

Buddhism, climate change, and new approaches to Energy for sustainable societies

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1. INTRO

It is a crucial time for nations to carefully assess and direct future energy use options. Rapid economic development and the need for massive fixed capital investments in supporting energy infrastructure require prudent decisions within a world with great uncertainties about the future viability of specific energy supplies. Such uncertainties range from physical and geopolitical scarcity to climate change policy. Even with substantial conservation and end-use efficiency, global energy use is likely to increase four-fold by the late 21st Century (GACGC, 2003).

Vietnam faces the same problem context as many nations – there is a strong need for rapid economic growth to bring material and quality of life benefits to the people but there is also a keen awareness of the wisdom of pursuing a low carbon economy development path. Hence, national strategies need to consider very significant and quite urgent

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decisions, not only about energy efficiency, but also about the design and creation of a production system and urban-industrial infrastructure that will have profound long-term implications for future sustained prosperity.

Energy use has an obvious role in helping to determine economic conditions (such as output capacity, productivity, competitiveness, and economic security). These material quality of life factors are instrumental for meeting key Millennium Development Goals (MDGs) such as the eradication of extreme hunger and poverty and the generation of productive and dignified employment. Energy also has clear and direct links to MDG environmental sustainability goals (affecting issues from climate change to biodiversity loss to access to safe drinking water) given its significance as a source of pollution and land use modification. However, energy is also a powerful enabler for many forms of social and economic change that can contribute to achieving other MDGs – for example, electricity access facilitating education, child mortality, and other health conditions, and information and technology transfer for global partnership for development goals.

Indeed, the notion of “sustainable” energy use is consistent with and supportive of the various MDGs which require the use of energy to help meet essential material needs in a way that does not deplete natural resources and their services required for the well-being of others now, and into the future (Tester et al., 2005). This is the notion of sustainable energy pursued here. Implementation of sustainable energy systems involves the sustained capability for energy use that maintains high levels of well-being including the full range of impacts and flow-on effects that influence economic, social and environmental conditions of people within a nation (and around the world). Such systems will have the long-term ability to effectively satisfy human needs in a true full “social cost” sense. Life cycle and full supply chain impacts would need to be assessed in the long-term ensuring constant levels of natural capital (and hence the ability for nature to continue to provide the vital services required for human well-being).

A shift to sustainable energy will inevitably involve not just technical

and environmental dimensions but a range of powerful sociocultural and political factors. Social and environmental aspects of sustainability are important as both targets and determinants.

There is little debate that current energy use is problematic and cannot be sustained to ensure long-term well-being gains for the majority of the world's people. Fossil carbon sources currently provide about 80% of world's energy (EIA, 2013) and remain the most available and affordable option for most nations; but this is contravened by a host of supply and demand-related adversities such as potential future supply (e.g. peak oil), geopolitical, and other restrictions on access, and long-term viability in terms of the policy responses to greenhouse gas (GHG) emission impacts. Arguably, fossil carbon has also created societies based on physical and technical systems that are highly dependent on massive throughput levels of "extreme" energy. They are highly interventionist systems that are difficult to maintain given their inertia and fixed nature requiring high societal "metabolism" levels of materials and energy. All energy options have own problematic side effects, but those of fossil carbon energy have reached troublesome levels.

Buddhism is well placed in terms of contributing to the assessment of what energy options are likely to be in humanity's long-term interest (represented by many of the MDG criteria). A central premise of this paper is that it provides a good basis for criteria for identifying and measuring "sustainable" energy use.

The main aim of this paper is to **outline the potential role for a Buddhist-perspective contribution to assessing and guiding sustainable energy use**. As we shall see, Buddhism can help in many areas. However, perhaps the primary contribution is that the practical wisdom imparted by Buddhist traditions helps provide a decision-making criterion logic and rationale amidst the formidable complexity related to assessing the costs and benefits of energy of different forms, technologies and applications. We propose that Buddhist practical wisdom has a simple and workable framework basis for doing so. It is in need of much development, but it is argued that the effort is worthwhile and the time is ripe. It is argued that the typical approach of financial

analysis (even augmented by market inclusion of “spillover” effects) cannot deliver in this regard.

