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Good afternoon and welcome to our CIC Start Online webinar our presentation is just about to begin, we welcome Paul Winson from Corrou Concepts and Dr Charles Russell from Glasgow Caledonian University.

You can ask questions at any point during the webinar.

If we are out of time for questions we will answer them at the end of the webinar this presentation is being transcribed live today's webinar is about the EcoTrip heating control field trial this was a study undertaken By Glasgow Caledonian University for Corrou Concepts here today are Dr Charles Russell of Glasgow Caledonian University and Paul Winson of career concepts our first speaker Gordon cannot be with us today so will start presentation with Charles Russell thank you very much Charles it's a pleasure to be here, thank you.

Branka will be talking about the work of John Paul so apologies for Gordon who couldn't make it today I'm going to cover little bit about what Gordon would have talked about anyway and I will obviously cover all things that we experienced in the field trial so first of all I will pass over to Paul who is the inventor of the EcoTrip device to explain the rationale and the background and give us some background.

Over to you Paul

Hello everybody heating controls have got more and more clever unfortunately the people using the controls have not got more clever! We have started with a design of an EcoTrip which is a switch designed to save energy from heating which is wasted when the houses are empty. We are all very good at turning off lights when they are not wanted.

The Scottish environmental attitudes and behaviour survey which was conducted on behalf of Scottish government a few years ago found that 94% of people feel it is important to turn the lights off, and as you see 48% say they always do so and that's not too bad but then look at the situation with heating and 73% of people feel it's important to our heating, but you can seriously change the number is below three quarters of those who feel it is important but only 32% say they always do so and we can make a direct comparison of lighting and heating and the stark reality is shown up the fact that people are more reluctant to turn off heating when it is not needed is really odd for this reason let's look at a typical fuel consumption in existing homes in Scotland the average Scottish home the amount of energy on heating is around 70%, that is the blue area in the pie chart the amount that is expended in lighting is such a small slice around 12 o'clock.

So in other words there is a lot more to be saved by economising on heating than on lighting of course there are good reasons for this and perhaps the most important one is the convenience it is easy to turn the lights off and on at the flick of a switch but not so easy with heating. The object of Corrou concepts is to produce heating control that is as easy and convenient to use as the lighting switch.

Shall we start with the humble room thermostat the great thing about the device is that it is basic, passive, it does not need an external energy source it is self acting - in other words when the room stat detects the desired temperature has been reached then the device itself operates. So our objective has been to design the EcoTrip to be simple to operate as a thermostat - have we succeeded? Well, perhaps not but we believe we have come pretty close this is the EcoTrip design, and what we have done is taken the standard room thermostat but linked it with a mechanical countdown timer this means if you're going out for say, three hours, you may want to turn the heating off for 2 1/2 hours but the house would be warm on your return.

The thermostat just operates in the normal way turning it to find a suitable comfortable temperature the time itself is mimicking the thermostat in the way that it operates this is the device as it was realised for this trial I have one here thermostat on the right-hand side easily set to whichever temperature is comfortable. A countdown timer on the left can be set by turning it like this very convenient if you have overdone it you can turn it back if need for longer, you can continue to turn it longer if you completely change your mind you can set it back to 0.

