Rethinking energy efficiency delivery – what can we learn from sport?

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Abstract

Should we rethink government approach to energy efficiency delivery? Have government energy behaviour change programs delivered the long-term sustainable change of the quantum needed to address anthropogenic climate change? Is it time to look at other models and approaches used to deliver large behaviour change action? The physical and human infrastructure that facilitates behaviour change through community-based sport and recreation programs is the result of decades of deliberative government funding, delivering one of the largest behaviour change programs across major developed economies. In the face of global climate change it has been suggested that to move to an energy efficient and low carbon economy will need similar levels of behaviour change.

By examining the delivery of sport related behaviour change at a local community level in Australia and the UK, we can envision a new approach to delivering the resources and structures needed to transition to an energy efficient economy. The research shows that involvement in sport at a community level in both countries is provided through a cohesive and well organised training and support structure, developed over many years, which combines the expertise of sporting professionals with the local involvement of thousands of community volunteers. This is contrasted to the nature and level of government resources devoted to community level energy efficiency programmes and their support structures, which is patchy, inconsistent and short-term.

This paper considers the lessons of sport policy delivery to examine the human and physical infrastructure required to sustain significant and widespread energy efficiency household behaviour change. Drawing on recent research on local energy governance, the paper highlights the potential roles of all levels of government in developing and maintaining an infrastructure that can support and expand community level energy efficiency programmes.

Introduction

Concern about anthropogenic greenhouse gas emissions has led voluntary community groups, individuals and governments in many countries to consider a more sustainable level of building energy and carbon performance (Kapsalaki & Leal 2011). Improving the energy and carbon performance of residential buildings, through energy conservation and efficiency measures, and installation of household and community scale renewable energy systems, will play a key role in delivering substantial and sustainable greenhouse gas emission reductions in developed economies (Levine et al. 2007; Department of Climate Change and Energy Efficiency 2010; International Energy Agency 2010).

In the United Kingdom, while there has been a huge growth in government driven programs aimed at encouraging the use of solar and energy efficient technologies and changing household energy use practices, those campaigns have failed to deliver the scale of actions required to reach the governments' own domestic energy reduction targets (Utley & Shorrock 2008), with the majority of household actions amounting to small behaviour changes such as switching light bulbs and relatively simple retrofit actions such as installing loft insulation (Eyre, Flanagan & Double 2011). For example: two thirds of UK homes still have insufficient insulation by contemporary building standards (Palmer & Cooper 2011).

Similarly in Australia, while the national government has committed to a 2050 greenhouse gas emission reduction target of 80 per cent against the annual emission level of 2000, more than a decade of government driven activity has failed to reduce emissions below that of the 1990 Kyoto baseline or the Australian Government baseline year of 2000 (Department of Climate Change and Energy Efficiency 2012a).

Is it timely to consider other approaches to the delivery of energy technology purchase and use behaviour change programs? Can we learn from other models of behaviour change delivery? Where have governments been more successful at delivering significant behaviour change through alternative delivery systems?

In countries such as Australia and the United Kingdom, organised sport, including but not limited to Olympic and Commonwealth Games sports, have developed the necessary physical and human infrastructure to encourage and support participation in physical behaviour change activities across many levels of consumer interest. To give a sense of scale, in Australia, with a population of 22 million there are some 2.3 million sport and recreation organisation volunteers, with 60 per cent of children aged between 5–14 participating in organised sport, and over a quarter of the population aged 15 years and above particitating in organised sport (Australian Bureau of Statistics 2012). Sport infrastructure provides players, coaches, umpires, administrators, and scientists the technical, social and financial assistance to participate at the level of their choosing, delivering community service and substantial behaviour change. With long-term deliberative government funding, both at national and regional level, this infrastructure is designed to support many volunteers who interact at the community level to encourage and sustain participation in organised physical activity, providing health and other benefits. To highlight the quantum of government action provided to support community human infrastructure, the recent policy paper *Australian Sport: The Pathways to Success* committed resources to assist the training of an additional 45,000 community coaches and officials over a four year period, amongst many other initiatives designed to enhance participation at a community level (Australian Government 2010).

