DOCKETED	
Docket Number:	19-ERDD-01
Project Title:	Research Idea Exchange
TN #:	253352
Document Title:	Lawrence Berkeley National Lab Comments - The Imperative for Greater Sufficiency
Description:	N/A
Filer:	System
Organization:	Lawrence Berkeley National Lab
Submitter Role:	Public Agency
Submission Date:	11/28/2023 3:27:09 PM
Docketed Date:	11/28/2023

Comment Received From: Max
Submitted On: 11/28/2023
Docket Number: 19-ERDD-01

The Imperative for Greater Sufficiency

Please see attached PDF

Additional submitted attachment is included below.

Subject: Comment on the imperative for greater sufficiency

To: California Energy Commission

From: Max Wei (Mwei@LBL.gov), Tianzhen Hong, Jeetika Malik, Lawrence Berkeley National Lab

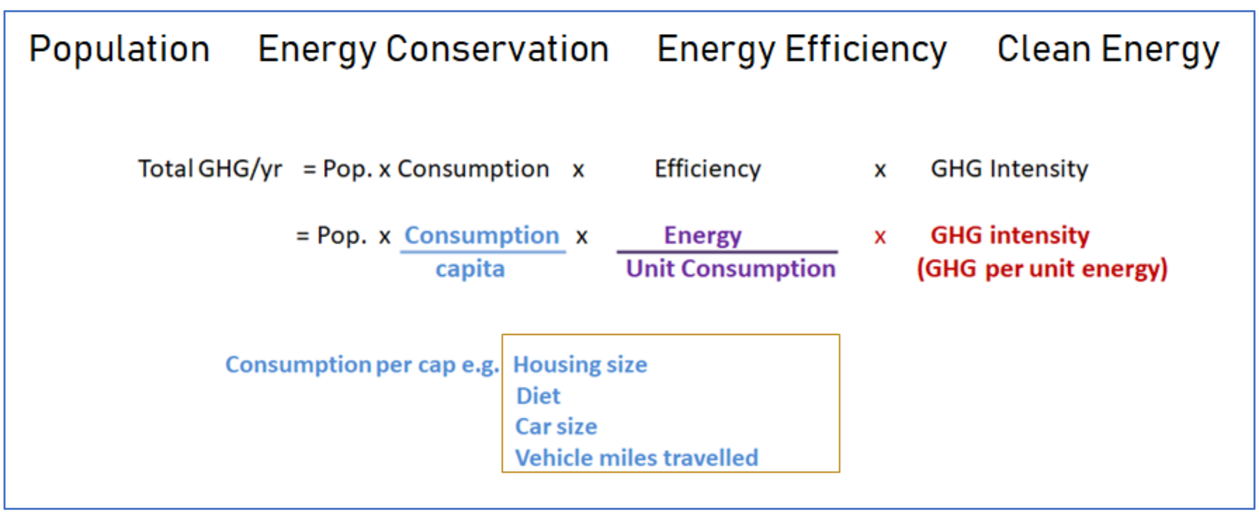
Date: 11/27/23

We thank the Air Resources Board and the Energy Commission for their support and development of leading-edge climate policies and their continued support for technology RDD&D.

At the same time, we encourage the Energy Commission and Air Resources Board to strongly consider adding sufficiency (or deep energy conservation) to their set of key approaches for sharply reducing GHG emissions. This recommendation is motivated for three critical reasons that are described further below: 1) risk mitigation to missing the state's climate targets by 2045 and mitigation of other key societal risks, 2) to enable greater equity and energy system resilience, and 3) for its focus on well-being while providing the best chance for a stable and livable planet.

We highlight that the scope for this is quite broad and includes many opportunities for innovation in technological innovation, policy innovation, as well as social innovation. Thus, through the state's EPIC R&D program and/or other programs, including sufficiency has the potential to unlock a new wave of innovation and entrepreneurship to benefit the state, provide greater consumer choices, improve affordability of key services like housing and mobility, and potentially improve overall quality of life.

BOX: ***WHAT IS SUFFICENCY?***



From a consumption inventory perspective, total annual GHG can be disaggregated into population, energy conservation, efficiency, and GHG intensity of energy supply. Energy conservation is the energy service per capita term which here is denoted as consumption per capita. For example, this could be housing size per capita, diet, car size or number of cars per capita, or VMT per capita. It could also be household measures such as the volume of refrigerator per capita or material consumption such as the kilograms of steel or aluminum per capita. Sufficiency can be defined as energy conservation to avoid *further breaching planetary boundaries while delivering human well-being. It's about using less stuff, less waste, and not wrecking the planet while maintaining our 21st Century way of life.*

Energy efficiency (EE) is typically a normalized term (Energy per unit consumption). Sufficiency works together with EE and clean energy. For example, EE delivers highly efficiency homes and appliances, and sufficiency, through "right-sized" homes and appliance consolidation, reduces overall lifetime GHG emissions. EE and clean energy alone are not enough. For example, residentials buildings have become much more energy efficient since 1975 but much of those gains have been offset by increasingly large home sizes. The planet doesn't care about relative energy savings, but only absolute GHG emissions.

INCREASING RISKS AND THE NEED FOR RISK MITIGATION

We believe that the 2022 scoping plan does not adequately consider the risks of not meeting the targets (and concomitant risk mitigation), climate tipping points, resilience imperatives to extreme weather, implementation/transitions risks, negative shocks to the natural and working lands carbon sink, and other exogenous shocks.

For example, the plan calls for 100 Mt of CCS by 2045 from near zero today (a ramp up in about 25 years to an emissions level that exceeds the entire industry sector GHG emissions today). Scaling up a new energy supply technology typically takes about seven decades, and large-scale energy transitions can take anywhere from 50 years to 200 years (biomass to coal; coal to electricity, etc.) at a country level. This plan is thus intrinsically very risky given all of the implementation and technology risks.

