

Energy Sector Management Assistance Program (ESMAP)

Efficient Clean Cooking and Heating (ECCH) Program

Analysis of transition pathways for modern energy cooking services (MECS).
A systematic map protocol.

Stakeholder engagement

Following good practice for systematic reviews (Haddaway et al 2017), two workshops were held to engage relevant stakeholders in the systematic map. The first Stakeholder meeting was held at Loughborough University on 30th October 2019. It comprised mostly academics with expertise in modern energy cooking systems, transitional pathways and theories of change. Many of the people at this meeting are involved in the umbrella MECS programme. This meeting discussed the complexities of modern energy uptake. After consulting with this group a targeted primary research question was developed to frame the scope of this systematic review.

To frame the question, interdisciplinary dynamics were considered, including: energy pathways, transitions, urbanisation, globalisation, economics, the environment, technologies, geographies and political economy. The resulting discussion led to the formation of a working title for the systematic review:

“What factors are critical to achieve a large-scale transition towards sustained use of modern energy with particular reference to cooking in LMICs?”

The discussions highlighted the significant differences of opinion, and shades of interpretation within the energy sector, from considerations of the World Bank’s multi-tier framework, to considerations of what is defined as clean cooking (electricity, gas and pellets), to the notion that energy transitions are not necessarily linear and the idea of an ‘energy ladder’ was not always helpful.

There was considerable agreement that the review should take account of technology transitions in other sectors that might help inform decision-making for the cooking sector. It was acknowledged that this could potentially open up a very large body of knowledge – essentially any movement from an older to a newer technology from post-industrial times. Assessing whether studies about these transitions would be of relevance to cooking would be difficult to ascertain from Title and Abstract only. This stage is central to the process of screening for inclusion in a manageable fashion that defines the systematic review method – the impossibility of considering all potentially relevant papers at full-text is accepted. Further, the group agreed that studies from all countries should be considered, not simply studies from LMICs, since insights into drivers of change could be taken from one context to another. The review will analyse evidence FOR LMICs, but draw on evidence from everywhere. Again, this will result in a very large set of studies to assess and the review team will have to take account of stakeholder input, but make a practical decision in order to complete the review on time and to budget.

Helping to narrow the review, was the decision of the group to look at ‘large-scale’ programmes/interventions whose objective was to drive technology transition. A large set of concepts and keywords defining large-scale were generated in the meeting. There were discussions about geographical entities (towns, regions, etc.) vs areas with high population density that may not be defined as an entity. There was acknowledgement that this would be difficult to assess by a screening process, but that the interactive systematic map could include a layer showing population densities. This was an interesting idea that stimulated thinking about other meaningful layers – access to clean energy, access to electricity, etc. that might be included.

The second stakeholder meeting was held in Nairobi on the 8th November 2019, following the Clean Cooking Forum 2019, to engage with mainly policy makers, NGOs and businesses. The preliminary question developed at Loughborough was scrutinised by this second group with broad agreement that it represented the aim of the project.

Further development of search strategies and terminology to include in database searching was developed to provide the review team with a comprehensive list of search terms and inclusion criteria. The meeting provided a list of over 100 terms to include in the database Boolean search strategy. (Lists of keyword terms are included in Annex 1).

Concerns surrounding search terms relating to scale were raised with the thought that their inclusion would limit literature return. The discussion raised the point that studies of individual households are themselves almost always part of large-scale interventions or programmes, and the team reassured participants that the inclusion strategy would ensure that such studies are included. The review would not, however, include pilot studies of individual households, nor studies that gathered data on energy use in households as part of a wider survey into, e.g. poverty, which was not part of a large-scale programme of energy transition.

Similarly, the discussion on how to define ‘sustainable’ was rich, with concerns raised about whether insisting on its inclusion in the search string would exclude potentially important studies. The response of the review team was to suggest that we would infer sustainability from the length of time measurements were made (outcomes) after the programme (intervention) started. Data in the systematic map could be filtered with this time criterion (an example was shown of the systematic mapping tool that allows for such filtering (see <https://oxlcl.github.io/evidencemaps/>).