Clearly the nature of organised sport and the motivations for involvement in organised sport are different from those associated with climate change action. The purpose of this paper is not to compare the similarities or differences between sport participation and climate change action, but rather to highlight that governments have chosen specific delivery mechanisms to achieve large scale behaviour change in different portfolios, and it may be valuable to reflect on the different delivey models. To illustrate the different mechanisms, the sport model is centred on the creation and support of community-based volunteer enabled action, while for climate change governments have chosen a predominantly technology focussed delivery model providing support directly to individual households (more on these models later).

Given the amount of behavioural and structural change needed to reduce anthropogenic greenhouse gas emissions by 80 per cent by 2050, and the failure of the current approach to deliver the necessary large and widespread transformation of household emission impacts, an examination of the sport delivery model may provide a fresh vision for achieving improvements to the energy and carbon performance of households.

This paper is structured to provide a contextual basis to the need to address anthropogenic greenhouse gas emissions, particularly those generated due to household energy use and behaviour. The discussion section provides an examination of government strategies for sport and environment regarding: the characteristics of the human and physical infrastructure supported; and the nature of government funding. The paper concludes by presenting a vision of the type of human and physical infrastructure needed through deliberative government funding to support community-led climate change action.

Contextual background

Human impact on the global climate is one of the greatest economic, social, political and environmental challenges facing all communities (Stern 2006; Garnaut 2008). The evidence presented by the world's leading climate scientists is showing that anthropogenic greenhouse gas impact has reached the level which is altering the global climate (Houghton et al. 1997; Flannery 2005; Pittock 2005; CSIRO 2007; Metz et al. 2007).

Studies by eminent economists such as Stern in the United Kingdom and Garnaut in Australia have examined the consequences of anthropogenic climate change and recognised the immense task, and the need for strong leadership by government (Stern 2006; Garnaut 2008). Economists point out that the challenge of addressing climate change must be faced by all sectors of the economy, and by industry and households alike. Both Stern (2006) and Garnaut (2008) argue the role of government is to ensure market signals lead to low carbon investment decisions, to provide complementary measures to address non-price market failures, and to inform adaptation responses.

The scale of action required, and proposed, is unprecedented. For example, the Parliament of the United Kingdom passed the Climate Change Act 2008 (Parliament UK 2008), which requires that by 2020 annual greenhouse gas emissions should be reduced by 34 per cent as compared to 1990 levels, and 80 per cent by 2050. The European Community has agreed to collectively reduce emissions by 2020 by no less than 20 per cent as compared to 1990 levels, and calls for developed nations to reduce emissions by 60 to 80 per cent by 2050 (European Commission 2007). In Australia the national government has committed to a 80 per cent reduction in emissions by 2050 as measured against 2000 levels (Department of Climate Change and Energy Efficiency 2011a).

However, while the scale of the change has been recognised by governments, many commentators suggest that response activities to date have been insufficient to hold increases in global temperature to below the Copenhagen Accord target of 2 °C (Anderson & Bows 2011; New et al. 2011), are not working (Committee on Climate Change 2012), have been difficult to coordinate (Matthews 2012), and that more ambitious action should be adopted (Committee on Climate Change 2009).

Improving the energy and carbon performance of residential buildings can play an important role in delivering substantial and sustainable greenhouse gas emission reductions in developed economies (Boardman 2007; Levine et al. 2007; Energy Saving Trust 2010; International Energy Agency 2010). Boardman (2007) noted the importance of household action stating

that reducing household energy use may be easier and cheaper than emission reductions in other areas of the economy, whilst providing additional health and social benefits. Mapping out the transformation needed to reduce UK household emissions by 80 per cent, Boardman (2007) identified the need for wholesale transformations of technologies, retrofit processes, and levels of participation; pointing out that almost every home will need to be upgraded for the UK to meet emission reduction targets.