The savings from using the EcoTrip are difficult to estimate so, we asked Strathclyde university to run computer simulations and give us some idea of what sort of savings might be made, and they are fairly elaborate computer programmes they were run for two different types of dwelling the Scottish stock average, which I believe was a terraced house, 100 mm of loft insulation etc and this is the sort of graphic they were producing the period of this 24 hours, showing the temperature change across today the upper line is the room temperature shown by the rooms stacked the lower one is the bedroom area using thermostatic radiator valves in this example uses the heating coming on in the morning, and the temperature rising to the set limits and then a pause is imposed at this point the temperature drops and heating comes on again and heat through for the rest of the day turning off in the late evening they did a lot of work on this and the results summarised in this graph this graph shows different levels of saving on the vertical axis against varying pause periods on the horizontal axis from 0 to 25 hours black line is 1919, probably insulated house and the red line is a stock average has so how does this work, well if we take the five hour pause looking at the pre-1919 house for example, the saving is about 2 to 3% slices on the basis of somebody turning the heating off for five hours once a week every week of the year they would save 2% on their annual fuel bill the temperature drops momentarily heating off less heat escapes from the house, the heating comes on again and yes, you start to use up some of the savings you have made by simple application of the laws of thermodynamics, but you always end up saving more than you cost in starting up the heating again something that is not always appreciated by every member of the public so, we in our own home experiment with this and found that we were saving around 4% per annum obviously it was a mixture of different pauses and different frequencies over the year but 4% might not sound much but compares very favourably with other energy-saving methods particularly to using a smart meter so by this time is July may be starting to think this is all well

and good but it looks a little old-fashioned and clunky we do something with an electronic version well Honeywell had a shot at that this is their home expert and certainly a lot smaller and need to look at however it uses four buttons batteries, an LCD screen and if you make a comparison between the EcoTrip and home expert, then certain advantages over the home expert emerge I will elaborate on the asterisks shortly the most important difference between the EcoTrip and the home expert is the passive feature of the EcoTrip the fact it is battery free batteries are a bit of a no no in the housing sector we have had bad experiences with battery-powered smoke detectors for example so were a lot of other things as well which make the EcoTrip usable by the visually impaired and so on so-called set and forget easy to change both devices are relatively inexpensive, and yes, the home expert does have extra features but of course, with extra features comes more complication so if we look through these particular selected items looking at the setting of the home expert it requires one button press followed by a button hold if you want to change that setting i.e. a readjustment TV to make two button presses and a button-hold the EcoTrip can be set to a quarter hour or expert uses whole hours if you had to cycle through quarters of hours it would require four times the button presses so

That is why Honeywell use whole hours but of course you lose the ability to set it as finely as the EcoTrip both can be used for cooling in addition to heating that feature has to be enabled the big advantage of the home expert says it does have these extra features, although it does add complication so, that summarises the advantage is as we see them we feel that that could certainly help people cut down on the amount of energy they use on heating a quick estimate of the sort of potential estimate of that saving is based on 60,000 GWh that are used in Scottish homes per annum in terms of energy consumption and we think that 1000 GWh are probably spent heating homes when they are empty and nobody is in so one terawatt is the potential energy saving does the EcoTrip have the potential to drive behaviour change? And significantly reduce this wastage?

We believe that the simplicity and convenience of this device could do so would you find it handy when you go out so I'll move on to the field trial section of our presentation so little bit about taking the concept into reality this was quite a journey for Paul, in the development of this product Paul came to me with the idea of a field trial and the idea of working with a housing association and housing association turned out to be interested, west of Scotland housing association with particular reference to a project with one of their developments in Cumbernauld now, Gordon would explain this if he were here but here we go this was built in the early 90s, a reasonably new build there are 22 housing units and there are flats in the point box .

47 units in the top picture there are a number of mid-terraced flats equal to 32 units point blocks are shown above terraced are shown below the properties have been undergoing quite a lot of energy efficiency upgrades anyway in the last several years it is obviously an ongoing commitment by west of Scotland housing association that they make the homes as energy efficient in order to reduce fuel poverty they have had cavity insulation installed in 2007 and 2008 they have upgraded the loft installation where access is allowed in 2009 to 10 they are of a fairly good spec now last remaining issue of this development, a curious one, but obviously to do with the way the development was set out at the time is that all the properties were heated by electric storage heating until finally gas boilers were installed into the area these houses have been extremely expensive to heat because of that the heating