Initial scoping studies undertaken by the review team using all terms suggested by the two meetings returned well in excess of 300,000 records across 4 bibliographic databases (CABI, Web of Science, SCOPUS and ScienceDirect). Initial random-sample analysis of this dataset indicated a large number of irrelevant literature. The search strategy was refined to remove many of the terms collected from the search string and incorporate them as inclusion criteria or outcomes from the included studies represented in the codified data extraction sheet.

Both stakeholder meetings suggested a very comprehensive list of potential sources of studies, including organizations, networks and communities of interest which published or archived relevant evidence. These are listed in Annex 2; all organisations with contact emails will be contacted to request grey literature

Objective of the review

Primary question

“What factors are critical to achieve a large-scale transition towards sustained use of modern energy with particular reference to cooking in Low- and Middle-Income Countries?”

Sub-questions

“What are the drivers of and barriers to large-scale transition towards sustained use of modern energy cooking services?”

“What are the drivers of and barriers to large-scale, sustained transition to modern cooking energy in Low- and Middle-Income Countries?”

“What factors have been considered critical to large-scale, sustained technology transitions in selected sectors (sanitation, telecommunications, clean water) that may provide insights for modern energy cooking transitions in Low- and Middle-Income Countries?”

It should be noted that the third sub-question is not intended to be as comprehensive as the other two, rather the aim is to retrieve studies that could provide insights from large-scale programmes that may be useful in developing strategies for modern energy transitions. This is reflected in the broader set of search terms for the selected three sectors. Similarly, the decision to limit sub-question two to LMICs was taken after consideration that there is a huge literature on transitions to electricity in European and North American countries, which is not the main focus of the current review. In this case, the search will not be adjusted, but the selection process will ensure that no-LMIC electricity transitions are not included.

Definition of the question

large-scale - (national, sub-national, regional, state, district, city, town, area of high population density)

Using the well-established PICO framework, the following elements were derived:

- Population: Users at a large-scale level that have experienced a technology transition from a baseline/traditional level, or been exposed to a programme promoting a transition
- Intervention: a technology programme or intervention implemented at scale
- Counterfactual: in a review of drivers/barriers there may be few studies that consider a control group who were not exposed to the intervention. This element will not be a necessary precondition for included studies, but will be recorded if present in the study design and analysed separately.
- Outcomes: data reporting uptake of the technology (in numbers of people or density of uptake) and information on factors driving or inhibiting uptake

Methods

Searches

Bibliographic databases

Clarivate Analytics Web of Science™ Core Collection <http://apps.webofknowledge.com/>.

Elsevier's SCOPUS <http://www.elsevier.com/online-tools/scopus>.

CAB Abstracts - CAB Abstracts: (<http://www.ovid.com/site/catalog/databases/31.jsp>)

Grey literature sources

Google

Google scholar

Websites of organizations and networks listed in Annex 2

Search string

A number of search strings for closely-related systematic reviews were examined as a starting point.

Puzzolo et al (2013) used keywords grouped into stove and fuel type and uptake:

((cook* AND (fuel* OR technol*) OR (stove OR cookstove OR cook-stove OR woodstove OR wood-stove OR LPG OR "LP Gas" OR "Liquid petroleum gas" OR "Liquefied petroleum gas" OR Biogas OR Biodigester OR Bio-digester OR Ethanol OR Solar OR "Clean fuel" OR "Modern fuel")) AND (Accept* OR Adopt* OR Deliver* OR Dissemin* OR Implement* OR Scale OR "Scal* up" OR "Roll* out" OR "Tak* up" OR Uptake).

While this search was successful for a focus on cleaner and more efficient household energy technologies, it did not encapsulate the broader aims of the current review. Time was spent at both stakeholder meetings examining possible keywords and concepts to incorporate into a robust search string.

