

Suburban Practices of Energy Descent

Samuel Alexander* and Brendan Gleeson†¹

Abstract: This article proceeds on the basis that the cost of energy will rise in coming years and decades as the age of fossil energy abundance comes to an end. Given the close connection between energy and economic activity, we also assume that declining energy availability and affordability will lead to economic contraction and reduced material affluence. In overconsuming and overdeveloped nations, such resource and energy “degrowth” is desirable and necessary from a sustainability perspective, provided it is planned for and managed in ways consistent with basic principles of distributive equity. Working within that degrowth paradigm, we examine how scarcer and more expensive energy may impact the suburban way of life and how households might prepare for this very plausible, but challenging, energy descent future. The article examines energy demand management in suburbia and how the limited energy needed to provide for essential household services can best be secured in an era of expensive energy and climate instability. After reviewing various energy practices, we also highlight a need for an ethos of sufficiency, moderation, and radical frugality, which we argue is essential for building resilience in the face of forthcoming energy challenges and a harsher climate.

Introduction

¹ *Research Fellow, Melbourne Sustainable Society Institute. Lecturer, Office for Environmental Programs, University of Melbourne. Research areas: degrowth, permaculture, voluntary simplicity, “grassroots” transition. Author: *Degrowth in the Suburbs: A Radical Urban Imaginary* (2019); *Carbon Civilisation and the Energy Descent Future* (2018); and *Art Against Empire: Toward an Aesthetics of Degrowth* (2017). Website: samuelalexander.info Email: samuelalexander42@gmail.com

† Director, Melbourne Sustainable Society Institute, University of Melbourne. Founder & former director, Urban Research Program at Griffith University. Research areas: urban and social policy, environmental theory and policy. Author: *Heartlands: Making Space for Hope in the Suburbs* (2006). Co-author, *Degrowth in the Suburbs: A Radical Urban Imaginary* (2019). Recipient, John Iremonger Award. Email: brendan.gleeson@unimelb.edu.au

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Cities are humanity's most intricate creations. They are the meta-formations within which other expressions of human creativity emerge and develop, and this complexity, like life itself, depends on energy for its sustenance and development (Smil 2017). Energy is not just another resource or commodity: it is the key that unlocks access to all other resources and commodities, thereby giving shape to the physical boundaries within which human societies must take form. Responding to urban problems and pursuing societal goals almost always involve energy investment, yet the more problems that are faced or goals that are pursued, the more energy a society needs need to maintain its way of life. This is how civilizations take form and evolve, both enabled and constrained by their energetic foundations (Tainter 1988). Indeed, a society must be able to meet and afford *ongoing* energy requirements if its specific socio-economic form is to persist. If energy needs cannot be met or afforded, the society will transform or be transformed, voluntarily or otherwise.

Never has this energy dependency been truer than in the low-density urban landscapes of suburbia, predominantly comprised of stand-alone houses and generally inhabited by high-impact, energy-intensive households, which are both creatures and creators of the growth economy (Alexander and Gleeson 2019). Suburban affluence is the defining image of the good life under globalized capitalism, often held up as a model to which all humanity should aspire. The dominant development model has seen the global consumer class expanding as more economies industrialize and urbanize. But every aspect of this industrial mode of existence has been shaped by the cheap and abundant fossil energy supplies that have become accessible in the last two centuries (Smil 2017).

This dependency on fossil fuels has given rise to an energy crisis with two main dimensions (Moriarty and Honnery 2012). First, fossil fuels are finite resources that are being consumed at extraordinary rates (IEA 2018), such that their supply will one day peak and decline even as demand threatens to grow (Mohr et al. 2015). Second, the combustion of fossil fuels is also the leading driver of climate change (IPCC 2018), meaning that humanity must decarbonize by choice even before we are forced to do so through geological depletion. Further to those challenges, it remains highly uncertain whether renewable energy technologies will be able to fully replace the energy services provided by fossil fuels in an energetically or financially affordable way (Moriarty and Honnery 2016; Alexander and Floyd 2018). Thus, the future will be defined by increased

energy scarcity not energy abundance, which implies an “energy descent future” with rising energy costs relative to today (Odum and Odum 2001; Holmgren 2012).

Rather than further diagnosing these problems, we assume the energy predicament outlined above and proceed on the basis that the cost of energy will rise in coming years and decades as the age of energy abundance comes to an end. We also take as given the close connection between energy and economic activity (Keen et al. 2019; Ayres and Warr 2009). On that basis, we assume that declining energy availability and affordability will lead to economic contraction and reduced material affluence. In overconsuming and overdeveloped nations, such resource and energy “degrowth” is desirable and necessary from a sustainability perspective, provided it is planned for and managed in ways consistent with basic principles of distributive equity. A large literature has emerged over the last decade defending and examining the various complex issues surrounding such planned degrowth (Weiss and Cattaneo 2017; Kallis et al. 2018; Trainer 2020). We are broadly sympathetic with that paradigm. It informs the analysis below. Of course, scarce and expensive energy may well arrive *without* sufficient planning and in inequitable ways. This means that societies may need to prepare for economic contraction which looks and is experienced more like recession, depression, or even collapse—an unplanned economic contraction. But whether economic contraction arrives through design or disaster—or some mixture—this profound turning point in industrial civilization will be experienced very differently depending on context, including the vast array of suburban settings that now exist in the global urban age (Gleeson 2014).

In this article, we examine how scarcer and more expensive energy may impact the suburban way of life and how households might prepare for this very plausible, but challenging, energy-descent future. While we acknowledge various structural challenges (especially access to land and the problem of carbon-dependent urban infrastructure), our analysis focuses primarily on the social or “grassroots” responses that may be available within those existing structural constraints. In addressing this theme and context, we acknowledge a tradition of prior commentary on “peak oil” adaptation (Heinberg 2004; Greer 2008; Hopkins 2008; Holmgren 2018). However, we do not fall into the catastrophism of some suburban analysts of energy descent (Kunstler 2005). Our aim is to provide an up-to-date exploration of the energy challenges facing suburbanites in a carbon-constrained world. We also feel that our scholarly analysis and review of the

issues are worthwhile contributions in an age where energy descent futures remain neglected and on the fringe of academic literature. We believe that scholarly neglect owes primarily to widely held techno-optimistic assumptions about renewable energy transitions. (For a critical review of those assumptions, see Alexander and Floyd 2018.)