In addition, the Buddhist worldview can inform the understanding required for assessing the functionality of the economy’s operation in relation to its true goals (with energy as a key component of this operation). Hence, it can help ensure the goal focus is highlighted and consistent. There is a key role for consistent empirical knowledge to evaluate the demands/desires pushing the economy (and its veracity with respect to anticipated well-being outcomes). *Kamma-vipaka* is a distinct theme throughout the discussion.

2. CURRENT APPROACHES FOR ASSESSING ENERGY OPTIONS

The state of play for assessing energy is a massive and indeterminate area. The process is often for major public projects or at least major energy options subject to significant regulation. Energy, itself, is a difficult concept with a plethora of nuances in measurement with a great deal of variation in aspects regarding its benefits in use (with different options and applications and exergy or availability for work).

The major typical decision-making process regarding the desirability of selecting whether to proceed with a project or to select from options, is based on the measurement and comparison of levelised revenue to levelised expenditures for initial capital costs, operating and maintenance costs, and fuel costs. Levelised energy costs are compared to the price at which electricity must be generated from a specific source to break even over the lifetime of a project (Tester et al., 2005). The primary guiding criterion is often to maximise net present worth utilising individual rates of return based on private costs and benefits (so that the return is greater than a minimum alternative rate of return such as that for treasury bonds).

When energy assessment is restricted to private costs and benefits, financial analysis is deployed to identify the monetary costs and benefits faced only by the party responsible for the project. Existing energy economic assessment approaches include net present value, internal rate

of return, payback, and debt-service-coverage ratio. Simple payback methods assess how long it takes to recoup the initial investment or expenditures (3-4 years is often adequate). Such approaches may or may not involve discounting. When discounting is used the net present value (NPV) of private benefits and costs is the key by assessing future income and cost streams. Life cycle costing is a major form of engineering economic assessment or project analysis. In this approach, all the costs are usually discounted and totalled to NPVs as a present day value.

However, given that decisions over major energy options usually have very significant and long-term implications for society, over and above the private economic agents directly involved, the assessment process broadens into program analysis in energy policy planning (with a much wider inclusion of stakeholders).

Hence, the next step in terms of more complete analysis is social cost-benefit analysis where social costs and benefits are assessed rather than simply private returns (Gorter and Just, 2010). Social costs and benefits include both private cost and benefits as well as effects known as “externalities”. Externalities are flow-on effects that affect people’s welfare but are not considered directly in a decision to use something (in production or consumption), which is typically based on the normal supply and demand factors that set price and resource use levels. They can also be seen as “off-book consequences”. They are costs (and benefits) incurred by society at large, often via changes in the natural environment, as opposed to the conventional project costs and revenues faced by the project developer. Ideally, they are evaluated on a life cycle basis. Examples of major sources of negative externalities from energy use include waste heat and urban heat island effects, electromagnetic radiation, noise, solid, liquid, gaseous effluents including indoor air pollution, resource depletion, especially for non-renewable sources, ionising radiation, aesthetics, indoor air pollution, military conflict and tension, community disruption, and urban sprawl. A detailed reference on externalities associated with energy can be found in Bickel and Friedrich (2005).

There is an increasing recognition of the significance of externalities associated with energy and the necessity for their inclusion in assessments of the net community economic welfare implications and sustainability of energy options for society (Markandya et al., 2010). Many externalities are also now typically included (or “internalised”) in the private assessment of energy projects given increased regulation, taxes, and legislation requiring environmental protection measures by energy developers (for example, cooling towers for Rankine styled electricity generators and stack-gas scrubbers for coal-fired power stations). That said, comprehensive and accurate accounting for externalities, and their monetisation via economic valuation techniques is problematic. Difficulties of externality quantification include synergistic effects, time scales, and unclear action-dose-response outcome amongst numerous other challenges. Economic valuation of externalities using techniques such as existing, surrogate, and hypothetical markets introduces a whole additions range of problems. There is abundant literature on these issues and it is not possible to survey them here.