Tests of these search strings were carried out to test the feasibility of including all keywords suggested at the meetings to achieve a balance of accuracy and precision. Tests of strings of terms are reported in full in Annex 3, together with the number of articles retrieved. Good practice in systematic reviewing tests possible search strings against a set of documents known to be of direct relevance to the review question. The set of documents used to test comprehensiveness of the search is in Annex 1.

A further important consideration in creating a search string was to take account of the practical considerations of time and resources for the review.. To assess what would be practical in a review with the time and resources available, use was made of the systematic review tool PredicTER¹ (Haddaway & Westgate 2019). The tool uses algorithms derived from real experiences of different systematic review teams working in environmental science (and related fields) to estimate time taken for different stages of a review based on the number of articles retrieved from searches, and a number of other factors. PredicTER estimated that within the time allocated for the project, no more than 11000 records retrieved from searches could be processed by the team. The first search run using keywords suggested in the first workshop yielded 159,881 in one database alone (Scopus) – see Annex 3.

¹ <https://predicter.org/>

A revised version capturing the main concepts from both meetings, yielded 65,000 records in Scopus.

(initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR cooking OR ((cook* OR stove) AND (fuel OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas")) OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*)) AND ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale).

The tool predicted that it would take on average 456 days for review completion, and is therefore not practical within the time constraints of the project.

Drawing on Lewis & Pattanyak (2013), who introduced a filter based on analysis method (regression and statistics):

keywords were grouped into fuel and choice and scale AND analytical method - ("cookstove," "biomass," "fuelwood," "fuel wood," "firewood," "biogas," "electricity," "solar power," "photovoltaic," "renewable," "charcoal," "energy," "energy ladder") AND ("choice," "choos*," "switch*," "adoption," "dissemination," "uptake") AND ("household," "residential," "domestic") AND ("regression," "statistics")

and departing from Puzzolo's general format which did not add such a filter to her search strategy, the review team explored adding an appropriate filter 'barriers and drivers' to the search string.

This, achieved a result that fell within reasonable boundaries of what numbers of articles could be practically processed during the very short duration of the project (by comparison with most systematic reviews and systematic maps, which can routinely take over 12 months to complete).

The following search string also took account of feedback received from Advisory Group members in earlier drafts of the Protocol. The majority of test papers were retrieved using the search string. It was recognised by the team that particular effort would need to be spent on hand-searching (or 'snowballing') references in related systematic reviews and literature reviews, and from reports received after requests for grey literature.

(barrier OR driver OR constraint) AND (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR cooking OR ((cook* OR stove OR cookstove OR cook-stove OR woodstove OR woodstove) AND (fuel OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas" OR Biogas OR Biodigester OR Bio-digester OR Solar)) OR electrification OR "clean energy" OR "cleaner energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*)) AND ("pathways to change"

OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale))

It should be noted that suggested replacement of the original term ‘clean cooking’ by ‘cooking’, to take account of advice that there was a danger of missing studies on ‘cleaner cooking’ added 7 additional articles, addition of the term ‘village’ added 3 articles, and addition of a set of fuel terms (biogas OR biodigester OR bio-digester OR solar) added no additional articles. However, addition of the term ‘project’ added 446 articles and the term ‘constraint’ added 1792 articles. This represents a large additional screening burden, but will make the search more complete.

The string was adapted to each of the major bibliographic databases, and a simplified version used for Science Direct, Google and Google Scholar searches and for organizational websites, which do not support long, complex Boolean logic

Article screening

Screening strategy

Bibliographic information of articles retrieved from the searches will be downloaded to EndNote reference management tool and duplicates removed. The set of articles will be uploaded into Colandr, an open-source tool created to incorporate computer assistance for screening and metadata extraction. The machine-learning capability of the screening tool reduces time spent on screening considerably. Literature retrieved will be screened sequentially for relevance at the (1) title, (2) abstract and (3) full text. After title and abstract screening stages, reviewers will download the accepted articles for full text screening. Reasons for not including articles at full-text will be reported (based on PICO framework – e.g. article rejected because Population was wrong, or article rejected because no Outcomes were reported. At this stage of the process, studies are not included or excluded on the basis of quality of research design or analytical robustness; these are assessed during data extraction (see below)