upgrade was actually planned for the earlier part of the winter, but due to the logistics are often happen it didn't actually happen till march so at the inception of this project we thought we would have a whole winter to look at but effectively we had six weeks to run the trial at this particular time however that said it was still quite something to find such a good match for this trial I first want to say a little bit about why the housing association was attracted to the EcoTrip one of the problems that Gordon finds with installation of these quite modern, combi gas boilers is the often the tenants will play with the controls, switch them off, switch them on, and they are often dealing with breakdowns, dealing with the controls themselves which is an enormous drain on their time and resources and it doesn't leave the tenants happy the idea of having the EcoTrip was that instead of switching the heating off at the boiler they could perhaps switch it off using a different control that was his main rationale that's why he was keen to do this we then have a field trial we have to remember that at the same time, we were testing EcoTrip, but also a new heating system is being installed for the tenants at the same time, so in and of itself you are dealing with quite a big change in how you deal with your heating so first of all, site selection.

This is looking at who we assessed for the trial we had a total of 10 households that we looked at and then want to look at the monitoring that we undertook, how did we test how the EcoTrip is used in different situations and we briefly look at the household survey to get a sense of who was involved in this, as it turned out the majority of the households were in the blocks of flats which are three stories for levels we had one other property in the terraced property which seem to be a little bit more difficult to get agreement however, we got a good range of different types of house type and people we wanted to see if it was possible to assess differences all the properties were undergoing the heating change the heating upgrade to a gas boiler as it turned out that those who wanted the EcoTrip tended to be people that seems to have more of a need to save money they are high users of energy and more energy conscious particularly with cost you can see we have a fairly mixed list of participants two bed single female over 65 one bed single female over 65 two bed etc in the control, participants we had little variation really, we wanted to get as broad spectrum as possible to try get a sense as to how was being used, the issue was that in any set development are bound to get whoever you get to do the trial so monitoring we decided to secretly take direct measurements of the first looked at was simply the direct gas use, simply taking a meter reading at the start and then the end to assess gas use we started with the EcoTrip being installed the EcoTrip was installed and some instructions were given regarding the use of the device we also would room comfort levels using tiny tag data so temperature and humidity data just to see how people are living and to see if it is detectable when heating is switched off.

Thirdly we had a data logger connected to the EcoTrip device to log the usage of the EcoTrip itself we could then work out the actual physical usage of the EcoTrip device so let's come back to Paul and look at the actual circuitry of the data logger and EcoTrip connection so how was this done Paul? The time that we used had to have the capability of changeover switch in order to be universally applicable to all the different kinds of heating systems but as it happened in this particular trial this system they were using didn't require a changeover really and that merits we had a spare relay we could use for the data logger connection so we were able to set up the log facility used this spare relay connection, and recorded the event when the timer was operated and how long it switched off for this would give is a

very good measure of when and how long the timer was being used by the occupants great effectively what this meant for me was that the data logger was a very simple installation we did conduct an early trial with this device it would work and the results showed that it did respond we concluded this would be a good way forward a total of his and of the results now on the actual energy use from the different sites we were looking to see if there are any obvious reasons for this for example, more people in the property would have a greater use of gas etc we thought maybe some kind of correlation there, what does seem to be clear from this which is kind of counter intuitive to what we would expect is that the gas use in the houses which are used to EcoTrip was actually higher than those that were not this is more an issue we believe with the design of the field trial rather than a genuine verdict you can see there doesn't seem to be any particular correlation, it is a fairly even kind of spread for electricity use for example an elderly man may have his heating high but their low electricity use for example the results of this don't really tell is very much about the difference EcoTrip made in these houses probably part of the design element of the field trial again, I've looked at the correlation, to see if there was a correlation if there is it is very very weak, between electricity use and gas use there seems to be a negative correlation in gases so it didn't really tell is very much individual lifestyles and the range of people in this particular study had more of an influence on energy usage comfort levels what we can see here is the data from the EcoTrip and the comfort level monitoring effectively these devices were placed in the living room and left recording every minute in this case and what we wanted to look at was to see if there is more variation to identify if people are using EcoTrip this particular example does seem to be more peaks in that period compared to the control however the actual results from the data logger were not particularly conclusive for this particular tenant it wasn't clear if they had used this EcoTrip device it looks like they had used it for a total of two hours a fortnight period, so a little bit inconclusive however you can see that one of the things is the third tenant when the gas installers were installing the flat they didn't install the wiring for the EcoTrip recorder unfortunately however we did ask if this particular tenant used the device and she said that she had used it, and you can see that there are quite clear times when it has been switched off on the left blue line we still need to confirm this, but it gives you a sense of what was measured as I said with the data logger we were left little bit confused really only one gave data that was credible really only one gave data that was credible but going back and retrieving the tiny tags I did ask, 10 said they had used the device and most said they had used it the data did not agree with that apart from in one case the evidence there seems to be inconclusive as to what actually happened so, so, that relieves us with that then finally I just wanted to cover some of the conclusions and recommendations we think that the methodology for assessment was robust enough use of the tiny tag in particular and surveys and meter readings it tells us how the things were being used but trying to understand the usage of the EcoTrip device was more complicated.