Existing energy efficient technology purchase and energy use behaviour change programs aimed at a household level have been designed to address the many barriers encountered at a household and community level, such as information barriers and upfront cost disincentives, but these programs have been insufficient to meet the scale of emission reductions proposed. The design of these programs has often resulted in single technology change rather than the comprehensive retrofit of homes or large-scale changes in lifestyle related energy use. For example: in Australia separate government program incentives have been provided to replace hot water systems, install insulation and purchase photovoltaics, but involvement in these programs has not required any assessment of the most cost effective or carbon reduction maximising actions, nor has it involved any assessment of the potential changes to energy use behaviour.

Programs and strategies are needed to broaden and deepen participation across all the relevant dimensions of action including the uptake of energy efficient technologies and behaviours; and should be tailored to ensure that the individuals receive suitable information to choose low carbon pathways (Stern 2006; Garnaut 2008). Does community-led climate change action provide the key to broadening and deepening participation, and setting the wider community on a path to a low carbon future?

The evidence for community-led action

What evidence exists to demonstrate that community-led climate change action can deliver the quantum and breadth of savings necessary? There is a growing body of literature that demonstrates that community-based strategies can lead to significant changes in household behaviour (Jackson 2004; Centre for Sustainable Energy & Community Development Xchange 2007; Adams & Berry 2008; Hamilton & Killip 2009; Middlemiss 2009; Preston et al. 2009; Mulugetta, Jackson & van der Horst 2010; Centre for Sustainable Energy 2011). The potential role for community-led action has also been reflected in the UK Department of Energy and Climate Change's Low Carbon Transition Plan, which notes that 'we often achieve more acting together than as individuals', going on to describe the Government role as 'creating an environment where the innovation and ideas of communities can flourish'(DECC 2009).

The literature highlights a number of ways in which community-based action can encourage significant and sustainable behaviour change. Table 1[1, 2, 3] outlines how community led action can encourage change, and example methods which it uses to do so.

Whilst community-led groups focus on a variety of sectors to achieve individual behaviour change (such as transport, goods and services and food), energy reduction in homes is an area that is most frequently focused on, thus it is the area we will use to illustrate the arguments in this paper.

Barriers to achieving behaviour change faced by households and communities are many and varied (Hamilton 2011). Examples include:

- Financial issues: many high impact actions such as solid wall insulation or solar photovoltaics require significant upfront expenditure.
- Supply chain issues: products and services may not be readily accessible in all regions.
- Skills issues: local tradespeople may not have the necessary skills or experience to install, integrate or maintain energy efficient or renewable technologies.
- Infrastructure issues: some actions such as district heating systems require community scale infrastructure, which may be beyond the capacity of individual households.
- Attitudes and agency: households may feel their efforts would be insignificant in the context of the challenge of global climate change.

Many of these issues can be best addressed within a local context, using trusted information sources, engaging with local contacts and expert tradespersons, and exploiting locally available incentives. However, to be most effective, local level action needs to be supported by policy settings at all levels of government (Mayne et al. 2013).

Climate change as a concept can appear quite abstract and detached from everyday matters, and households can feel a sense of helplessness and disempowerment (Heiskanen et al. 2010). Research has found that engagement and participation in environment activities are likely to be greater when those issues are presented as local and directly relevant to the community (Action with Communities in Rural England 2009; Marshall 2009).

Local sources of information are often a more trusted and valued, whilst external information flows, particularly from commercial interests, are often less trusted (Roberts, Humphries & Hyldon 2004; Energy Saving Trust 2007; Preston et al. 2009; Kemp 2010; Mulugetta, Jackson & van der Horst 2010). The Energy Saving Trust (2007) suggests 'the main influences on our lives stem from local social connections, rather than from national ones.' Kemp (2010) states 'Local actors, whether neighbours, friends, social networks, local councils, independent agencies, are generally the most trusted sources of information and advice' and suggests that community-led schemes are more likely to be successful than those imposed by outside initiators. Mulugetta et al. (2010) notes that many studies have demonstrated that people who are known and trusted (such as friends, neighbours and family), can play important roles in overcoming barriers to home energy behaviour change, through sharing best practice, creating positive associations and awareness of energy reduction.