Our article involves an examination of energy demand management in suburbia and how the limited energy needed to provide for essential household services can best be secured in an era of expensive energy and climate instability. After reviewing various energy practices, we highlight the need for an ethos of sufficiency, moderation, and radical frugality, which we argue is essential for building resilience in the face of energy challenges. We begin, however, with an energy focus, and then explore the broader implications for urban material culture.

In order to delimit the scope of our analysis, we focus specifically on what we call “new world” suburbia—the suburban contexts of the United States, Australia, and New Zealand, which share many cultural and geospatial characteristics. Often poorly designed in terms of energy efficiency, these extensive suburbs will not all be knocked down for them to be built again in “greener” or more efficient ways. Built environments are highly fixed capital that evolve relatively slowly. Replacement rates occur at less than 5 percent per annum in Australia, more like 1-2 percent in the United Kingdom (Gleeson 2014; Dixon et al. 2018). Instead of rebuilding, we argue that the task is to *resettle* the suburbs according to a new imaginary (Alexander and Gleeson 2019). We agree with permaculture theorist and practitioner David Holmgren (2018) and simplicity theorist Ted Trainer (2010) that when approached creatively, these low-density suburban landscapes show themselves to be a promising place to start a grassroots, transformative retrofit of the built environment in an age of rising energy costs and broader environmental crises. In what follows, we consider and outline the social practices and values needed to effect this deep suburban transformation, drawing on various literatures, including degrowth, permaculture, voluntary simplicity, urban studies, and critical energy analysis.

Unlearning Abundance: Energy Descent in the Suburbs

What, then, might energy descent look like at the level of the suburban household? What does it mean for a household to plan for economic contraction and embrace a context of rising energy costs? Does this necessarily imply hardship, deprivation, and sacrifice? Or, if negotiated wisely, could such a managed descent give rise to an alternative, less materialistic form of prosperity? This raises practical questions about what suburban households can do to begin building a post-carbon economy within the shell of the old, but it also highlights the question of what role socio-cultural transformation needs to play in reclaiming the suburbs for a new era of energy scarcity.

Some of the practices and attitudes reviewed in this article will come as no surprise, such as retrofitting a house for increased energy efficiency; a material ethics of frugality and sharing; household investment in solar panels; mending and making things rather than always buying; radically reducing waste; cycling; relocalizing food production via backyard gardening and urban agriculture; and connecting with local farmers and producers. Such “old ideas” will not excite those who fetishize “the new,” but we argue that such practices deserve cursory restatement because they have a necessary and significant role to play creating the socio-cultural conditions needed for an energy-descent future to be managed well. If growth and consumerism cannot be maintained in a high-cost, energy-scarce future, it is important to understand what material and energy sufficiency would look like in suburban contexts that are currently so resource and energy dependent.

We also review other potential features of a retrofitted suburbia that have received far less attention in mainstream sustainability and resilience discourse, including domestic biogas production, disconnecting from fossil gas, composting toilets, solar ovens, peer-to-peer sharing, the gift economy, and re-commoning public and private space. Many of these practices are particularly suited—sometimes *only* suited—to the suburban landscape, in ways we will explain. We do not present such a brief survey as a universalizable or complete blueprint to be applied independent of context. By considering a range of such practices, and highlighting their underlying principles of motivation, it is hoped that we can begin to discern a new, post-carbon suburban imaginary that outlines a constructive and positive response to forthcoming energy descent.

Our underlying assumption is that sustainability in the suburbs (and more broadly) cannot be achieved merely through techno-efficiency improvements and the decarbonization of consumer lifestyles (Hickel and Kallis 2019). The extent of decoupling required is simply too great. Of course, all societies do need to exploit appropriate technologies and design innovations in order to produce and consume more efficiently. But to have any positive effect, efficiency must be grounded in an ethics, economics, and, ultimately, a politics of sufficiency and self-limitation (Alexander 2015). In over-consuming and over-producing societies, that means a radical, but voluntary, demand-side reduction in energy and resource use. Efficiency without sufficiency is lost, as demonstrated by the increasing resource demands of growth capitalism over recent centuries (Kallis 2017).

A demand-side reduction will involve the ethical renegotiation of our relationships with the material world, as well as a vast and growing politics of collective action to support and realize it (Read et al. 2018). The rejection of materialistic values and practices is generally referred to as voluntary simplicity, otherwise known as “downshifting” or just “simple living” (Alexander 2009). That means unlearning consumerist cultures of consumption which are so easily taken for granted and normalized in developed nations (Hamilton and Denniss 2005). It also means relearning the lost arts of creative frugality which were commonsensical in previous eras of relative scarcity. But it also means creating the range of societal structures to support rather than inhibit post-consumerist, sufficiency-based ways of living. Even though it is currently out of intellectual and political fashion, we maintain that there is an utterly indispensable literature on sufficiency, moderation, self-limitation and frugality that must inform any coherent sustainability-justice agenda, especially in anticipation of rising energy costs and climate instability (Westacott 2016; Alexander and McLeod 2014).

Recall that “economy,” according to Aristotle, meant the good management of the household, and, for him, the household was the foundation of the *polis*. In our age of governmental paralysis and failure of nerve, this Aristotelian perspective might again highlight the necessity of a social strategy that begins with the intentional transformation of daily life in the suburbs.

A Necessary Caveat: Energy Descent for Whom?

At once we need to highlight a critical tension raised by our approach to retrofitting suburbia—a tension that speaks to the complexity of any praxis and politics of suburban transformation. On the one hand, the new energy context of scarcity and higher prices that may soon dawn categorically entails a significant reduction in the energy and resource demands of the wealthiest societies, so it is important to grasp what such downscaling might look like in terms of lived experience. The forthcoming analysis considers that question in some detail. On the other hand, it is clear that there are many people, even in affluent societies like Australia (from where we write), who are in precarious financial situations, struggling simply to feed and clothe their families, and who certainly do not experience their consumption practices as being excessive and superfluous (Bauman 2004). Degrowth and energy descent for whom, one might ask?

