		ypes							
No.	Categories of control/optimisation/visualisation	Relative Humidity	CO2	VOCs (gases)	Presence/Occupancy	Switch/Light sensor	Current/Temperature/Pressure	Manual Input	Systems
1	Manual on/off controls								System 1
2	Manual boost controls (single or multi-speed)								All Systems
3	Manual boost controls (single or multi-speed) with timer								All Systems
4	Fixed Boost Controls								All Systems
5	Variable Boost								All Systems
6	Background ventilation controls								System 1, 2 and 3

Ventilation Controls - Types of Input		
Parameter	**Description**	**Indicative of occupancy or demand?**
Manual Input	A direct signal from the occupant directly turns on or increases the ventilation rate.	
Relative Humidity	Relative humidity is a measure of the partial pressure of water vapor to the equilibirum vapor pressure of water at a given temperature, and is a measure of moisture relative to a certain pressure and temperature. It is used as a metric to regulate ventilation rates based on the moisture generated in household activities such as cooking or showering, mainly in wet rooms.	
CO_2	The concentration levels of CO2 and can be used as an indicator of indoor air quality. Therefore, ventilation rates can be regulated based on the measured CO2 concentration levels generated by the occupants or by other activities (i.e. cooking).	
VOCs (gases)	Volatile Organic Compounds are organic chemicals which have a high vapor pressure (i.e. volatile) and they are generated from building materials, furniture, office equipment and consumer products. Some of them are dangerous to human health, and therefore VOC sensors can be used to determine when ventilation rates need to be increased or decreased. Contrary to humidity or carbon dioxide, VOCs are not caused by human activity.	

VENTILATION CONTROLS

Ventilation Controls - Types of Input		
Parameter	**Description**	**Indicative of occupancy or demand?**
Presence/Occupancy	Occupancy detection sensors can be used to determine how to regulate ventilation rates, as many of the pollutants that are typically removed by ventilation systems are caused by human activity.	
Switch/Light sensor	In rooms with no windows, a switch or light sensor can be used as a proxy for occupancy, and therefore as a way to determine when ventilation rates need to be increased.	
Current/Temperature/Pressure	In certain circumstances, these parameters can be used to determine how to regulate ventilation rates. For example, a current can be used in electric hobs to determine when the kitchen extract fan should be connected. Similarly, a temperature sensor that measured a shower hot water pipe could be used to determine when a bothroom fan should be turned on. Pressure differences between the inside and the [illegible]	

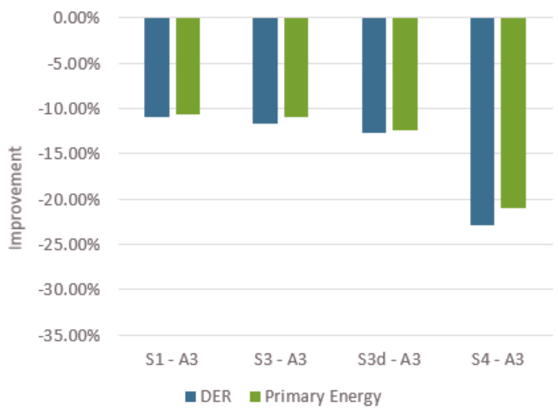
- **Lack of potential energy savings for ventilation in SAP**
  - Based on minimum ventilation rates
  - Intermittent extract ventilation = no energy consumption
- Lack of control standards
- SAP Appendix Q Process


2%
0%
-2%
-4%
-6%
-8%
-10%
-12%
-14%
-16%
Relative energy performance
PIV
MEV
dMEV
S4 (inside)
S4 (outside)
House
DER
Primary Energy
System 1 Level (0%)
MEV performs worse than S1
dMEV performs 2% better than S1
MVHR (inside) has a significant benefit
MVHR (e.g. loft) performs equal to S1

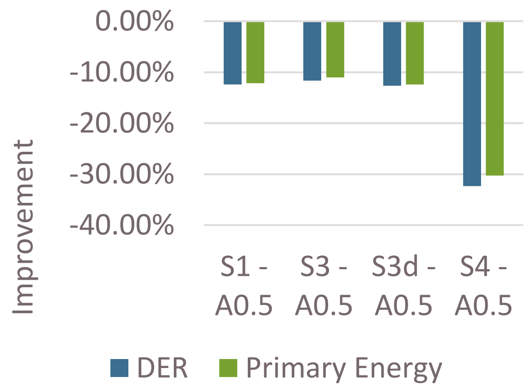
SAP 10.1 – “Natural” Ventilation

- Minimum level of airtightness in naturally ventilated dwellings
- Energy savings capped at AP_{50} = $3m^3/m^2h$
- Dwellings with mechanical ventilation will continue to receive savings

Air Permeability = 3 m³/(m²h)



Air Permeability = 0.5 m³/(m²h)