Consistency checking

Screening will be carried out by three team members, with Kappa tests performed at the start of each screening stage on a random subset of 100 studies to confirm alignment of criteria interpretation between reviewers (Cohen 1960). A Kappa score of greater than or equal to 0.6 will be used to demonstrate sufficient reviewer agreement. If the Kappa score is not achieved, reviewers will discuss discrepancies, then repeat the screening process with a new random sample of studies. Once screening is sufficiently consistent between the three screeners, articles will be single-screened, with a subset (7%) of randomly-selected articles in the ‘rejected’ file re-screened by all three screeners and subject to a Kappa test to ensure that consistency remains high.

Inclusion criteria

In order to be included in the systematic map, articles must meet the following criteria:

Type of publication: research article, conference paper, book chapter, working paper, occasional paper; policy paper; technical paper, evaluation paper, policy brief, etc

Date: no limit, but time limitations of the review will almost certainly mean that older material that is not available electronically and requires access to physical libraries may not be able to be included. All such cases of non-inclusion on this basis will be documented.

Research design: no limitation on research design. Qualitative and quantitative research

Population: large scale (village or larger) area subject, or area of high population density subject to a technology change programme. Transitions to electricity for cooking will be limited to studies from LMICs. The rationale for this is the desire to focus on transition from biomass to cleaner cooking, which is critical for achieving SDGs in LMICs. Transitions from biomass in non-LMICs were either historic or outside the focus of the current review.

Intervention: large scale ‘programme’ (village or larger) aimed at producing a technology change (any sector). Large-scale electrification studies from non-LMICs will not be assessed in the current study; they will be set aside for future analysis if required.

Counterfactual: will not be a requirement of inclusion, but will be recorded if present in the study design

Outcome - reported uptake of new technology (numbers, density, etc.), with measure of ‘sustained’ change captured if reported, but not an essential element for inclusion. Reported drivers and/or barriers to change.

Language –the stakeholder meetings accepted that language coverage could not be fully comprehensive, but that English, French, Spanish and Portuguese language articles would be included, and other languages would be noted as existing but not further analysed. A possibility of including the important Chinese literature was discussed and this is being pursued separately. The problem of consistency-checking is a material drawback, because the team does not include a Chinese speaker, who can check the work of coders working from Chinese original material, nor do we have resources to train two coders who can act as checkers of each other’s work. The body of Chinese-language literature will be set aside for help in developing the theory of change, but will not be assessed in the systematic map analysis. .

Practical consideration and limitations of the review process

Given the short duration of the review project (5 months), and the necessity of balancing the time constraint with both comprehensiveness and rigour of the review, the following table indicates where variances from best practice for systematic review will likely occur.

Bibliographic databases	Three major databases will be searched – see strategy. Other possible bibliographic databases which will not be included are AGRIS, AGRICOLA, Science Direct.
Organizations & grey literature	The long list of organizational websites considered useful could be extended. A suggestion was made at the stakeholder meeting to write to all African universities asking for post-graduate theses on the topic of interest. This may not be possible to accomplish in the time. The review team sent a short information flyer explaining the project and asking for grey literature by mail merge to as many addresses as the