However, the systematic attempt at identification and quantification (including valuation where possible) can be seen as preferable to neglecting such effects. The first step of externality analysis is to identify and measure the full flow-on impacts (biophysical and social) and link them to specific economic actions. It involves inter-disciplinary research from relevant biophysical and social sciences and provides valuable information for establishing the key economy/society-nature impact chains needed for effective sustainability strategies, over and above ongoing efforts at monetary valuation.

The externalities, or external benefits and costs, of different energy options varies greatly in accordance with their biophysical nature, the technologies of production and power generation and a range of qualitative factors such as recyclability, reliability, and the usefulness of the produced energy for specific processes and functions.

Alternatively, from a more technical point of view, energy use can be assessed by energy accounting approaches such as the “energy returned on energy invested” (EROI) measure. This approach evaluates energy

projects in the currency of energy itself and involves a life cycle comparison between energy input to a project for all phases (including construction, operation, fuelling, and decommissioning) and its net useful output of energy. The EORI concept also has many shortcomings in terms of being a sustainability indicator for decision-making. Major limitations include the lack of an intrinsic way to incorporate externality effects and the very substantial differences in the range and magnitude of social costs and benefits of different forms of energy that are bundled into a total energy measurement unit.

3. SUSTAINABLE ENERGY ANALYSIS – FOUNDATIONS FROM A BUDDHIST-INSPIRED PERSPECTIVE

There is widespread and growing acceptance of the need for externality analysis and systems approaches for assessing sustainable resource use – especially for the pervasive and far-reaching core influence of extensive energy systems.

However, we begin our main discussion from the position that social cost-benefit analysis and simple energy accounting approaches such as EROI are, alone, inadequate to the task for effective energy economic decision-making (Stiglitz et al., 2010).

To show how Buddhism can integrate and enhance contemporary sustainability assessment approaches and provide a more effective decision-making guide, we build upon one of its prime problem-solving frameworks – the DPSIR approach.

The DPSIR framework, developed by the European Environmental Agency, takes an interdisciplinary and systems analysis view. Environmental issue themes are typically analysed as a series of separate steps (D-P-S-I-R). For example, climate change may be analysed as economic activities (and underlying social factors) forming the driving forces (D) that exert material and energy flows (GHG emissions) and other pressures on the environment (P). In turn, these generate changes in the state of the environment (e.g. changes in greenhouse gas atmospheric concentrations; changes in average temperatures) that lead to impacts

on society (e.g. loss of agricultural output; flooding impacts). These unintended impacts (often externalities) may elicit societal responses (R) via policy and other action to modify the initiating driving forces (or, more superficially, alter pressure and state conditions). Externalities figure prominently in the DPSIR framework, as they comprise many of the key linkages in the $D \Rightarrow P \Rightarrow S \Rightarrow I$ relation. Appropriate responses to ameliorate environmental, social and economic externalities are covered in the “responses” (R) part of the framework.

The DPSIR model has been adopted by the majority of the European Community nations as the best way to structure environmental information concerning specific environmental problems so as to reveal existing causes, consequences, effective responses and trends and the dynamic relationships between these components (Pillman, 2002). Because the DPSIR model does not have a very systematic approach to its analysis of driving forces, we have combined it with an extended version of the famous IPAT equation used to break down environmental impact pressures (I) into key sources such as population, affluence (level of output) and the environment-intensity of that output.

However, in the simple IPAT equation, neither T nor A, help us with perhaps the most important and useful information for scientific understanding and strategic responses to specific environmental problems. It is critical to know and measure (1) the nature and composition of consumption or production within the overall output bundle and, (2) the environmental impact associated with the production and consumption per unit (often per \$) of each specific type of economic activity, or good or service. Hence, we disaggregate the “technology” (T) part of the original IPAT equation into:

- N the nature, or pattern, of consumption and production, and,
- T the technology-environment relation for each specific type of production or consumption.