1. Delivering learning and action programmes – Carbon Conversations: http://carbonconversations.org/

2. Delivering learning and action programmes – Transition Streets: http://www.transitionstreets.org.uk/

3. Delivering learning and action programmes – Low Carbon Living Programme: http://www.lowcarbonhub.org/low-carbon-living-programme

Table 1. How community led action can encourage change, and example methods which it uses to do so.

How community led action can encourage behaviour change:	*Example method:*
Establish climate change action as locally relevant	Communicating impacts and mitigation actions that make sense and are meaningful in a local context, e.g. the public opening of exemplar homes to demonstrate successful approaches to household energy reduction and renovation.
Utilise agents trusted by households	Engaging wider community through known and trusted people and networks, such as schools, churches and civil society organisations
Encourage innovation	Developing methods for collective purchasing of energy efficient or renewable technologies at household and community scale.
Create ownership and commitment to change	Delivering learning and action programmes (such as Carbon Conversations, Transition Streets or Low Carbon Living Programme)
Influence and change social norms	Through providing practical low carbon alternatives, such as car clubs, bring and take events
Create a shared vision	Encouraging organisations, businesses and householders to commit to energy reduction or renewable energy uptake through signing and implementing charters
Enable shared learning	Public information events, networking between community organisations

Community-led climate change action provides a good opportunity for engagement with households in a manner that is relevant, trusted, creates ownership and commitment and enables social learning. The level of behaviour change and the community-wide participation needed to reach the emission reduction targets set by governments evokes parallels with the scale and reach of behaviour change action delivered by organised sport.

The sport model

The system of Olympic and Commonwealth Games sports in developed nations such as Australia and the United Kingdom is organised around a core infrastructure of physical and human resources developed over time mostly, but not exclusively, from strategic state funding. This core infrastructure incorporates the systems, personnel and materials that draw participants firstly to the sport, and then facilitates the technical development of participant players, coaches, referees and administrators. This core infrastructure also includes the facilities that attract interested parties and enable them to build the necessary behaviours, skills and knowledge to participate at the level of their choosing.

Resources are pumped into sport across various the participatory streams: such as playing, coaching, refereeing; administration, and facilities – with an explicit goal of encouraging broad-scale participation in organised physical activity (Australian Sports Commission 2011b). Government resources support the development and maintenance of technical guides, training courses, events, equipment, uniforms, training facilities, competition facilities, mentoring programs, sports science and directly fund participation through scholarships, salary supplementation and travel opportunities (Australian Sports Commission 2011a).

At national and regional level, a large share of government resources are targeted at professionally managing each sport, supporting the army of volunteer coaches, providing organised opportunities to compete, developing the numerous referees and officials needed to run each sporting event, and creating and maintaining the facilities needed for participants to train and compete. Some funding is allocated to the development of individual elite athletes and officials, but these individuals provide important role models encouraging further participation. At the local level, almost all resources are targeted at team and club level participation. The nature of sport funding is centred on facilitating sport participation as a sustainable community activity, rather than the funding of individual household (or athlete) actions.

Examining each Olympic or Commonwealth Games sport we can see a chain of international, national, and regional associations with professional staff and financial resources, designed to provide technical and other services to each level of activity – from elite national squads to local clubs and school teams. Through this system, sport has developed transparent career paths for all types of participants (athletes, administrators, coaches, referees, scientists). Many participation activities have professional and semi-professional opportunities wholly funded or supported by the state, and all types have participant development paths created and maintained by government resources. Yet, the volunteer ethic underpins the delivery of sport. The vast majority of sporting coaches, referees and administrators in developed nations are volunteers providing community level services. The infrastructure of sport means these volunteers are supported by layers of semi-professional and professional services, and a system that provides technical support and encouragement to sustain activity over the long-term.

While the motivations for participation in organised sport may differ from those attracting households to take energy efficient and low carbon actions, the concept of a multi-level physical and human infrastructure designed to support an army of community-based volunteers may be an appropriate delivery mechanism to achieve government established greenhouse gas emission targets.