This raises structural and distributive issues concerning class, privilege, and property ownership. These issues entail a critique which has been leveled at the permaculture, ecovillage, sustainable consumption, and “simple living” movements regularly (Frankel 2018). Although the practices reviewed in this article will need to be a part of any post-carbon future, many (but not all) of the practices depend on the ownership of land or access to secure housing, which are privileges far from being universally provided.

Access to affordable land and housing is fundamental (Nelson and Schneider 2018). This draws the analysis into radical and controversial territory, because broadening societal access to land and housing implies a revision of property rights and market structures which sit at the conceptual heart of capitalism. Options for radical “top down” reform have been considered elsewhere, including the following: design new measures of growth to replace GDP, establish limits to resource use, reduce work hours, design public budgets for more public goods, invest in renewable energy, transform the financial system, and guarantee the right to housing (Alexander and Gleeson 2019: 181–195). For now the point is simply that some of the practices reviewed below are not easily embraced by those unable to secure ownership of, or secure access to, housing and land. As populations grow and put more pressure on cities, this problem of ownership and

access to affordable housing threatens to intensify, unless there are some bold policy interventions aimed at broadening the distribution of wealth, power, and property in society (Nelson and Schneider 2018).

Similarly, tenure is profoundly important. There are obvious reasons why people renting will not invest in solar panels or water tanks in a transient or insecure rental property. That is, renting implies what urban theorist Anitra Nelson (2018: 102) calls an “unsettled temporariness.” Even digging up the lawn and growing food can depend on the permission of landlords. Furthermore, retrofitting a house can be expensive and many households may not have discretionary expenditure to invest in solar panels, efficient appliances, or water tanks, especially if trying to get into the housing market which may imply oppressive mortgage obligations.

It would be naïve, therefore, to suggest that personal or household action alone can resolve the problems suburbanites face in an energy descent future. But the following program of action still remains a necessary part of the picture of transformation. It just means that there are deep structural, financial, and cultural obstacles that lie in the way of such a grassroots transition scaling up.

Nevertheless, we also recognize the latent transformative potential of those who have the agency to downshift their material living standards (Holmgren 2018). These relatively high consumption suburbanites—relatively prosperous working and middle classes—may have to play a lead role creating the social conditions needed for a politics of energy descent to emerge. This article will focus predominately on that class capacity to act within existing structural constraints. But this focus on suburban homeowners can only be the start of any response to energy scarcity and rising energy costs, and ultimately this constituency must commit to and collaborate with broader social movements of solidarity, resistance, redistribution, and transition.

Suburban Practices of Energy Descent

Our survey of household actions and attitudes begins by focusing on the central question of energy: how suburbanites can practice, and , in some instances, already practice energy

descent (Holmgren 2018). After reviewing these practices, we consider some broader homesteading activities consistent with an energy descent future, including the practice of voluntary simplicity, relocalizing food production, and participation in alternative economies outside the market.

The Necessity of Demand Reduction

The most important thing any household can do to decarbonize energy use and prepare for energy scarcity is simply to reduce energy demand. After all, a transition to 100 percent renewables will be proportionately easier to achieve and more affordable if demand is significantly reduced. Since the Industrial Revolution, energy has been so cheap relative to its rewards that it has been easy to be wasteful and careless in energy use (Smil 2017). That very wastefulness provides a source of grounded hope, however, because it means there are huge opportunities for demand reduction in ways that do not imply any reduction in wellbeing. In ways we will now outline, trimming superfluous energy use requires both behavioral changes and investments in household retrofitting activities for increased efficiency and self-provision (Sorrell 2015).

In terms of behavior change, households can practice a range of important but unexciting energy rituals, including: turning lights off when leaving the room; taking short showers; never using (or having) a clothes dryer; only judiciously using air-conditioning (more for health than comfort); washing clothes only when genuinely needed; closing curtains and windows on really hot days to keep the heat out; putting warm clothing on in cool temperatures before turning any heating on (and only heating the rooms being used); watching TV or online entertainment sparingly; unplugging appliances when not in use; and a long list of tiny other things too mundane to mention. One Australian study estimated that these types of behavioral responses could reduce average in-house energy use in a household by half (Alexander and Yacoumis 2016). That study did not exhaust the range of practices available. Mainstream environmentalism has been on top of this behavioral advice for decades, and it should not be dismissed. But while such practices are necessary, they are far from enough to achieve sustainability, given the systemic embeddedness of consumption practices and the problem of structural “lock in” (Trainer 2012; Sanne 2002). Nevertheless, they begin

building household resilience, by anticipating reduced energy availability through voluntary energy demand reduction. In terms of retrofitting a house, options include:

- investing in efficient appliances (like a small fridge) and solar panels, and progressively electrifying all gas appliances;
- putting extra insulation in the walls and roof to minimize the need to heat and cool the house;
- closing gaps around doors and windows;
- planting a west-facing grapevine or deciduous tree that shades the house with its foliage in summer, keeping it cool, but lets the sun hit the house in winter by dropping its leaves;
- installing thick curtains to keep heat in (or out) as needed; and
- other equally mundane but useful things of this nature.

A range of small and more significant changes can add up to surprisingly large demand-side energy reductions (Holmgren 2018). All of them increase resilience in anticipation of energy becoming scarcer and more expensive. In short, if energy becomes increasingly unavailable or unaffordable in a context of energy descent and economic contraction (whether planned degrowth or unplanned recession), being able to manage with as little energy as possible becomes an essential household skill.