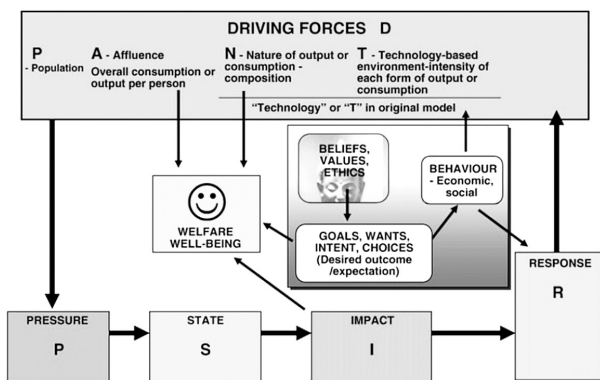
There are at least three dimensions to the Buddhist contribution to enhance the DPSIR framework as a device to guide sustainability assessment of energy and other significant natural resource management

issues. One important aspect, discussed in some detail soon, builds upon the strong connection between externalities and Buddhist notions of inter-connectedness and knowledge of *kamma-vipaka*.

However, we argue that there are 2 other aspects from Buddhism that enrich the potential utility of the DPSIR analytical framework and its capacity as effective analytical basis for helping to achieve sustainable energy scenarios for future economies.

Firstly, the Buddhist worldview would involve the incorporation of values, beliefs and ethical dimensions into the DPSIR framework. It is their influence as driving forces behind the behavioural outcomes (and collectively, social and economic developments) that generate the environmental pressures behind climate change. Furthermore, we need to identify how the DPSIR links to actual societal objectives – typically targeting net gains in well-being. Important influences on well-being are depicted as the traditional, if contentious, link to overall affluence (GDP per capita), as well as welfare impacts of (1) the nature and level of specific types of consumption, (2) environmental quality, and finally, (3) from the nature of goals, wants and expectations about life and activity outcomes. The addition of these two key aspects (beliefs and values, and the major links to true well-being) is fundamental for a Buddhist-inspired perspective, and they have been added to the basic DPSIR model in Figure 1. We cannot explore the extensive links between theories of economic welfare and Buddhist release from suffering here.

However, this extension to include the motives and influences upon well-being provides a much more complete basis for the effective



assessment of sustainable energy options.

Figure 1 An Extended Framework for Sustainability Assessment – Blending Buddhist Insights with the DPSIR Approach

The notion of pervasive interdependence is fundamental for full impact (externality) analysis and Buddhism and both seek their analysis and solutions in the understanding of this web of relations. In Buddhism, the law of dependent origination explains how all outcomes, results or effects (*vipaka*) of speech, action or body arise from multiple causes or actions with intent (*kamma*). In turn, these causes arise from other *vipaka* and phenomena cease when the pre-conditions change. This is basis of the law of *kamma-vipaka* which adds the qualitative aspects by identifying how ignorant action with “unskillful” or bad intent will lead to adverse results across the three realms (society, nature and back on self). “Skillfulness” is gauged by the extent to which craving, greed, delusions or aversion are embodied in the underlying motive and intent of the original action (Attwood 2003).

For both Buddhism and sustainability analysis, these shared notions invoke the importance of understanding and careful reflection upon the full, long-term consequences of (and in Buddhism, the intent behind) economic and other human actions. This observation is a fundamental aspect of most relevant synergies between Buddhism and sustainability.

