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People power in the A + B transition

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Abstract

Over time there have been many examples of failed technology transfer, most often attribute to social opposition based around concerns of impacts on either individuals or the environment more broadly. The same holds true for energy technologies and yet we know in this A + B approach technologies are a central component of achieving a successful transition. Most of this will likely come from a top down approach of politicians, policy makers, industry and academia deciding on the best way forward. However to date, slow progress has shown that many are reluctant to commit the required resources for making the transition and the IPCC report "Global Warming of 1.5°C" highlights how far behind we are on achieving the required carbon mitigation. We suggest that alongside the technological developments it will be critical to acknowledge the role of people power. A bottom up approach to decision making and technological change. To do this we suggest building a global approach to energy literacy will be a critical component for closing the loop and creating action. This will put people at the center of the decision making for identifying the way forward but does so through a systems lens that takes into account the overall sustainability of the system, governance, market operations and the range of technologies and associated infrastructure. We aim to draw on a range of case studies from across China and Australia to illustrate how this might be achieved in practice.

Keywords—values, climate action, energy technologies, systems, knowledge sharing.

I. Introduction

There is no doubt that the Intergovernmental Panel on Climate Change (IPCC) report "Global Warming of 1.5°C" released in 2018 [1] has captured the attention of many individuals across the world. Just how to respond to these warnings however, remains an enigma to many. People want action but they do not necessarily want to pay for it. This makes it a challenge for those in policy positions, who appear to lack the tenacity to make the bold moves and investments required to overcome the threat of climate change impacts. While this conference has identified a host of technological fixes, in both the A and B streams that can help to remedy the situation, a value action gap remains – both at the individual, corporate and policy level [2].

In this paper we outline some suggested actions to break the cycle around lack of leadership and compelling actions required for the transition towards a low carbon energy supply. What is different about this paper is that we focus on the human element – the people power – and suggest ways that can complement the implementation of both existing and new technologies but also draw on systems thinking about where and how these interventions might happen. We present case studies of examples of how this has been applied. We also make comparisons across both Australia and China to highlight opportunities for how this might be operationalised at scale to achieve the desired rapid uptake.

II. Background

A. A systems approach

For any of this to be effective, a systems approach will be essential. We argue that while this can happen at the national, state or local level there are fundamental elements required of the system to achieve a successful transition to a low carbon energy society. Adapted from Ma and colleagues [3] they argue the four main elements for a systems approach include: (1) sustainability of the overall system surrounds, (2) governance of society, (3) operation of market and (4) energy technologies and associated infrastructure (Ma et al. refer to energy systems).

Sustainability of the overall system and its surrounds points to considerations of continuous inputs (imports, natural resources etc.) and outputs (exports, emissions etc.) along with any threats that might exist (energy security, environmental damage etc.). Governance of society focuses on the highest level decision making of society and the resultant policies which will ultimately influence the operation of the market through available capability, market mechanisms and human behaviors in response to these. Finally, energy technologies and associated infrastructure points to identification of the individual portfolios that exist in the system and what opportunities can arise from this thinking [3]. These will vary across countries and therefore impact the overall inputs and outputs of the system especially using the A + B approach for each technology portfolio.

B. The role of technologies

There is no doubt that technologies, both existing and those under development, will have a critical role to play in the transition. Suggestions for what the mix of these might comprise have been outlined in a range of documents including those of the IPCC, the International Energy Agency (IEA), World Energy Outlook (WEO), and copious specific strategy and policy documents from government and industry across the world.

However, while there are a plethora of options, what has been clear from the lack of action to date, is that there is a lack of coordination across the technology and required infrastructure platforms. At the same time, the lack of coordinated modelling from the highest to most localised level, has been far removed from any of the action that is taking place on the ground. For example, while there has been successful deployment of solar rooftop PV in Australia through a number of incentives, the lack of coordination at the national level has meant that the costs of avoided CO_2 has been astronomical. Exceeding by hundreds of dollars ex-Prime Minister Gillard's proposed price on carbon of AU$23. Notably it was this proposal that ultimately led to her deposal.

Similarly, with China installing up to 40 Gigawatts of renewable energy in 2018, there is much progress towards a lower carbon energy supply. However, it could be argued that due to a lack of systems thinking in this deployment, China, like many other countries including Australia, is experiencing a number of curtailment issues. Such curtailment renders the whole system more inefficient and may ultimately work against the overall purpose of the transition.