Behaviour change programs in the form of organised sport have been supported by the state over many years due to well understood physical and mental health benefits, enjoyed by both the individual and the community at large (Warburton,

Nicol & Bredin 2006; Khan et al. 2012). Similarly, action to address climate change in various forms, such as thermally comfortable homes, active transport choices and community-centred action, can result in physical and mental health benefits (Schweitzer & Tonn 2003; Nitschke, Tucker & Bi 2007; Rudge & Gilchrist 2007; Bi et al. 2011). Does the current structure of community-led climate change action facilitate a similar level and reach of sustained behaviour change to that delivered through the sport model?

The current environment model

A simple examination of climate change activity highlights the absence of a similar infrastructure to support community action. There are at least 600 community-led initiatives working on aspects of climate change across the United Kingdom (Low Carbon Communities Network 2012), and around 100 climate action community groups in Australia (Climate Movement 2008), the majority of whom include actions on energy efficiency and eco-renovation as part of their actions. These initiatives have emerged despite, not because of, what many consider to be inadequate Governmental response (Moloney, Horne & Fien 2010), illustrated by the Transition Networks' framing of the relevance of community-led action: 'if we wait for the governments, it'll be too little, too late; if we act as individuals, it'll be too little; but if we act as communities, it might just be enough, just in time' (Transition Network 2012).

Unlike organised sport, there is little formal structure to frame community-led climate action, with ad hoc support systems, informal networks, and impromptu sharing of resources and experiences when synergetic events occur (Adams & Berry 2008; Preston et al. 2009). The level of support varies between and across the countries. For example in the United Kingdom some counties have started to develop and resource support structures (such as organisations which provide support and training to the community groups, and skillshare networking between the groups), whilst others do not. Similarly in Australia, some regions such as the Australian Capital Territory have started to develop stronger links between community-led climate change action and regional policy, providing some resourcing to support community-led activity, although this does not occur at the same level in other regions. Inconsistent levels of funding and the ad hoc nature of support, poor marketing of support opportunities, the complexity of application and reporting processes, and the structure of support (i.e. timing, flexibility, scope of coverage) present barriers to higher levels of community-driven activity (Adams & Berry 2008; Centre for Sustainable Energy 2011). Some researchers have found that inconsistent policies targeting community-based support, sometimes leading to the withdrawal of funding programs, has had negative effects on community action (Kemp 2010). Similarly emerging results from ongoing research has revealed that funding and support focused more on installing hardware (e.g. community level solar photovoltaics) without sufficient provision for project management and sustaining the day to day functioning of groups can deplete the capacity of a community led group.

Similar to organised sport, community-led climate change action is often heavily reliant on volunteer time and a small number of local enthusiasts. The key differences are the formal structures, support services, and sheer scale of resourcing that sustain organised sport, ensure opportunities for continuing knowledge and skill improvement and encourage ongoing participation. Without the appropriate support structures, reward systems and resourcing, community-based climate action is unlikely to be sustainable over the long-term, expand to engage meaningfully with all households, nor achieve its full potential to provide the necessary reduction in household energy use (Adams & Berry 2008; Preston et al. 2009).

Again it is important to divorce participation motives from the concept of creating human and physical infrastructure. For example: action on climate change does not receive a similar level of prominence in the media to that of high profile sports such as football, but then almost no Olympic and Commonwealth Game sports receive that level of media for all but the fleeting moments of their periodic staging. Participation in the majority of organised sport is sustained and developed by an expansive human and physical infrastructure rather than media or commercial interests.

The nature of funding from government for climate change mitigation action has centred on incentives for individual action, often providing direct cash incentives to households to take action (i.e. technology subsidies), or through mandatory requirements for other organisations to provide incentives to individual households (i.e. retailer obligation schemes).

Relatively small levels of funding have been directed to the development of community level activity. For example: in Australia, large-scale community level engagement has been primarily limited to the Solar Cities Program (Australian Greenhouse Office 2005; Department of Climate Change and Energy Efficiency 2011b), which provided financial resources to seven communities to improve building related energy efficiency and trial solar technologies. The AUD $94 (€73) million Solar Cities funding should be framed against the Solar Homes and Communities Program which provided over AUD $1 (€0.77) billion to households to install solar photovoltaic technology (Department of Climate Change and Energy Efficiency 2012b), the AUD $2.5 (€1.9) billion allocated to the Home Insulation Program (cancelled after 1.2 million installations), and AUD $323 (€251) million in subsidies for solar thermal hot water systems. Technology specific funding outweighs community level funding by a ratio of 40 to 1.