Related to the 2nd Noble Truth, pervasive interdependence and dependent origination are major Buddhist principles that help explain the fundamental roots of the unsustainability from energy use. In the Buddhist world view, there is a universal “ecology” and symbiosis, or a web of cause-effect relations between all universal phenomena. Intervention from an original source that is “unskillful”, or causes harm or violence, will emanate out through the web of existence and return to negatively impact the source (Yeh, 2006). In this sense, the “welfare” of all phenomena outside an individual directly affects their own welfare. Self-interest becomes consistent with unselfishness. Compassion, wisdom, and loving-kindness become the rational directive and logical ethic for choices and behaviour and apply across the full gamut of people’s social relationships, and the relationships between themselves

and nature (Batchelor and Brown, 1992).

Given the primacy of interdependence, it becomes critical to carefully examine the means and implications involved in the pursuit of gains in well being. If the process involves high levels of intervention and disturbance from the initiating source (a characteristic of fossil fuel dependence), then the web of cause-effect relations between the three realms will have unintended negative consequences for the well-being of the instigators. This is apparent with the troubling climate change, infrastructural vulnerability, and political conflict that is now confronting the current carbon-based world economy. Such sensitive interdependence portends the inherent wisdom of the Buddhist advocacy of the “Middle Way” with its careful focus upon moderation and meeting true well-being needs with minimal and non-violent intervention.

Together, the Four Noble Truths and interconnected nature of reality provide a key insight. The realization is that maximization of affluence and output derived from economic activity types (N) with high levels of social and natural environmental impact (T) will fail to close the desire-want $\Leftrightarrow$ satisfaction gap. Furthermore, these behaviours will have additional negative welfare effects upon humans via the impact (I) factor in the DPSIR model. Similarly, discontent will be exacerbated by a value system where goals and expectations are incorrectly predicated on the idea that well-being is a function of increasing consumption.

Unfortunately, fossil fuel-based consumer economies have all of these characteristics. In Buddhism, human-induced material, energy and waste flows are disturbances in the karmic cause-effect web and their neglect in assessing the consequences of choice and levels of economic activity will jeopardize intended welfare outcomes.

4. A KAMMA-VIPAKA ASSESSMENT OF SUSTAINABLE ENERGY

The assessment of the sustainability of energy use has had little in the way of tangible guidelines in the past. Here, we propose the plausibility of an effective criteria for sustainability assessment of this critical domain of human action, in the form of a “*kamma-vipaka*” index.

Drawing upon the Buddhist world view and the goal of harmonising energy use in terms of its impact of the external world, this sustainability assessment criterion would be intended to effectively identify minimum intervention or disturbance levels as indicators of the net well-being effects of energy options. The aim is to search for options (and related technologies and patterns of use) with the lowest overall lifetime costs (including supply chain and extended flow-on effects) or least-harm option (perhaps per unit of well-being). This requires knowledge of how the energy application is contributing directly to well-being in the provision of goods and services. A focus upon total energy use in delivering well-being (rather than just unit useful energy) makes such an approach amenable to consumption efficiency and a re-examination of the consumption - well-being nexus.

The complex and unpredictable nature of externality impacts in the action => dose => response relation (D-P-S-I), and hence the high level of uncertainty regarding impacts, provides a strong rationale for a simple metric such as the minimisation of disturbance. As discussed, synergistic effects, locational shifts, confounding influences and the long-term nature of possible effects generates almost intractable complexity regarding biophysical, social and monetary flow-on externalities. Hence, the practical wisdom and basic minimum intervention rule of a Buddhist perspective may well provide a fruitful alternative to inform decision-making regarding energy-related types, technologies, use levels and consumption and production mixes.

The notion of practical wisdom has many meanings but it is deployed here as *phronesis*. This is typically seen to be the virtuous capability to effectively (“wisely”) evaluate or judge both “good” outcomes (“better lives”) and how they can be reached. Its unique essence in integrating practice and principle, however, comes from the combination of several features:

- (1) The decision process is not one of exact cause-effect calculations and universal laws but is deliberative
- (2) And is strongly guided by moral dimensions requiring values and ethics to assess the outcomes (and arguably the means)

(3) And involves interpretive and prudent judgements appropriate to complexity and uncertainty, and unique contexts that require

(4) Critical analytical reflection and consideration of epistemic knowledge systems, the social and technical practices, and action effects

(Kinsella 2012; Schram 2012)

This description is similar to Billsberry and Blink's (2010, p.173) where practical wisdom "refers to pragmatic, context-dependent and ethics-oriented knowledge focused on value-based judgments".