The scoping plan also shows an enormous range of possible outcomes for natural and working lands (NWL): NWL is projected to be a net source of emissions through 2045 with a reduction of carbon stock of up to 650 MMtC by 2045 (vs a baseline of 180 MMtC). Thus, there is a chance that NWL become a much larger source of emissions than the scoping plan scenario.

Other shocks are potential climate tipping points and exogenous shocks. Global average warming of 1.5 °C will reached as early as 2028 and there is increasing risk of climate tipping points above 1.5 °C and several tipping points may be breached already. Thus, there is an ever-growing risk to the earth leaving its previously stable climate system (Holocene Era) and these risks could shift the Earth into a much more extreme climate system. Exogenous shocks include acute energy or critical material supply disruptions as seen in the Ukraine war and past conflicts.

THE NEED FOR MUCH GREATER EQUITY AND RESILIENCE

Income inequality has grown sharply over the last 25 years in the state and wealthier Californians can have a carbon footprint that is many times that of low-income residents. By reducing the level of overconsumption at the high-income levels and providing better distribution of clean technologies, sufficiency efforts can improve equity. Sufficiency is also not just about reducing consumption among the wealthy but about reducing the amount of waste and throwaway items that can be found across income levels. Instead of single use goods and cheap throwaway items, there can be movement to longer lasting goods of higher quality, greater functionality and utilization, and greater repairability.

At the same time, extreme weather is becoming ever more frequent in the form of extreme heat, extreme storms, high winds, and flooding. Greater sufficiency means lower requirements for critical services and the energy system can be more resilient.

FOCUSING ON WELL BEING FOR ALL AND ENSURING A SAFE AND LIVABLE PLANET

High material wealth is not a guarantee of well-being. Our priority should not be solely about GDP growth but steady improvement in human well-being for all.

Given all of these risks and considerations, the state should take measures that it can to mitigate and minimize these risks while ensuring the well-being of its citizens. A movement to much greater energy conservation will provide multiple benefits:

- Provide **deep demand reduction**
- **Ease the broader decarbonization** effort
- **De-risk** future dependence on unproven technologies
- **Avoid disruptions** from forced sufficiency in the future
- **De-risk** future resource conflicts, and
- **Provide greater** resilience, equity, and well-being

Sufficiency, working in concert with energy efficiency and clean energy supplies gives us the best prospects for not further exceeding planetary boundaries and achieving greater equity and well-being for all. Adding sufficiency to our decarbonization portfolio will result in a more achievable, equitable, and resilient energy transition.

The potential of sufficiency for decarbonization has also been acknowledged in the recent Intergovernmental Panel on Climate Change (IPCC) report estimating the lack of sufficiency policies within residential sector accounted for 54% growth of the global emissions. While for the U.S. residential stock, a 44% emissions reduction potential is estimated from new housing due to sufficiency practices (decrease in dwelling sizes, high growth of multifamily housing) combined with higher electrification (Berrill et al., 2021).

EXAMPLE TECHNOLOGIES FOR GREATER SUFFICIENCY

Sufficiency is about living better with less stuff. And doing more with less is the **ultimate engineering and technical challenge**. We provide some examples below.

HOUSING: Multi-family (MF) housing for affordable housing is a key enabling area for greater sufficiency. Opportunities here include innovation for how to design lowest embodied and life-cycle carbon designs, how to retrofit or convert existing spaces to MF units efficiently and quickly and at much lower cost, e.g. commercial spaces to MF residential and/or large single-family units to multi-family units; and how to design and/or retro fit housing spaces to be flexible and multi-functional.

We also note the need for more data collection e.g., on accessory dwelling unit (ADUs) energy consumption, residential building benchmarking, and consumer preferences and willingness-to-adopt vs value propositions of greater affordability and/or resilience.

Building codes and standards are an area for updating for the 21st Century for example for increasing EE requirements for larger buildings or homes and/or capping energy and GHG consumption above a threshold e.g. > 2100ft^2 single family homes.

A specific example of sufficiency in resilience is the cool room concept for extreme heat waves. This is a concept that has the capability to switch to low power cooling mode during extreme heat waves to be more grid friendly but also give people the choice to shift to lower cost mode to provide sufficient cooling but also ride out an extreme heat wave.

TRANSPORTATION: Many land use and urban design concepts integrate the built environment and higher density with less passenger vehicle usage.

Other transportation examples include transit system designs for co-functionality e.g. as resilience hubs; extreme climate friendly "last mile" transit options, and AI/VR for virtual travel experiences.

NOTE: This comment reflects the opinions of its authors and not necessarily those of LBNL of the Department of Energy.

References:

- Malik J., Hong T., Wei M., Rotmann S.; "*Prioritize energy sufficiency for decarbonizing buildings*". Nature Human Behaviour, (2023): 1-5
- Berrill, P., Gillingham, K. T., & Hertwich, E. G. ; "Linking Housing Policy, Housing Typology, and Residential Energy Demand in the United States". *Environmental Science & Technology*, *55, no. 4 (2021): 2224-2233.*
- Hu, S., Zhou, X., Yan, D., Guo, F., Hong, T., & Jiang, Y. "A systematic review of building energy sufficiency towards energy and climate targets." *Renewable and Sustainable Energy Reviews* 181 (2023): 113316.
- Bertoldi, P. "Policies for energy conservation and sufficiency: Review of existing policies and recommendations for new and effective policies in OECD countries." *Energy and Buildings* 264 (2022): 112075.