- Lack of potential energy savings for ventilation in SAP
  - Based on minimum ventilation rates
  - Intermittent extract ventilation = no energy consumption
- **Lack of control standards**
- SAP Appendix Q Process

- Lack of recognised control standards
- Ecodesign recognizes ventilation controls through “in-use” factors

Calculation of the specific energy consumption requirement

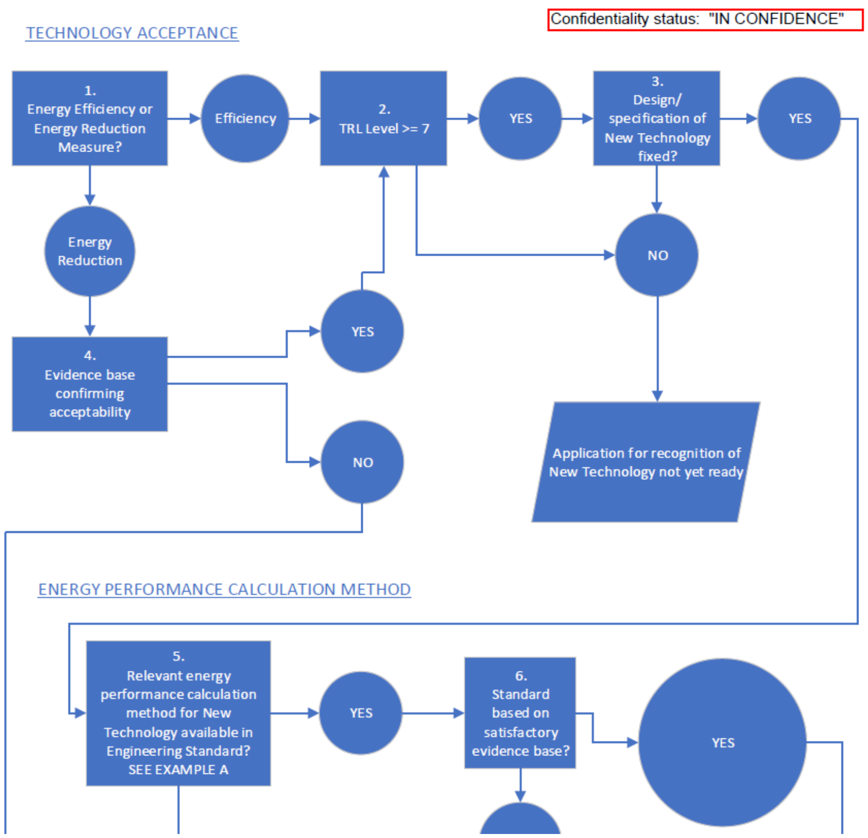
$$SEC = t_a \cdot pef \cdot q_{net} \cdot MISC \cdot CTRL^x \cdot SPI - t_h \cdot \Delta T_h \cdot \eta_h^{-1} \cdot c_{air} \cdot (q_{ref} - q_{net} \cdot CTRL \cdot MISC \cdot (1 - \eta_t)) + Q_{defr}$$

ventilation control	**CTRL**
Manual control (no DCV)	**1**
Clock control (no DCV)	**0,95**
Central demand control	**0,85**
Local demand control	**0,65**

- Lack of potential energy savings for ventilation in SAP
  - Based on minimum ventilation rates
  - Intermittent extract ventilation = no energy consumption
- Lack of control standards
- **SAP Appendix Q Process**

BARRIERS

- Industry concern with regards to New Technology Recognition Process
- Complexity, costs and uncertainty are the main issues