	team could readily assemble. There will be insufficient time to follow-up individually with organizations.
Languages covered	The bulk of the studies assessed will be in English. Priority will, by necessity, be given to processing the English-language articles. The team can cover some French, Spanish, Portuguese and Italian. The team may be able to cover some Arabic. Chinese coverage may be able to be covered in a parallel effort. The team will attempt to document how much material in other languages is potentially available to inform subsequent reviews about the size of a follow-up review to embrace these languages.
Date of studies	Non-electronic articles will be processed in reverse chronological order. It is recognised that there was much work on clean cooking in the 1980s, but that much of this may not be available electronically. The team will document the existence of such material even if it is not processed. This will enable subsequent reviewers to focus on this body of knowledge.
Critical appraisal of studies	Systematic maps do not routinely require the same level of critical appraisal as systematic reviews, since meta-analysis is not performed. There is insufficient time to apply a rigorous critical appraisal of studies in the current project. However, data extraction and coding for all studies in the report will include details of the study design that can be used as a filter to show methodological weaknesses (e.g. missing data, un-documented sample selection, etc.). Subjecting all included studies to independent statistical/analytical assessment is outside the remit of the current study and will not be applied.
Review period	Review periods for the Protocol and subsequent outputs will be shorter than one month. While not ideal, requesting rapid turn-round for feedback will be help ensure the review is completed on time

Data coding and data extraction

The coding and extraction template devised for the current preview drew heavily on that of Puzzolo et al (2013). In this review, synthesis of the included studies was organised under seven pre-specified domain headings, which had been identified from other reviews on household energy adoption. Attention was also paid to equity, focusing on poverty, gender issues and urban vs rural locations. It is beneficial to synthesis literature in ways that allow later cross-synthesis comparisons to be made and there was agreement that the coding sheets devised for these earlier reviews would serve as good templates to adapt to the present work. The seven domains used by Puzzolo were Fuel and technology characteristics; Household and setting characteristics; Knowledge and perceptions; Financial, tax and subsidy mechanisms; Regulation, legislation and standards; Market development; and Programmatic and policy mechanisms. The coding sheet devised for the present work comprises the following 79 extraction elements organised into 17 categories:

	Unique ID
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Article metadata	Reason for exclude (PIOQ)
	Brief details of reason if Q (and in some cases I)
	Synthesis Paper? (Y/N)
	Supplementary Material Required? (Y/N)
	Reference Type
	Year
	Author
	Title
	Journal Title
	ISBN/ISSN
	DOI
	URL
	Abstract
	Volume
	Issue
	Pages
	Keywords from databases
	Notes
Aim	Study Aim
	Is the Study about Cooking Sector?
Population details	Country
	Region
	Latitude
	Longitude
	Rural/Urban/Peri-Urban
	Unit Studied
	Population affected by Intervention (N)
	Units Sampled (n)
Intervention/programme details	Primary Intervention Aim - Social (supporting data present)
	Primary Intervention Aim - Economic (supporting data present)
	Primary Intervention Aim - Environmental (supporting data present)
	Funding Source
	Implementer
	Dates of Intervention/Program
	Sector
	Sector Specific Intervention
	Baseline Technology (Transition From)
	If Other Please State
	Target Technology (Transition To)

	If Other Please State
Study design details	Study Design
	Data Collection Approach
	Data Collection Details (Text from paper)
	Study Date
	Study Duration (Years)
	Years Since Intervention (Sustainability Measure)
	Measure of Uptake/Sustained Use (% of N)
Basic critical appraisal	Missing Data? (Y/N)
	If Yes, Is There Accountability?
	Is Secondary Data Used? (Y/N)
Independently Measured Outcomes (For data on perceptions see Drivers/Barriers section)	Social (Human Health and Wellbeing, Safety, Education, Gender Equity, Time Savings, Drudgery, Hygiene, Convenience, Aspiration, Leisure, Other, etc.)
	If Other Please State
	Economic (Income Generation, Employment, Cost Saving, Inflation, Sustained Funding, Supply Chain, Fuel Use, Time Saving, Other etc.)
	If Other Please State
	Environmental (Environmental Pollution, Climate, Emissions within Homes, Deforestation, Water Quality, Other, etc.)
	If Other Please State
	Success Measure (Text from Report)
Characteristics of Setting - Enabling Factors e.g. household characteristics, farm, uplands, lowlands. Compounding factors	Drivers
	Barriers
Knowledge and Perception, Information	Drivers
	Barriers
Technology Characteristics (Fuel) - impacts based on measured data - e.g. time, safety, health	Drivers
	Barriers
Financial, Tax and Subsidy Aspects - Did financial incentives (or lack thereof) lead to programme success/failure	Drivers
	Barriers
Regulation, Legislation and Standards	Drivers
	Barriers
Market Development (e.g. Distribution, advertising campaign)	Drivers
	Barriers
Programmatic and Policy Mechanisms (e.g. Government leafleting, demonstrations, setting up networks, government promotion)	Drivers
	Barriers
Poverty	Drivers
	Barriers