One of the other things we had was a fairly small sample size what we do know is that all the householders who had the device installed claimed that they used it, we cannot back that up with the evidence we have an idea as to what happened there which will come back to one of the issues that we dealt with was that the device was installed at the same time as the gas upgrade we believe this would have caused confusion particularly with the use of the thermostat and timer at the same time we think all this activity and change at the same time may have impacted on their understanding of the device and how to use it properly and then, of five houses that were assessed only four had EcoTrip installed

the trial period was very short it was in the late spring we also started the trial a heat wave at the end of march which was particularly frustrating especially for Paul for me I was just glad that we could start, but for Paul it's very frustrating a short period of time to really understand there was no real time to go back and understand and test it further I think conducting this trial over a full winter period with more households with a fuller briefing use and then going back after a month or so and asking them and showing them again how to use EcoTrip would help in my view a further trial should be conducted, perhaps it retrofit situation thank you very much we already have some questions from our online viewers so I will start with these how does heavy mass construction, as in southern Europe change your assumptions? Well there are different elements to this I think that perhaps, when we actually look at this there are two elements one, the technical side does the EcoTrip work as a device? Second aspect is to do with heating control devices in general and the user's ability to actually understand what they're doing its ambitious what we were looking at I think, correct me if I'm wrong Paul but what are looking at here is the device should keep things as simple as possible many of the people who have this device installed were either elderly or living in difficult situations in terms of the nature of the building, I'm not sure I think that's requiring something a little more sophisticated but this device was not intended for that Paul yes I think it is a very interesting question.

Obviously different buildings have different cell characteristics.

if you have heavy construction, which is absorbing heat and so on, changes things somewhat but, I would assume the laws of thermodynamics are unchanged and that would mean that there are still savings to be made I would guess that perhaps not so many, if you have got thick walls retain heat for longer but that would be interesting extension to the study or for Strathclyde university to simulate foreigners I don't think that the difference overall would be so marked thank you.

Aside from heating not switching back on automatically, why not just switch off your heating manually for a few hours? Quite often you don't know how long it would be a way for anyway yes what we have found is that quite a lot of people try to do this using the thermostat and turn the thermostat down we believe this device does encourage people to turn heating off knowing it is timed to come on again I even know people who just turned their heating off and then just put their coat on until heating comes on again when they are home but for elderly people and those with young children they want their home to be warm when they come home yes it is true that sometimes you go out and you're not at all sure when you will be back but certainly our own experience is that we weren't often caught out, and in the majority of times we knew when we would be back also if you got really clever at using this device, you could even anticipate going out and save further by operating the EcoTrip before you went out for example if you are good if you know you are going out in one hour, you could add this hour to the off time and save as the house cools down it will still be comfortable question: we have a better option in Canada, smart thermostat that learns your pattern when you work and when you are at home.

Any comments? I see this as a substitute for the programmer, or you can program a weekly pattern you know you're out for longer holidays compared to others in a week the sort of thing that has been talked about here is very good automation of that process I defy any system to anticipate when I myself am

going out, I am retired I don't have such a schedule, what happens during the day is highly variable I do get out a bit! But there is no way that I have a typical week.