Practical wisdom involves evaluation of practical action types, means and levels with prudence, or full concern or caution for the moral or social (and related environmental) repercussions for the common good (benefiting society collectively, rather than simply the private individuals involved directly in the action being studied) (Lenssen et al 2012). Reflecting the interconnectedness emphasis of Buddhism and the full consideration of externalities in sustainability analysis, this view of practical wisdom highlights that concern for the consequences upon the well-being of others is vital for one's own well.

While technical know-how, universal laws, and narrow instrumental and cognitive mechanisms are not central, the concept of practical wisdom is generally concordant with the valuable role of using context-based experience, history, and knowledge for wise judgements.

The phronetic approach has clear relevance to the complex ecological web of human-nature relations as we cannot expect to know how exactly how the parts are connected and the full effects of energy-related decisions.

Given profound interconnectedness and related concepts of interdependent well-being, both Buddhism and full impact sustainability analysis share the conclusion that judgements about the "goodness" of possible actions are inevitably fraught with complexity and uncertainty and the best approach is to follow a simple rule – *minimise intervention in (or "disruption", "harm" or "violence" to) the social and natural worlds*. In the new sustainability analysis approaches (such as the SEMM techniques), this is manifest as the

minimisation of society's biophysical throughput or metabolism, and other negative externality effects that flow on in cause-effect chains across space and time.

Hence, a *kamma-vipaka* approach to sustainable energy helps emphasise and encourage research and development for national strategic policy regarding energy and other key environmental resources and would provide useful insights in combination with related sustainability analysis techniques to create less harmful, more gentle, economic systems. Promotion of clean energy sources and "green techno-economic paradigms" focusing on material and energy saving via information and communication technologies would fit well with this approach.

Despite a strong empirical component, the Buddhist path primarily relies on metaphysical explanations that still face significant scepticism in the positivist science and economic analysis frameworks that guide so many decisions in the global market economy. In its teachings, Buddhism has a marked empirical aspect in its belief in developing experiential understanding of the nature of karmic action and result (Kalupahana 1976).

There are a range of relatively new techniques from sustainability sciences that offer a highly compatible approach and knowledge base to help substantiate the practical wisdom guidance implicit in Buddhist principles for action such as minimum intervention, moderation, non-harm, compassion (*karuna*), and loving-kindness(*metta*), and sympathetic joy (*mudita*).

Indeed, there has been a strong growth in organic, holistic views of the human-nature relation and the need to "ecologize" economic systems. One of the most recent and comprehensive incarnations of this integrated, synthetic framework is the theoretical, empirical and policy utility attached to the depiction of the operation of the society and its economy in terms of a "metabolism". The socioeconomic metabolism consists of a network or "circulation" of physical flows of materials and energy (inputs and waste output) between nature and the economy,

and the transformations and accumulations of these flows for human production and consumption within the economy.

These techniques include the related tools such as life cycle assessment, material and energy flow analysis, ecological footprints and environmental input-output tables (see Daniels and Moore (2001), Daniels (2002) and Wiedman et al., (2011)).¹ These tools are growing rapidly in terms of application, sophistication, global and impact coverage, and methodological integration. Essentially, the ‘socioeconomic metabolism mapping’ or SEMM methods share a goal of measuring and “mapping” the resource and other biophysical flows, and often social impact effects, of consumption and production. The economy is a complex and highly inter-related entity; and specific goods, services, sectors, and other economic activity cannot be considered in isolation. A basic premise is that every action leads to a complex set of “ripples” through the (increasingly global) economy leading to impacts well beyond its original limited spatial and temporal domain. The parallels between the measurement of externality impacts, and knowledge and care for the law of *kamma-vipaka*, are obvious and clear.