While these developments in the deployment of energy generation technologies provide some hope, the opportunities for transforming our energy systems through the use of new infrastructure and software such as artificial intelligence and big data is also unexplored. Recently in Australia, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has developed the National Energy Analytics Research (NEAR)[1] program which "brings together energy data, research and reporting from across the sector and makes it available to all from one central location". Access to such data helps to provide greater evidence of how energy is being consumed in the home and in businesses. Such data linked to technological deployment such as rooftop solar PV combined with the individual meter data provides opportunities to transform our understanding of how energy is being used based on both internal and external factors. However, there are often concerns raised around such proposed uses of data and artificial intelligence. These may be as simple as privacy considerations, but also can include worries about safety and other risks - not to mention unintended consequences [4]. All of these have a bearing on how such technological advances will play out in society.

C. *Overcoming the challenge of the human element*

History has shown that anticipating the human response to the implementation of energy generation technologies or new and emerging technologies, has been far from successful across most countries. This includes failed technology acceptance based on fear of the unknown; concerns about the impacts of new developments on livelihoods and lifestyles; or perhaps fundamental differences in host communities' worldviews. Huijts, Molin and Steg, (2012) have developed a model for technology acceptance which highlights key considerations from a socio-psychological point of view [5]. This model is helpful when considering what is required for the A + B transition. We have applied this model to explore potential acceptance across a number of technologies, albeit with national surveys and it helps in highlighting the potential trigger points for opposition [6] [7].

Public opposition has been particularly evident with technologies such as carbon, capture and storage (CCS) (or carbon, capture, utilisation and storage (CCUS) as it is more often referred to today). CCS offers the potential to mitigate large quantities of CO_2 and many international models, including those of the IPCC's 1.5°C report, deem CCS essential for enabling a successful transition to low carbon, particularly based on the slow progress around the world. However, because of its links to the fossil fuel industry, many in the public remain staunchly opposed to the implementation of CCS. Similarly, there are those who express concerns about the safety of storing CO_2 underground and the potential negative impacts of having a storage project in their local area [8]. Examples of failed CCS projects include the Barendrecht project in the Netherlands [9] or the HECA project in California[2] which were both stopped due to public opposition.

More recently, there has been recognition that China, governed as a socialist state has the potential to achieve far more in technology deployment than its democratic counterparts as it has the ability to minimise opposition. There is also a willingness to trust the government in their decision making. This ability to deploy new technologies with limited opposition makes it an important country for demonstrating and deploying new technologies. Although this does carry ethical considerations about what constitutes a "just transition" and who should carry the burden of trialling new technologies. That said, China is well advanced in the deployment of new nuclear power plants and through its 5 year strategic plans is leading the way in transitioning through the development of new technologies.

D. *Energy literacy to power people*

We argue that essential to the above considerations is the importance of building an energy literate society. In doing so it will capitalise on the power of people to support the tough decisions required to move the dial on action in a positive way. Through a number of interviews we found that it almost impossible to reach agreement on a single definition for energy literacy. However, it was agreed that an energy literacy framework would comprise cognitive (knowledge and skills), affective (attitudes, values, personal responsibility) and behavioral elements. This resulted in an energy literate person being defined as *someone with the appropriate level of knowledge which empowers them to make informed rational energy decisions and actions which have a positive outcome for the individual, and ultimately, society at large* [10].

Another complementary definition is offered by the Office of Energy Efficiency and Renewable Energy in the United States[3] . Their definition was developed through a

[1] https://near.csiro.au

[2] https://www.kget.com/news/top-stories/david-has-slain-goliath-4-billion-kern-heca-project-dies/388271413

[3] https://www.energy.gov/eere/education/energy-literacy-essential-principles-and-fundamental-concepts-energy-education

series of workshops, public listening sessions and expert consultation and includes:

- *"*can trace energy flows and think in terms of energy systems;
- can assess the credibility of information about energy;
- can communicate about energy and energy use in meaningful ways;
- is able to make informed energy and energy use decisions and take action based on an understanding of impacts and consequences*";*

If one accepts these definitions it becomes easier to contemplate ways to implement a literacy framework. We believe there is merit in taking the time to engage the broader public on the topic of energy – including the whole supply chain - so that they understand the trade-offs involved. Ideally this will help them to make more informed decisions about their energy use in their daily life, particularly in relation to CO_2 emissions. It is also likely they will become more supportive of tougher policy decisions that have a climate mitigation component to them.