There is no system that could guess exactly twice weekly schedule but then things change at the weekend do we always have shopping at the same time etc or to the theatre on the same evening? I think not thank you Kevin also commented we have also found that setback below 15c has no benefit as it takes too much energy to get back to 21c that kind of contradicts our research we have always found that you do tend to save more than you would lose, to having to regain the heat so perhaps it is a different type of construction yes we overlooked the traditional housing and pre-1919 build so perhaps construction type has a lot to do with this.

I expect there is some significant differences with Canadian build? Paul output like this if you want to be comfortable when you leave, and you wanted comfortable by the time you get back, and what you're paying for in the interval is the amount of heat that is lost from the home, if you keep the temperature up or if you keep it even to 15 while you're out, you're going to lose more heat and therefore expend more energy in recovering that heat I can't think of any circumstances might change that thank you another question from michael I think defaults to 18c would have been better than off.

It would also be good to make the thermostat harder to change has that been considered? I'll answer that question one of the things we found with this originally the thermostat that have the same kind of setup as the EcoTrip one of the things that we found was that they were using the thermostat as they would use a normal thermostat i.e. as a switch to turn off the heating, and that is damaging to this device solely to look at the housing association advice to parents that if they were going out to turn it to 0 and that would turn the heating off so part of the message given to tenants has confused this somewhat one of the problems that we were faced with was that a lot of the people were finding it too hot with a new heating systems.

I know that sounds crazy but many people were turning them off it was such a new thing for them to have unusually warm and comfortable homes that they were turning it off I think that's part of trying to understand this if you model it from an ideal scenario that's fine but this is actually including the human element another similar, from Gregor Macgregor similar question as Kevin woods if the EcoTrip turns heating for a number of hours surely the use of energy would be great to bring the room back up to temperature, allowing it to be thermostatically controlled, it seems that research is required to establish who is right here well all I can do is repeat what we have said already if I could use the analogy of a bucket of water with a hole in the bottom the water falling out the bucket represents the loss the rate that the water goes in has to equal the rate that the water goes out if you want to maintain that if you stop pouring the water in then the water will eventually run out I believe you will use less water in refilling the bucket than if you maintain a full level all the time thank you, from Keith I cannot help but think that this is a rather simplistic solution that will appeal to a very limited market in today's world surely an app interface via a mobile phone to control the entire system would be the way to go? Paul yes if you have a few hundred pounds to spare on the kit then yes, all well and good you can turn the heating on as you come back using your mobile phone, great things might get a little more complicated if you have several members of the family for example but pretty good yes however, the sort of people I

think would particularly benefit from the EcoTrip are the elderly, maybe the visually impaired perhaps younger people and a very significant slice of the population want simplicity and ease of use nothing complicated, nothing to break nothing difficult to manage and I would hope, and our research so far indicates that there is a market, a substantial market for something as straightforward, as easy as this.

What we are about here is promoting behaviour change is there, it is on the wall, it is convenient it's like a room stat that you are using anyway Charles it's very interesting when you talk to the users, and I think as somebody who sits in front of a computer and has ideas, obviously we are becoming more technical and solutions are more technical when it comes down to it, when you go and speak to elderly people and there are a number of elderly people in this housing trial most of them would not want to go near heating control they were terrified if they touched them they were worried that if they touched them, the heating would fail or they would have to inconvenience somebody to come out and fix it for them - either somebody from the housing association, or somebody that they just know.

These are elements of human behaviour and as we as engineers designers are thinking about it, there is the human interaction with the device is important the other thing is the drivers for these people elderly people do not want to waste money they want to save money, but the need for heat is often much greater they as they are more often at home £300 may be okay for a professional couple to spend heating controls but it is difficult for those closer to the fuel poverty line the other thing I noticed was the youngest person in the trial had her house around 3 to 4c warmer than some of the elderly people when I asked do you worry about heating? Her answer was "not at all."