Each SEMM approach has its own emphasis. For example, the Eurostat version of material flow analysis focuses upon society’s “disruption” levels in terms of flows (in mass units) of bulk materials such as biomass, energy minerals, and water. However, they all share a strong interest in system level analysis and assessing the full sustainability impacts of socioeconomic driving forces (such as the level and type of production and consumption (i.e. A.N in the IPANT equation)).

Buddhist-inspired economies and the suite of sustainability tools aimed at analysing and reducing society’s metabolism share similar bases in terms of their perception of the relationship between humans, society and nature/the universe. A central theme is interconnectedness

1. Other examples of the general SEMM tools and indicators include substance flow analysis, total material requirements, environmental space, the sustainable process index, material intensity per unit service, physical input-output tables, and enterprise or company level eco-balances.

and the concomitant role of external effects beyond the initiating or transacting parties. It substantiates the need for people to “internalize” their actions so that their market and non-market behaviour and choices take into full account the extended influence of their intent and actions on the three interwoven spheres of human existence (their individual selves, the community and the natural world).

Typically, many of the SEMMS focus upon externalities linked to biophysical economy flow measurement across

(a) all stages of the energy life cycle – exploration, production and harvesting, preparation, transport and storage, further processing, purification; utilization; recovery, waste and decontamination and by-product storage, as well as

(b) full supply chain externality impacts of material and energy flows from each life cycle stage

However, there is, of course, a substantive need to include socioeconomic impacts and techniques such as environmental input-output analysis and life cycle assessment hold this capability.

In summary, the SEMM techniques provide one very useful knowledge base – a context-specific episteme – about the likely nature and magnitude of action-effect and flow-on effects through the economy, society and nature (paralleled in the generalised view of Buddhism and *kamma-vipaka* flows through self, society and the universe). Hence, the SEMM approaches can help operationalize the practical wisdom that Buddhism offers for effective sustainable energy analysis.

There are numerous indicators of externality or karmic impacts. The critical issue for a Buddhist-inspired approach to the assessment of sustainable energy use is to identify a limited range of indicators that effectively represent the level of intervention or harm associated with alternate options. Ideally, the result should be a “master” proxy or general “*kamma-vipaka*” indicator that correlates closely with a wide range of socioeconomic metabolism and other sustainability impact indicators.

Some of the best potential candidates for future research as

kamma-vipaka sustainability indicators include:

- land disturbance measures and related ecological footprint measures (especially when enhanced with global multi-regional environmental input-output analysis)
- some variation or composite of the EROI energy accounting measure that also includes energy demands and other impacts of energy quality, and associated externalities
 - total energy or low entropy loss incorporating all impacts,
 - total energy per unit GDP or value-added (given its weaknesses and need to better address GDP as a measure of well-being)
- multi-criteria analysis based on a detailed set of sustainability impact indicators
 - material and energy flow measures (for example, total material requirements (in mass terms) in Eurostat approaches)
 - LCA-styled normalisation measures (that show relative contribution to an environmental problem themes and contributions of specific functional units to the sum of all broader regional or global impacts)

5. CONCLUSION

In order to effectively assess sustainable energy options it is critical to consider and integrate social, economic and environmental concerns and their links to well being in a highly inter-connected universe. Most existing efficiency criteria for assessing energy use are inadequate. The Buddhist world and the complementary socioeconomic metabolism mapping (SEMMs) techniques introduced in this paper provide a potential means for more valid basis for “sustainable” energy decision-making. It is not a simple task given the intrinsic complexity and uncertainty associated with the implications of energy use. Nonetheless, it is argued that it should be possible, drawing upon Buddhist wisdom, that a fairly direct measure will emerge – a measure based on intervention or disturbance levels.