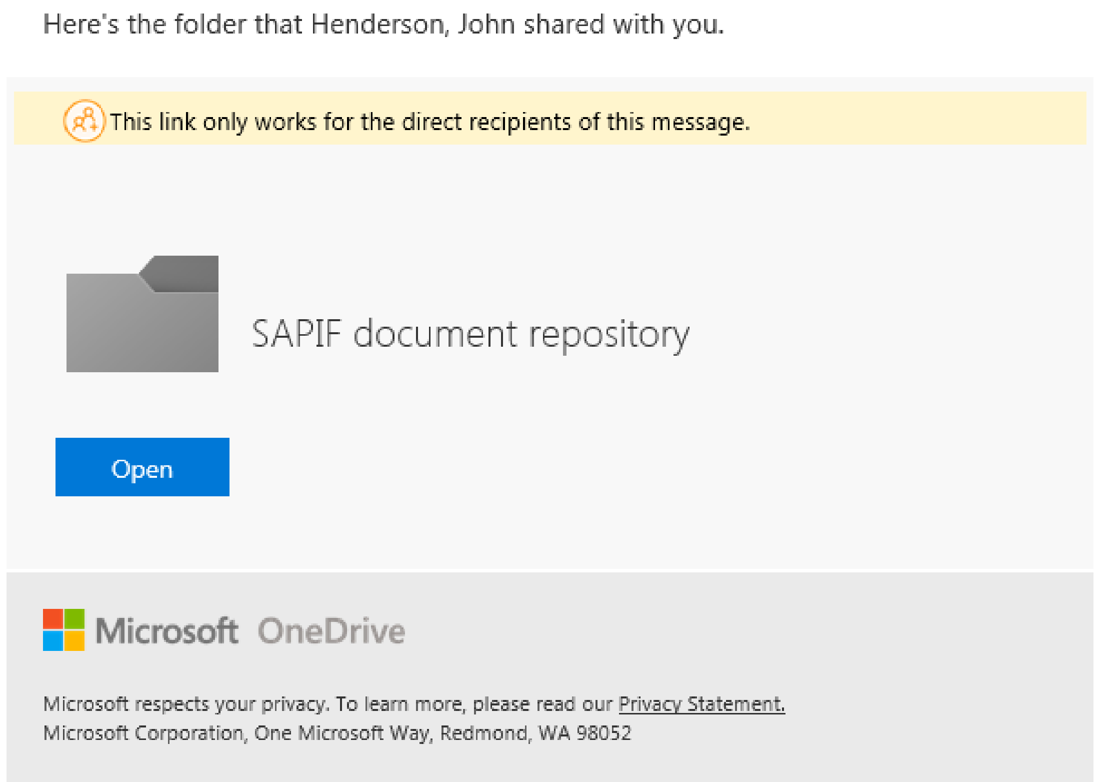


NEXT STEPS

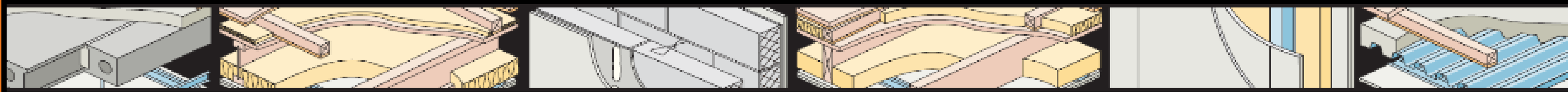
- Finish controls high-level classification
- Catch up with Overheating WG to understand overlap
- First draft of final report by Christmas

SAPIF WGs’ Data Store

- Shared SAPIF folder with subfolders for each working group
- You’ll receive a link in an email from John Henderson looking something like this:

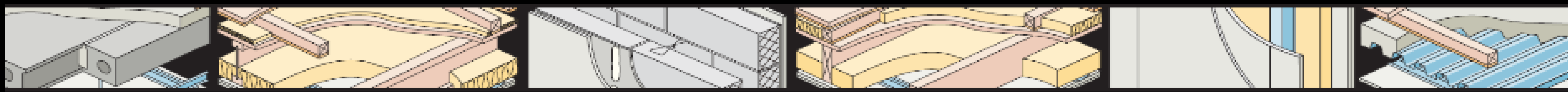


SAPIF WGs' Data Store



- Access is limited to named recipients of the link (SAPIF members)
- Simplest way to access the folder is to click on this link each time
- If you are asked for a password, that is your own email password – not one set by BRE / RDL / BEIS (so don't ask us what it is!)
- Should all 'just work', but let us know if any teething problems that you think are not fixable at your end

Summary and Meeting objectives



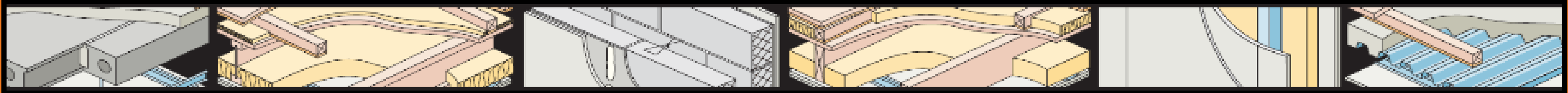
The overall objectives:

1. Publicise each WGs work + final opportunity to contribute.
2. Highlight WG overlaps and interfaces with other WGs

Key aspects:

- For SAP 11
- Assignment completes end Q1 2020
- Part L is out of scope
- New technologies - available in mid-2020s onwards
- Performance Modelling criteria and how judge compliance

The next steps



What would you like ……

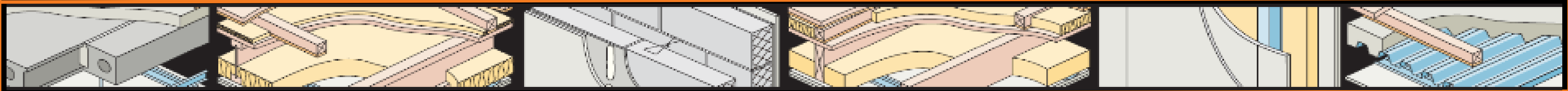
What is the timeline …..

What are the outputs ….

Future SAPIF meetings …………….   Objectives ….

January 2020	Open to all	"Last chance before handover"
March 2020	Leaders / CoLeaders only	Presentation of findings

thankyou



www.robustdetails.com