III. IMPLEMENTING AN ENERGY LITERACY PROGRAM

To build and implement an energy literacy program it will require a coordinated approach. Based on earlier international research into public attitudes towards energy technologies it is clear that many of the public responses towards technologies are similar regardless of nationality and country [11] [12]. This provides an element of hope for a coordinated international effort that could raise the bar in disseminating the necessary information, making it easily accessible for individuals when they need to make decisions about their energy use or governments are implementing new energy technologies, for example.

However, it is clearly not a one size fits all approach and a key consideration will be tailoring the necessary information for different stakeholder groups. If an energy literate person needs continuous learning about this topic, it is reasonable for such an education to start when students are in schools. Currently there are a number of school programs that work well however, they are ad hoc in their delivery. Ensuring a more consistent approach in schools could constitute a quick win to ensure a more concerted effort starts with children in schools. Similarly all universities have the opportunity to implement broader knowledge sharing programs about energy. Arizona State University, for example offer a subject "The Thread of Energy" which is open to all undergraduate students from any discipline. If we believe that most university students will be our future leaders in some capacity, understanding energy will be an important skill for them when running corporations or governments and so on. Building a program that can be offered across disciplines – almost as a generic skills for all students in their undergraduate degrees will help to build the required knowledge and awareness of the need for urgency and action of the transition required.

At the societal level, it becomes more challenging as target audiences will have a variety of preferences in ways to access the information. Peer group knowledge and sharing sessions, interactive information pathways, printed hard copies alongside online materials, intergenerational approaches, and home visits all have been identified as effective modes of communication in multiple participant discussions. selecting an achievable scope, clearly distinguishing between education and advocacy, supporting environmental awareness and supporting numeracy efforts.

One example that successfully built individual knowledge and reduced the overall carbon footprint of individuals was Energymark [13]. "Energymark" process was based on providing trusted information developed by experts, use of social support and social networks to communicate the information, public goal setting and access to feedback. The study used a pre- and post-trial carbon calculator which focused on the energy used at home, waste, spending on products and services, beef consumption, and transport. The results of this longitudinal process, where participants would meet every 6 to 8 weeks in a place convenient to them, was effective but very resource intensive. Given the urgency of the situation empowering individuals through such a coordinated effort across the globe where facts and processes can easily be shared seems a plausible element for creating the required momentum to address this challenge.

Similarly, it is plausible to consider ways to share the information with politicians and their advisers. The large group process developed by Ashworth and colleagues [14] and subsequently trialed in Canada [12] and Scotland [13] in a more structured way can also help to impact the knowledge of the influential citizens. If delivered by universities and other research organizations, the process can ensure that advocacy is removed and the latest information about the trade-offs for each of the technologies is presented. If this is combined with the systems approach outlined earlier there is hope that a more concerted effort to this problem can occur.

IV. BUILDING A GLOBAL APPROACH

To ensure the success of this and use people power in the A + B transition we believe bringing together the four elements outlined in this paper: adopting a systems approach; understanding the role of technologies – both new and emerging – and what their potential is within the system; identifying where public opposition and support might exist; and then using an energy literacy focus and framework to move this ahead could play a significant part in achieving progress. While components of this have been done before, adopting a global approach to building energy literacy could be the essential link to progress.

Taking the four main elements offered by Ma and colleagues [3] it outlines an easy starting point for adopting a systems approach. Working with the overall sustainability of the system surrounds means acknowledging the current energy system flows, input and outputs from both internal and external driving forces is an important start. From here we start to interact with the top level decision making and governance with the bottom up from the people and this is where energy literacy can start to help in enabling feedback loops between the status quo of current energy offerings to where we need to be in the longer term and the energy technologies and associated infrastructure required.

By building a more energy literate society at the global level could provide hope for more proactive dialogue both at the influential stakeholder level as well as with the lay public. Drawing on the socio-psychological theories which have been tried and tested for energy technology acceptance will also be an important part. It demonstrates that an interdisciplinary approach is essential for overcoming this challenge and that it will not be achieved by technology alone. In our paper we will expand on a number of case studies which illustrate the best way forward and how it maybe operationalized across the globe.

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