In the United Kingdom the preference for technology funding over community engagement is similar. Since 1994 the central government has imposed an energy savings target on large energy suppliers (retailer obligation scheme) which must be achieved through specific technology change at the household level (Rosenow 2012). The latest retailer obligation scheme (2008–2012 Carbon Emissions Reduction Target) is expected to invest £3.2 (€3.6) billion in household energy efficiency upgrades. The Renewable Energy Obligation scheme and the renewable energy feed-in tariff are stimulating the installation of photovoltaic and other renewable energy technologies at a household level (Walker 2012; Cherrington et al. 2013). When we look to direct government resources targeting community-led action funding is limited, poorly coordinated, and piecemeal in its coverage and impact (Centre for Sustainable Energy 2011). For example: the Climate Challenge Fund provided £8.5 (€9.8) million over three years to community groups to engage locally on the issue of climate change, and the

Low Carbon Communities Challenge provides £10.0 (€11.6) million across some 22 communities to undertake action (Department of Energy and Climate Change 2009). The picture is similar to Australia, where community-based programs have significantly smaller resources compared to technology specific programs. Whilst individual project level funding has enabled recipients to achieve ambitious targets through their projects, it has not addressed the lack of infrastructure support for community groups, at a local, regional or national level.

It is clear that governments, through a deliberative policy approach, have treated climate change action as a technology problem rather than a community-led behaviour change challenge. This is equivalent to subsidising individuals to buy a football and boots, and then hope that they can win the World Cup. In comparative terms, what is missing is the administration to form a team, the coaching to prepare the team, the sport scientists to support the behaviour change, and the referees to adjudicate the match.

Time for a new vision

Given that the technology specific and individualist approach used in the United Kingdom and Australia is not achieving each government's emission reduction target; it is timely to consider a new vision to support and sustain a community-led strategy of energy behaviour change. This new approach should be seen to complement, rather than replace, existing policies that aim to address legal, technical, upfront cost, and other barriers that inhibit the transformation to energy efficient technologies and practices.

We suggest that to achieve deep reductions in anthropogenic greenhouse gas emissions through community-led voluntary household behaviour change actions, governments at all levels will need to cooperatively invest significant resources in the development of coordinated structures, facilities, materials and human resources to catalyse, enable and support community-led action. The long-term creation of the required human and physical infrastructure will to enable community groups to effectively engage with their local community, helping households to draw on the 'top down' incentives available. This is a new vision for environmental change, but a vision not dissimilar to the delivery of sport related behaviour change.

Funding, just as it exists for sport, should be provided on a long-term recurrent basis, where resources are provided for strategic purposes, with the delivery of activity undertaken at arms-length from government through community owned and operated organisations empowered by a network of professionally staffed support organisations. In the sport model, funding resources are provided by governments to independent sporting organisations within a strategic framework which defines agreed goals and targets, but provides significant freedom to each sporting organisation to make locally relevent decisions.

At a national level, support should be provided for the national coordination and facilitation of community-led climate change action. This needs to include the multi-level perspectives of all actors involved: the expertise and experience of community-led groups, organisations who support community-led groups, Local Authorities, public and private sector funding bodies and policy makers. Recurrent funding should enable professional provision of organisational management, events development and hosting, technical development of tools and materials, marketing, communications, exemplar funding, training, scholarships/bursaries, recognition award, and scientific research.

At a regional level (e.g. county level in UK, state level in Australia), support should be provided for the regional coordination and facilitation of community-driven climate change action. Recurrent funding should enable professional provision of organisational management, events development and hosting, regional input into tools and materials, marketing, communications, training, mentoring and performance assessment (including data collection and management). Regional staff should have the resources to regularly interact with and support community groups in their local community, whilst providing community group leaders with the resources and opportunities to engage at regional and national level.

Feedback structures should be established to enable multi-directional interaction and feedback across local, regional and national levels for all types of participants.