While there is obviously a privilege implied by owning a house—roughly 65% of Australians own their home—frugal financial practices and minimizing superfluous consumption can, to some extent, free up income to invest in a solar array, a biogas digester, heat-pump hot water system—all reviewed below—amongst other retrofitting investments. Within the permaculture (Holmgren 2018), voluntary simplicity (Alexander and Ussher 2012), and “transition towns” (Hopkins 2008) movements, households have been taking these types of actions and practicing energy descent here and now, whilst governments have been relatively inactive. Alexander and Ussher (2012) conducted what remains the most extensive empirical examination of the downshifting movement, and conservatively concluded that as many as 200 million people in Western nations are practicing voluntary simplicity, even if this subculture entails a wide range of practices, from light green consumerism to more radical expressions of simple living. Could this constituency yet radicalize, mobilize, and organize to become a social movement of transformative import? Journalist George Monbiot (2007: 42) famously declared that

people never “riot for austerity,” but rioting for a new vision of frugal abundance no longer seems quite so implausible, even if this broad movement remains in its infancy as a political project.

While the systemic and structural challenges cannot be analyzed in any depth in this article, the research and practices reviewed suggest that, in some suburban contexts, much can be done within existing structures to decarbonize the suburban household. Several suburban cases studies are reviewed in Holmgren (2018), with similarly promising and inspiring examples analyzed in Nelson (2018). The structural problem of carbon “lock in” is very real for some households (Sanne 2002). Nevertheless, for many households, a significant portion of their carbon footprint is largely a *choice* or *habit* that could be modified. This highlights a cultural or normative challenge, which arguably can be best resolved incrementally through ongoing grassroots activities and the evolution of new cultural practices and norms “from below.” To talk of “incremental change” and “evolution,” however, should not be interpreted as downplaying the urgency of change that is needed.

The behavioral practices are free but involve the challenge of changing habits, which humans are not very good at without nudging or other incentives (De Young 2014). The investments in efficiency or renewable energy production will cost money, and the challenge in that regard is about creating an ethos of sustainability that sees such investments as more important than other consumer commodities or experiences. That said, the economics of solar are becoming more attractive (Creutzig et al. 2017). Household solar is becoming less of a “cost” and more of an “investment,” even though the upfront expense can still be a barrier. Expensive housing and rent will also make such investments difficult for many, although financial resources could become available for some households, if more frugal and mindful spending practices were adopted (Dominguez and Robins 1992). This is a point to which we will return.

Making the changes reviewed above obviously requires the *desire* or *incentive* to take energy demand reduction seriously, which is lacking in many affluent cultures today. This lack is primarily because the dominant paradigm of techno-optimism pushes the message that we can just “green” supply rather than go to the trouble of reducing demand. Our counter-message is that significant demand reduction is achievable in many

suburban households, and it is important that decarbonization in the city begins with these changes wherever they are available. As more households take these small, but cumulatively transformative, steps, we contend new cultural norms would arise in relation to which current political and macroeconomic goals would be re-evaluated and, in time, potentially revised (Alexander 2013). Without dedicated demand-side action, any transition to sustainable and more resilient energy systems will fail.

Some political economists, such as Frankel (2018), will be quick to dismiss such “lifestyle” changes as being of little consequence, not recognizing that the structural changes that are certainly needed will never arrive until there is progressive culture that demands them. Practicing energy descent at the household level is an indispensable part of that cultural r/evolution, representing a prefigurative politics that is necessary to any post-carbon or post-growth transition (Alexander 2013). The rest of the household actions reviewed in this article should be judged in that light also—not as direct, consumption-based “solutions” to the problems of over-production, but as necessary groundwork for creating the new culture of sufficiency that will need to precede any new politics or macroeconomics of sufficiency.

Solar PV

On the path of household decarbonization, the second-best thing to do—after significantly reducing demand—is to invest in solar photovoltaics (PV), a strategy most suitable for suburbanites with their typically low-density, stand-alone houses and private roof space. There is still academic controversy over the best ways to decarbonize economies (Jacobson et al. 2017; Heard et al. 2017; Alexander and Floyd 2018; Heinberg and Fridley 2016). Still, few deny that solar PV will need to play a greatly increased role in energy production. Most governments around the world (notably Australia and the USA) are failing to take the lead on a clean energy transition and initiate deep decarbonization (IPCC 2018). Therefore, by force of logic, there is an increased burden on households and communities to invest in their own renewable energy, even if this may not always be the most efficient way to do it (Borenstein 2017). Household solar energy production is certainly more desirable than waiting, while governments do little or nothing. In any case, it is likely that a renewable energy future will be one that moves towards greater decentralization of energy generation, especially if battery technology

continues to advance (Liaros 2019; Palmer and Floyd 2020). The tide of household solar installations is strengthening this pattern, and grid architecture will need to evolve to adapt to changing patterns of generation and use.

Using the sun more directly through solar ovens is another practice highlighting the elegance of simplicity (Alexander and Yacoumis 2016). This is obviously climate dependent. While unable to completely replace an inside oven, solar ovens can reduce electricity for cooking several days a week in the warmer months, while also teaching households important lessons about the art of living in accordance with solar energy flows.

An Electric “Heat Pump” Hot Water System

One of the key features of deep decarbonization involves electrifying energy services previously provided by fossil energy. This presumes that electric appliances are powered by renewable electricity, since electric appliances running on coal-generated electricity can be more carbon-intensive than fossil gas appliances. Electric hot-water systems once cost much more than gas systems to operate, but developments in heat pump technology mean that electric systems are now up to 80% more efficient than they used to be (Gehl et al. 2012). Without going into the technicalities, a heat pump absorbs heat from the air and transfers it to the water, minimizing the need for further heating with electricity. This is a form of solar heating since the sun heats the air, and that heat gets transferred to the water, effective even in winter. Best of all, these heat pump units generally have a timer, which means that they can heat the water when the solar panels have maximum sun exposure. For this reason heat pumps can be conceived of as a battery of sorts, with the sun and solar panels “charging” the water when the sun is up and storing the energy in an extremely well-insulated tank. Residents can use the hot water in the mornings or in the evenings, when the sun is down. This minimizes grid demand in ways that make a 100 percent renewable energy transition more affordable and manageable.