There is no simple approach to formulating how to maintain the energy benefits of natural resources into the future whilst avoiding

severe side effects. There are numerous possibilities and appropriate solutions will change over time and with sociocultural, economic, and technological contexts. What is certain is that all technology and policy options will have their trade-offs. The key to making good decisions regarding the sustainability of options is a solid understanding of the totality of impacts upon the interconnected realms of self, society and nature. In this paper, our aim has been to advance this potential with the promising synergy of related ideas and tools that derive from Buddhist practical wisdom and socioeconomic metabolism concepts. This attempt has utilised an enhanced version of the powerful DPSIR sustainability framework that has been augmented by a consideration of well-being inherent in the Buddhist world view. The thesis is exploratory in nature, and in need of much more development – especially in the derivation of a useful proxy or general indicator(s) that can reflect the criteria that emerge from the synthesis of Buddhism and sustainability analysis.

We have not prescribed exactly how non-harm or minimum intervention might be measured as a composite of sustainability impacts. This will require considerable further research and development. An expedient goal would be to investigate and identify clear correlates or proxy indicators that act as good predictors of harm or disturbance levels. Such indicators are likely to have a close association with Millennium Development Goal outcome indicators. Good potential candidates for ongoing analysis would include (a) GHG emissions (with its plethora of climate-related and other external costs) (b) land disturbance measures and related ecological footprint measures (especially when enhanced with global multi-regional environmental input-output analysis) (c) some variation of the EROI energy accounting measure that also includes energy and other impacts of energy quality, and externalities (d) total energy or low entropy loss incorporating all impacts, and (e) total energy per unit GDP or value-added (given its weaknesses and need to better address GDP as a measure of well-being).

An appropriate energy returned to energy invested (EORI) measure must

include extraction, infrastructure, processing, transmission, and reliability concerns as well as energy expenditure regarding flow-on effects that need to be ameliorated or prevented. Improved measures will need to incorporate the special nature of permanent losses of non-renewable aspects, equity consequences, and differences in applicability of energy.

The combined Buddhist and SEMM approach can investigate total “karmic” impact indicators to help:

- assess the optimality of energy source choice options and hence mixes (energy sources are also variously described as fuel sources, primary energy sources, energy supplies (technologies)). Note that impacts can vary a great deal within types given quality, technologies and so forth.
- identify the urgency of efficiency improvements, and which energy forms and sectors to focus upon
 - assess the sustainability of source-specific technologies
 - provide information for other policy to reduce energy use
 - (with SEMMs) identify the major sources of undesired impact during a process or product life cycle and hence how best minimise intervention/disturbance dynamically with technology, production, and consumption changes.

When the Buddhist world view is integrated into the assessment of energy use, sustainability is not simply a case of reducing externalities, or enhancing efficiency through technology change. The nature and level of consumption (A.N in the drivers of the economy), and its relationship to well-being and quality of life, are re-examined in the light of the Four Noble Truths. Of course, the nature and level of consumption have a huge potential impact on the demand and use of energy, and become fundamental factors for reshaping the economy and society in general, towards more sustainable future energy scenarios. Hence, including (1) beliefs and values as major underlying influences behind driving forces and (2) new ideas about the effect of consumption and environmental impacts on well-being, provide rich new insights for assessing sustainability.

For example, the Buddhist world view would highlight that non-consumptive activities can increase wellbeing while action guided by endless craving and selfish material attachment will lead to further suffering rather than happiness. In specific regard to the natural environment, this change in belief, attitude and motive should have a beneficial impact by minimizing, or at least moderating and managing consumption so that material and energy throughput (and hence, environmental exploitation) is substantially reduced. Awareness of the karmic spillovers of material and energy consumption would act to decrease the overall scale of material output consumed as well as instigating fundamental changes in the nature or composition of economic output.

in the consumption mix would be linked to shifts in preferences favouring non-interventionist, low environment-intensity goods (for example, away from meat consumption and fossil fuels) and a structural shift toward spiritual development and other human activities that do not rely on significant material and energy throughput (for example, meditation, education and meaningful communication and a host of other positive development slinked to social sustainability).

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