Recurrent funding should be established for regional exemplar development, to enable annual creation of regionally relevant examples of best practice low carbon new homes, refurbished homes and community facilities. That funding should also enable community interaction with the exemplars through regionally and/or nationally marketed open house events, and the provision of associated guide materials and information to stimulate further community action.

The question of who funds and delivers community level engagement on a long-term basis needs raising. Whilst much community level action is delivered on a voluntary basis, evidence is emerging from recent research conducted by the authors that indicates funding is required for community-led groups to expand, develop their social innovations, and catalyse strategic interventions at a larger scale. In both Australia and the United Kingdom we have seen several of the larger community-led groups employ an administrator to deal with many of the day to day matters, which frees up the time of and providing support to active volunteers who are keen to develop projects.

If resourcing was scaled to that of sport, we could see capital funding provided for the development of regional information and training centres, creating the physical statement that climate change and energy action is as important to community development as sport. These facilities would provide a vocational base for professional staff, facilities for regional coordination and participant development (education and training facilities), and regionally relevant technology displays to inform and inspire households and develop the technical skills of assessors. This paper does not argue that capital expenditure of this sort is the most appropriate use of scarce resources, but using the sport analogy, if the cathedrals of sport, those physical training and competition facilities, are used to promote behaviour change and recruit participants, then why not apply the same concept to environmental change.

The end result is a coordinated system of human and physical infrastructure designed to stimulate and sustain community-driven climate change action, a system that creates a transparent career path for participants to reach their full potential in delivering behaviour change, a system that avoids the waste that results from the uncoordinated parallel development of tools, technical materials and activities.

This vision of a coordinated, well resourced, widespread community-based climate change program complements rather than replaces the need for leadership, fiscal and regulatory action to address other market barriers and market failures, but should be seen as an equal partner in the policy set used by government to deliver substantial and sustainable reductions in anthropogenic greenhouse gas emissions.

Conclusion

The need for climate change action is paramount, but current energy efficiency action delivery models are not providing sufficient change at the scale required. The proposed level of carbon emission reductions will require substantial changes to our homes, the way we use our homes, and to our lifestyles, with consequential health benefits. The current technology specific and broad-based marketing approaches used by government to encourage household action are not successfully engaging sufficient households to engender sufficient carbon reduction action.

Other delivery models have been successfully used by governments to deliver wide-scale behaviour change, and the deliberative funding of human and physical infrastructure for organised sport provides an interesting model that encourages and sustains participation.

Community-led climate change action has demonstrated success in establishing activity as locally relevant, utilising trusted local agents to inspire and support household behaviour change, addressing many of the barriers that inhibit the application of energy efficient technologies and practices. Community-led activity has been found to create ownership and commitment to change through creating a shared vision, enabling shared learning, and by changing social norms. But whilst there are examples of successful delivery, currently, community-led climate change activities are ad hoc, uncoordinated and under resourced.

Climate change policymakers can learn from the way organised sport delivers one of the largest behaviour change program across major developed economies, reaching the majority of households through an army of volunteers, and supporting the development of the knowledge and skills for administrators, players, referees, coaches and many other participants. Long-term deliberative government funding has created the physical and human infrastructure that facilitates behaviour change through sport. By examining the delivery and resourcing of organised sport programs we can envisage the level of activity, resources and structures needed to deliver a low carbon future through community-led climate change action.

A new vision is proposed describing the human and physical infrastructure necessary to support the extent of household behaviour change action required to avoid dangerous climate change. Policy change is required by all levels of government to cooperatively develop and maintain the physical and human infrastructure that will sustain significantly greater community-led climate change action. A well funded program of community-led climate change action does not remove the need for cost related barriers to be addressed through financial incentives for specific technologies, but rather complements technology specific policies by facilitating person-centred approaches provided by community groups, which could significantly increase the level of energy reduction achieved by each household and each community.

A change from the current technology specific policy focus to one designed to also build the human and physical infrastructure necessary to sustain community-led climate change action may lead to a faster and more wide-spread uptake of energy efficient technologies and energy conservation behaviours.

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