Biogas in the Suburbs

Most suburban blocks would have space for a domestic biogas digester, although this highly promising alternative technology is all but unknown in developed regions of the

world. In this regard the so-called “developing nations” have much to teach, with China having 27 million biogas digesters and India having 4 million (Bond and Templeton 2011). With irony, blindness, and paradox, the discourse of “development” can barely conceive of the possibility that “advanced” nations might have things to learn from the “less developed” nations.

Biogas is produced when organic matter biodegrades under anaerobic conditions (without oxygen). The primary benefit of biogas is that it is a renewable energy source with net-zero emissions. Whereas the production of oil and other fossil fuels will eventually peak and decline, humans will always be able to make biogas so long as the sun is shining and plants can grow. Biogas has net-zero emissions because the carbon dioxide that is released into the atmosphere when the methane burns is no more than what was drawn down from the atmosphere when the organic matter was first grown (Alexander, Harris, and McCabe 2019).

There are other benefits, too. The organic matter used in biogas digesters is typically a waste product. By producing biogas, households can reduce the amount of food waste and other organic materials being sent to landfills, which also means less methane in the atmosphere. Furthermore, biogas digesters produce a nutrient-rich sludge that can be watered down into a fertilizer for gardens, homesteads, or farms. All this helps develop increased energy independence, build resilience, and save money.

The level of food waste in affluent new world nations is alarming, around AU\$8 billion worth in Australia alone each year (ABC 2013). It makes sense to be diverting that waste from landfill to produce clean energy in the suburbs. Research by Reynolds et al. (2014) indicates that there would easily be enough food waste in Australia for all suburban households to cook on biogas without exhausting food waste streams, even if food waste was significantly reduced. New research on domestic biogas production suggests that putting approximately 1.5 kilograms of food waste per day in a domestic scale biogas digester can produce on average 38 minutes of cooking per day, which is enough to cover most household cooking requirements (Alexander, Harris, and McCabe 2019). Coupled with a solar hot water system this can allow for complete disconnection from fossil gas and minimize electricity demand.

Biogas has the potential to be a disruptive alternative technology that could contribute to the deep decarbonization and increased energy security. We maintain that suburban households should exploit this innovation on the path to a post-carbon and resilient society. Although it can seem like an energy miracle—clean energy from food waste—biogas is really nothing other than an elegant example of permaculture: working with nature and natural processes, rather than fighting against them.

Post-Carbon Transport

Suburbia was built with cheap oil and designed primarily to be car dependent. Electric vehicles will inevitably play some role in the transformation of transport in the near and longer term future. We argue, however, that it is a mistake to think they can solve the problem of the carbon- and resource-intensity of private automobiles (Alexander and Gleeson 2019: Ch 2). Any genuine transport solution will not involve electrifying the world's currently growing addiction to private motor vehicles but by finding ways to avoid the need for such vehicles altogether (Moriarty and Honnery 2016). The alternatives are walking, cycling, and electrifying public transport, which have many environmental and health benefits (Higgins and Higgins 2005).

Electric bikes are also likely to be of transformative significance, providing a kind of “middle way” between electric cars and the human-powered bicycle. Electric bikes retain most of the benefits of the human-powered version, while extending ranges and load capacity to cope adaptively with settlements and economies structured to suit cars and trucks. By making cycling lower impact on the rider and much more accessible, electric bikes could be a lynchpin technology for managing energy descent and initiating a degrowth transition, at least as an enabler that gets many more people engaged with post-car transport and gives people their first taste of the personal benefits and freedoms available to the cyclist.

Walking or cycling will be non-viable in certain contexts, and even public transport is not always available. These structural problems are well known and not easily or swiftly resolvable, even if the solution is relatively clear: build more infrastructure to support these low-carbon or post-carbon alternatives. Nevertheless, there is also vast

scope for replacing many car trips with alternative modes of transport that are less carbon-intensive, especially through a cultural embrace of cycling.

In Australia it has been estimated that three quarters of all personal car journeys are less than 10 kilometers, with half being less than 5 kilometers, and one third less than 3 kilometers (Alexander and Yacoumis 2016). It is reasonable to assume that a significant proportion of those trips could be replaced with cycling without hardship, although disability, heavy freight, or other complexities would mean a full substitution would be difficult or impossible. Nevertheless, a study in the United States by Higgins and Higgins (2005) has shown that substituting walking and cycling for short car trips, based on recommended daily exercise, could reduce U.S. domestic oil consumption by up to 34.9 percent, while also having huge health benefits and leading to reduced health care costs. No doubt other oil-dependent nations could also achieve significant savings through this “simple,” low-tech strategy.

Recent research by Laskovsky and Taylor (2017) in Melbourne, Australia, also bears consideration: the vast amount of urban and suburban space dedicated to cars, roads, and parking is deeply wasteful, especially when it is understood how inefficiently that space is used in terms of irregular occupation. Reclaiming this land for other purposes is an exciting urban prospect, as it would open up vast tracts of land for an array of retrofitting activities limited only by our imaginations.

Low-Meat Diets and Population Issues

We close this section on energy with a brief consideration of decarbonizing diets and family size. While not limited in relevance to the suburban context, these issues have significant implications for energy demands and thus deserve comment.

The production of animal products is hugely energy (and carbon) intensive and there is absolutely no way that average Western levels of meat consumption could possibly be globalized in a sustainable way (Poore and Nemecek 2018). While there are some prospects for efficiency improvements in the production of animal products (which might come at the expense of animal welfare), the necessary but rarely acknowledged

part of the equation is drastically reducing (or, for some, eliminating) meat and dairy consumption in diets (Hadjikakou 2017; Hadjidakou and Wiedmann 2017).

Nevertheless, this issue ought to be approached with the subtlety it deserves. Global averages can mislead, and a localized economy necessarily means shortening the chain between production and consumption in ways that demand context-dependent analysis (Holmgren 2018). To provide an extreme example, it is no good asking the Inuit people to reduce meat consumption, given that eating sea mammals is their primary means of sustenance, and there are communities around the world similarly dependent on animal agriculture to survive. Much land is not suitable for cropping, in which case the distinction between grain fed and pasture fed animals is important. Reducing the former could certainly open up more land for lower-carbon, non-meat food production, which would be far more energy efficient on account of feeding food to humans instead of that food to animals and then eating the animals. The role of grazing animals in landscape restoration and regeneration is also an important consideration, too often overlooked by those ignorant of land management and food production (Massy 2017).