She would heat her house regardless, there are so many other things at play here other drivers influencing people's attitudes and behaviours behind this, we got to put that into some kind of multivariate analysis to look at probably, having something simpler is easier I ask everybody how they controlled the heating many said they just switch it off.

Having this kind of device seemed to be aligned with how this particular group would go about using the heating Paul I might add that it is an incidental benefit of the EcoTrip they are keen to minimise the bill of course but the advantage of the EcoTrip is that they would select the period, turn heating off for perhaps a hour or two and should they fall asleep for example at least it comes back on again before they get too cold so many elderly people may turn off the heating when they think they can manage without it and it does not come back on again automatically perhaps it could get into trouble with low temperatures the EcoTrip comes back on again automatically thank you very much I have a question myself.

What is next for EcoTrip? what are you hoping to do next?

Well I would say that this trial has really been very useful I'd say I would say this trial has been really very useful I'd like to the field trial of a large number of dwellings, what we need is to find the finance for that we are in discussion with Heriot watt university in Edinburgh who has a major trial that they are deciding with 90 dwellings and we think that there might just be an opportunity to join in that trial the might be other options as well the ultimate of course, is to get a manufacturer interested particularly

from our point of view a manufacturer with Scottish presence and license to them the production of this device the EcoTrip Branka we have additional question from Kevin I do agree that any setback is better than no setback, but the smart thermostat is what should be used and he has provided a web address therefore others another question, what have you learned from this field trial? How would you improve this trial? Paul while I think there are a number of questions, first of all we have to make the EcoTrip somewhat more robust.

We were a little surprised at the extent to which some users were not too gentle with the controls! That's engineering detail we can take care of we also need to improve the logger arrangements.

Charles has said we did do some bench tests of the setup which seemed satisfactory wasn't registering in the way that we had anticipated.

Although it was a very limited number so we to investigate what happened there no doubt there are other lessons Charles? Charles yes it was accommodated study, studying the use of devices in people's houses is always a little bit complicated so to do a large number would be great I think one of the things that I would like to do people used to turning their heating on and off using a timer or a thermostat I know it seems quite simple, but that simple change in using a timer rather than the thermostat is more complicated for people than we might think simply to look that would be quite useful so I think there is much to learn in the trialling element so I think there is much to learn in the trialling element so how much would EcoTrip cost its current form? Well as it is at the moment, it is assembled from proprietary parts the cost retail price is about £50 that's without the labour of fitting of course however about 50% of that price is the enclosure itself in mass manufacture this enclosure cost would be greatly reduced to expect that the final cost of production would be similar, if not much less expensive than devices currently available on the market I spoke to all the tenants that had it and they all said that they used it some confusion was perhaps about the timer and the thermostat being in the same unit 12 of the units actually failed and had to be replaced and we think this is related to their confusion a few of the elderly people have the device installed very positive about the device they felt it was making their controls easier and making the control of heating more manageable that was positive but you know it is a very short period of time that we had and some hadn't even had an energy bill yet so we were just taking in working with whatever evidence we could okay so we don't have any more questions coming in from our online audience you have anything you would like to add what I have been struck by is concerned about the actual savings if you turn off your heating we would emphasise on that is that if you look at these in relation results from Strathclyde university the maximum saving is made in that hard to heat home, draughty, thick walls, where the boiler really has to struggle to get the temperature back again and yet that is the type of home where is the maximum saving compared to the average home so I believe turning the heating off when you need it is always better than just turning the heat down thank you very much I'd like to thank you and to thank our online viewers, and to attract your attention to our forthcoming events.

The next one is a live conference entitled mass matters in low carbon building design it will take place on 3rd September that this Monday at Heriot watt university this is a live conference, there will be no online transmission however we have had bookings from around the UK so please do not miss this

excellent networking opportunity, there are still some places available further information is available on our website cicstart.org and you can also book your place.

Our next webinar is entitled sustainable BIM driven post-occupancy evaluation on 27th September thank you very much for watching our webinar, thank you and goodbye.

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