None of this changes the fact, however, that in many affluent societies significantly reducing meat and dairy consumption is one of the most significant things people can do to decarbonize their lives (Wynes and Nicholas 2017). Having small families is the other issue deserving of note, and, indeed, the growth paradigm treats population as a driver of growth and therefore presumptively a good thing. Yet both strategies (reduced meat consumption and lower fertility) scarcely get a mention in mainstream environmental or political discourse. This willing blindness is a major cultural obstacle to any post-carbon transition and one that is not easily overcome. The best that can be done is to show by example that low or no meat diets can be healthy, cheap, and delicious, and that small family size accrues many benefits (financial, increased free time, more sleep) aside from the environmental ones. Climate activist Bill McKibben (1999) suggested a good starting question for the next generation of parents-to-be: “Maybe one?” As for diets, it is hard to improve upon the simple advice offered by food guru, Michael Pollan (2007): “Eat [fresh, unprocessed] food. Not too much. Mostly plants.”

Toward a Post-Carbon Suburban Homestead: Reimagining the Good Life

Beyond direct energy considerations, the emergence of expensive energy and a contracting degrowth economy will require a reevaluation of values and practices in other domains of life, too. Any consumerist culture is going to require a growth economy to meet its demands for ever-rising material living standards. The flip side of that coin is that a degrowth economy will depend on and require a material culture of sufficiency that embraces a post-consumerist existence of relative scarcity of energy and resources. The dual value of embracing this strategy is that it moves the culture of consumption in a more sustainable direction, but it also prepares the household for disruptive and unstable economic times in which reduced consumption is enforced rather than voluntarily chosen. That is, downshifting prepares the household for times of crisis or unplanned economic contraction, and thus increases resilience, even if the primary or initial motivating goal is sustainability.

By “voluntary simplicity” we are talking about more than taking shorter showers, turning the lights off, and recycling. A degrowth culture of consumption in an energy descent context must assume a far more radical form of downshifting. According to the ecological footprint analysis, humanity would need four or five planets if the Australian or U.S. way of life were globalized. If Australian living standards were attained by the projected global population of 2050, then humanity would need 10 planets (Trainer 2012).

Few analysts of the global predicament seem to appreciate the magnitude of this challenge: it requires a 75–90 percent reduction in ecological impacts compared to living standards in the wealthiest regions of the world, even if sustainable living will always be a context-dependent practice (Trainer 2012; Trainer 2020). As Hickel and Kallis (2019) have shown, efficiency, technology, and the decoupling strategy are failing to bring the global economy within sustainable bounds. It follows by force of logic and evidence that globalizing Western-style material living standards is a recipe for catastrophe—both ecological and humanitarian. A just and sustainable world necessarily involves some radically transfigured practices of consumption and production compared to the ecocidal

forms which have emerged in the West, and that means, among other things, embracing the all-but-forgotten wisdom of frugality, moderation, and sufficiency (Princen 2005; Westacott 2016).

Enlightened Material Restraint: The Practice of Sufficiency and Self-Limitation

What might this alternative suburban ethics of consumption look like in practice? As always, context is everything, but some broad comments may offer some general insight into how consumption practices may need to be transformed in and for an energy descent future. Above we addressed energy specifically, with the clear, but often complex, prescription being to radically reduce energy demand and invest in localized renewable energy production. In affluent societies of the “developed” world, some of the funds for such investment could be found simply by reducing expenditure elsewhere. Voluntary simplicity or downshifting implies being extremely mindful with one’s money and being aware that numerous small expenses (magazines, clothes, takeout food, that extra beer) over months and years can add up to considerable sums (Dominguez and Robins 1992). In a recessionary or depressed economy, of course, such downshifting may be enforced rather than voluntarily chosen, in which case it makes sense to anticipate the more austere material culture that lies ahead in an energy descent future. One thinks of the Depression-era slogan: “Use it up, wear it out, make it do, or do without.”

This should not be presumed to imply hardship necessarily (Kasser 2017; Lockyer 2017). At least, how well an individual or household manages economic contraction is partly a function of the values and attitudes one brings to experience (Burch 2012). Once sufficiency in material living standards is achieved (through basic provision of food, housing, clothing, energy), voluntary simplicity implies resisting the dominant cultural pressure to seek ever-higher incomes and instead seeking the good life in a range of non-materialistic sources of meaning and fulfilment (Alexander 2009). This essential insight is supported by a vast body of social and psychological research showing that money and possessions have diminishing marginal returns; the richer people get, the less money contributes to quality of life (Lane 2000; Kasser 2002; Kasser 2017).

In pursuit of voluntary simplicity, households will discover a number of practices that can reduce impact while also saving thousands of dollars every year:

- buying second-hand clothes;
- avoiding the lure of fancy possessions;
- growing a portion of household food;
- capturing water in tanks;
- making or mending rather than purchasing;
- developing cheap and low-impact leisure activities;
- sharing and borrowing;
- brewing one's own beer or cider; and
- minimizing waste and avoiding packaging.

In these ways, creating a surplus can be directed into the clean energy revolution, or allow for reduced working hours which can open up more time to dedicate to community action, home-based production, or simply more time for family, friends, and private passions (Read et al. 2018).

Of course, the usual proviso applies: many households even in affluent societies are living from paycheck to paycheck, with little room for voluntary downshifting. But in consumer cultures, there are many households that have normalized abundance with no conception of “enough” (Hamilton and Denniss 2005; Lane 2000). In anticipation of an energy descent future, such a normalization of abundance must be unlearned. The less people need to purchase to maintain their way of life, the less they are obliged to work to pay for that market consumption. By thus reimagining the good life beyond consumer culture, voluntary simplicity offers a path to maximizing freedom and advancing genuine wellbeing, a transition that Soper (2008) calls “alternative hedonism” and Raser-Rowland and Grubb (2016) refer to as “frugal hedonism.” (This rightly implies that self-interest is an incentive beyond environmentalism or concern for the world's destitute, and empirical research verifies that voluntary simplicity offers this hedonic reward [Alexander and Ussher 2012; Kasser 2017].)

Even the most radically downshifted suburban households, however, are probably still overconsuming on a global scale, so the practice of sufficiency must remain an

ongoing context-dependent process, not a static destination to arrive at or achieve once and for all (Princen 2005). This again points to the systemic nature of global crises, since it can be very hard or even impossible to consume less within societal structures that have been created to promote limitless growth and unbounded consumerism (Sanne 2002). Nevertheless, the structural transformation will never transpire until there is a post-consumerist culture that is prepared to embrace material sufficiency. Accordingly, new cultures of voluntary simplicity are required both to provide the social conditions needed for a degrowth economy to emerge systemically and to build resilience if economic contraction occurs through recession or depression rather than through planned design (Alexander 2013).

The political significance of the voluntary simplicity movement is most apparent in how it can carve out *more time for people to create the new (suburban) economy*. The politics of voluntary simplicity is typically conceived of in terms of “political consumers” who express their values through what they buy and where they spend (Stolle and Micheletti, 2013). That is fine as far as it goes, but it misses the more significant matter of freedom and time. Building a new economy from the grassroots up in an energy descent future will take time, and currently most households are “time poor,” locked into the work-and-spend cycle (Robinson 2009). By rethinking consumption levels, embracing frugality, and exchanging superfluous stuff for more free time, voluntary simplicity provides a pathway that can enable grassroots activism and suburban homesteading, while also being directly in line with the post-materialist values of degrowth and permaculture.

Eating the Suburbs

We have been exploring some of the practices and values that may be needed in order to build suburban resilience in the face of an energy descent future and a contracting economy. Having reviewed direct energy considerations and the ethos of sufficiency that informs the voluntary simplicity and downshifting movements, we turn now to the relocalization of food production and increased self-sufficiency through home-based production (Gaynor 2006).

There is a flourishing “local food movement” in many cities today (Norberg-Hodge 2019). However, its full potential has not yet been fully realized (Trainer 2019). Digging up backyards and front yards and planting fruit and vegetables, keeping chickens, and composting, are important practices, reconnecting people with the seasons, the soil, and the food on their plates. To borrow the phrase often spoken in Australian permaculture circles, we should “eat the suburbs.”

There are lessons here from the Cuban experience in the early 1990s. When the USSR collapsed, Cuba quickly found itself having to manage with greatly decreased oil imports (Friedrichs 2010). Despite this so-called “special period” being a time of considerable hardship, a key strategy for dealing with energy descent in Cuba was to relocalize and decarbonize food production by scaling up organic food production in and near cities, deeply influenced by permaculture theory and practice (Viljoen et al. 2005: Ch. 17-18).

Furthermore, in an age characterized by what Louv (2008) has called “nature deficit disorder,” the rewards of home or community gardening go well beyond the environmental and physical health benefits of eating local, fresh food. Getting into the garden and out of our cars offers mental health rewards, too (Soga et al. 2017). There might be silver linings to more austere material futures where home-based production and cycling become necessary due to rising energy costs and tightening household budgets due to a contracting economy.

Recent scholarly analyses demonstrate the productive potential of suburban blocks. Ted Trainer has undertaken a detailed quantitative analysis of East Hills, an outer suburb of Sydney, Australia, where he lives. Trainer (2019: 25) demonstrates through quantitative analysis that urban and suburban agriculture has highly significant productive capacity, concluding that “most, and possibly almost all food could come from within settlements, that is from home gardens, community gardens, neighbourhood commons, and very small farms.” Similarly, promising analyses have been published by the Melbourne based Victorian Eco-Innovation Lab (VEIL 2018; Trainer, Malik, and Lenzen 2018).

Nevertheless, few suburban households, if any, could be fully self-sufficient in fruit and vegetables, let alone in other things like wheat, oats, and rice, as well as any number of other foodstuffs like salt, sugar, nuts, and milk. But producing as much as possible saves money, increases self-sufficiency, builds resilience, and as noted, reconnects people with the land and soil. Trainer's analysis, just noted, also highlights the importance of moving beyond merely "self-sufficiency" and working toward a "collective sufficiency" wherever possible. This would involve reclaiming under-utilized public land, especially roads and car parks and increased sharing of private land for food production (Laskovsky and Taylor 2017).

In terms of creating soil, the suburban composting toilet may also have a place in a degrowth economy, as households stop exporting nutrient rich waste in potable water and instead treat their own waste onsite. Michael Mobbs (2010) of Sydney is among the early adopters. A composting toilet helps close the nutrient cycle; it creates fertilizer for fruit trees; and minimizes or avoids the need to import fertilizers for the garden, saving money. Human waste needs to be respected for safety reasons but it need not be feared, as explained and scientifically justified by Joseph Jenkins (2005).

Home-based food production also offers a means of escaping the market, to some extent, thereby undermining the industrial food industry by withdrawing financial support for it, and redirecting that support, when necessary, toward local farmers markets (Norberg-Hodge 2019). Over time we can imagine food production crossing beyond household boundaries too, re-commoning public space, and this is in fact already underway as people reclaim nature strips for food production, plant fruit trees in the neighborhood, establish community gardens, and cultivate unused land through "guerrilla gardening." Decarbonizing food production generally means relocalizing production—shortening the space between production and consumption. Urban agriculturalists are not waiting, and should not wait, for governments to lead this transition (Holmgren 2018; Trainer, Malik, and Lenzen 2018).

Escaping the Market: Sharing, Gift, and the Urban Peasantry

We close this incomplete survey of energy descent resilience practices by highlighting the importance of sharing, gift, and home-based production, all of which have untapped prospects for decarbonization, dematerialization, and relocalization. These are topics that also highlight how degrowth and energy descent involve an upscaling of informal, non-monetary, and “post-capitalist” modes of economy, as well as increased economic localization (Albert 2004; De Young and Princen 2012; Gibson-Graham et al. 2013; Holmgren 2018).

By sharing more between households—facilitated by the internet or by traditional community engagement—less energy- and resource-intensive production needs to occur to meet society’s needs. Indeed, even in a contracting economy (whether contraction is by design or by crisis), households can still secure access to the tools and other things they need, provided a culture of sharing emerges. This is the revolutionary reinterpretation of “efficiency” implicit in the degrowth paradigm: produce less; share more; thrive. Nelson (2018) explores the potential of sharing land and housing as a promising means of overcoming some of the access barriers to this fundamental need.

On a similar note, degrowth also arguably implies an incremental re-emergence of the gift economy—to some extent, at least (Eisenstein 2011). If living standards are forever expected to rise, long working hours required to support that ongoing material advance will generally leave people “time poor,” making it difficult for people to gift their skills and resources in the spirit of community and neighborly support. By consuming less and carving out more time for practices outside the formal economy, downshifting also can also enliven the informal gift economy.

As this culture of decommodification emerges, it becomes increasingly self-supporting: one household is liberated from the market economy to some extent by practicing voluntary simplicity, allowing more time to gift skills and resources outside the market; but as other households do that too, the benefits and rewards of the gift economy return, reducing reliance on the market economy and making voluntary simplicity increasingly viable, which further supports the gift economy in a symbiotic loop of mutual support. Paradoxically, then, financial frugality enables generosity, solidarity, sharing, and redistribution (Gibson-Graham et al. 2013). Over time, a new economy could emerge from within the shell of the old economy.

Finally, degrowth and permaculture in the suburbs implies turning the household into a place of production, not merely consumption (Holmgren 2018; Alexander and Gleeson 2019; Trainer 2019). On this point, some inspiration can be found in the past. Mullins and Kynaston (2000) assessed what they call the “urban peasant thesis,” and their review of the evidence shows that up until the middle of the 20th century, Australian urban households had operated a highly developed subsistence-based, domestic economy. This included the production of foodstuffs in suburban backyards, but extended to the manufacture of other household goods, including clothes, furniture, and even owner-built housing. Thus, the dwelling and the yard were seen primarily in utilitarian, rather than aesthetic, terms. This “urban peasantry” declined, however, in the postwar boom, as the rise of mass consumer capitalism enabled households to purchase goods previously produced within the household. This suggests that any degrowth or energy descent future of reduced productive capacity in the formal economy may well see the re-emergence of an “urban peasantry” in this sense, albeit one shaped by different times and concerns.

Conclusion

Some of the practices, attitudes, and approaches reviewed in this article are not new, and draw from modes of living that homesteaders, eco-villagers, permaculturalists, hippies, and other counter-culturists have been doing for decades or more (Alexander and McLeod 2014). We contend that the wider urban application of these practices is well justified in the face of a contracting economy and declining access to cheap energy, even if still often marginalized by dominant energy and consumption cultures. The social scientific evidence we have presented and reviewed is emerging to support these earlier exploratory and radical sustainability and resilience practices.

There are also a few new and emerging features, like domestic biogas and peer-to-peer sharing, facilitated by the internet, whose cultural potential is highly promising but remains largely untapped. Most of the practices are also enabled by the suburban context, such as solar PV, biogas, food production, solar-oven use, and water collection, which would be impossible, difficult, impractical, or at least significantly different in higher density urban contexts that deserve separate analysis.

These household practices and values are not a panacea to today's problems, but it is likely that managing an energy descent future is going to require more suburbanites embracing them, albeit in context and in household-dependent ways. Granted, things like second-hand clothes, biogas, composting toilets, home-based production, and sharing offer a humbler vision of the future than the eco-modernist visions defended today (Bastani 2019). But we contend that our humbler vision is much more coherent when the challenges of climate change and peak oil are taken seriously and the limits of techno-optimism are understood (Hickel and Kallis 2019). "Greening" the supply of energy and resources is necessary but insufficient; high-impact, energy-intensive societies also need to radically reduce demand.

Promising and necessary though these practices of suburban downshifting are, things are not always or often as rosy or free from contradiction as they might first seem. We opened this article by acknowledging the deep structural obstacles of class, privilege, and property ownership that lie in the way of any degrowth transition. Although space has not permitted a "top down" political analysis of energy descent planning in the national and/or international domains, there are myriad policy options available to assist with this transition, such as greater government funding of renewable energy, a strong price on carbon to quickly phase out fossil fuels, the development of broader networks of bike lanes, and exploration of distributive options (within and between nations) to ensure equity in a contracting economy (Alexander and Gleeson 2019: Ch.7). Without diminishing the importance of a "top down" response, the regressive state of contemporary national and global politics prompted us to focus on the social or grassroots strategies available, which we hold up as the most promising spaces for transformative change in an age of widespread political paralysis.

We are also disconcertingly aware of how many of the efforts to transition beyond fossil fuels depend, to date at least, on the very fuels those efforts are trying to transcend, as well as the globally integrated supply chains that are enabled by fossil fuels (Alexander and Floyd 2018). Solar panels, biogas digesters, heat pumps, and bicycles are currently a product of fossil fuels, and the same goes for nails, screws, steel sheet, and windows, as well as all the commodities that make households function, from pots and cutlery, to furniture and musical instruments. Indeed, even households with vast net

surpluses of renewable energy production will, in the absence of expensive battery storage, still draw from and depend on the fossil energy grid at night to keep the fridge running and the lights on after dark.

These critical reflections should not be interpreted as undermining the strategy or importance of retrofitting suburban households in the manner and spirit outlined in this article. It only points to the complexity of the predicament. Existing suburbanites can and should get to work building new, low-energy forms of life within existing structures, and, as this article argues, there is a huge amount that could be done in that space. The household may not be the world economy, but changing the world will require changing the household. We contend that a resilient suburban future will embody many, if not all, of the values and practices reviewed.

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