Gender	Drivers
	Barriers
Other	Drivers
	Barriers
	General Notes about the study

The template was adapted iteratively as articles were tested. It should be noted that some articles yield more than one study. In such cases, studies were given unique ID numbers and coded as though they were separate articles, while retaining article metadata information.

Working collaboratively

A shared workspace was created in Google Drive and daily back-ups were made of all sheets and documents stored on the drive. Access to relevant folders on the Drive were made available on request to project leaders. An Advisory group provided feedback on early version of this Protocol. Responses to the feedback were documented and were made available to group members.

Annex 1- Keywords & concepts – broadly grouped under Population, Intervention and Outcome concepts

Population terms & concepts	Intervention/Counterfactual	Outcomes
Rural	Technology Adoption	Sustained Use
Sub-Urban	Transition	Number* of Uptake
Urban	Uptake	Widespread
National (individual LMIC countries, listed)	Rollout	Energy Per Capita
Regional	Dissemination	Power Per Capita
Sub-Regional	Mechanisation	CO2 Equivalent
City	Delivery	Particulates
District	Conversion	Carbon Dioxide Equivalent
State	Scal* Up	Carbon Monoxide
Peri-Urban	Accept*	Carbon Dioxide
Community	Innovat*	Nitrogen Oxide
Neighbourhood	Diffusion	Black carbon
Village	Transition	Short lived climate pollutants
	Energy ladder	Access
National Program*	Energy Turnaround	Energy access
Regional Program*	Household Energy Transition	Pneumonia
Subnational Program*	Public Mobility	Respiratory infections
Subregional Program*	Mobility	Blood pressure
NGO Program*		Stacking
Project*	Household Energy	Environmental Impact
	Biomass	Emissions Within Homes
Government	Firewood	Health
High-Level Action Group	Charcoal	Time Savings
Off-grid solar access	Coal	Quality of Life Metrics
Wood-Primary markets	Solid fuels	
Companies	Wood fuels	Income
Enterprises	Traditional stove	Expenditure
Private Sector	Three stone stove	Productivity
Entrepreneur*	Open fire	Safety
Energy Markets	Modern Energy	Gender Equity
	Wood stove	Education
wood users	Decarbonization	Drudgery
biomass fuel users	Whole-Systems approach	Hardship
fuel wood users	Industrial Production	Time use
firewood users	Semi-Industrial Production	Time savings
charcoal users	Pay-As-You-Go Gas (with and without the gas)	Ventilation

	Consumption	Indoor air quality
	Manufactured stoves	Household air pollution
purchasing		air pollution
buy	LPG	polluti*
	gas	Smoke
	ethanol	Soot
	advanced stove	Smog
	TLUD	Burns
	biogas	
	gasifier	Deforestation
	pellets	Climate
	briquettes	
	kerosene	
	Kenya ceramic jiko	End-User Perception
	electricity	Supply-Chain Costs
	lighting	
	gel	Job Creation
	solar	Gender Imbalance
	Electrification	
		Behaviour Change
	Sanitation	Society Perception
	WASH	Risk Perception
	Mobile phones	Downstream Fuels
	Smartphones	Network Coverage
	Network	Sustained Public Funding
	Information technology, IT	Vertical Integration
	Subsidies	Welfare
	Sensors	Wellbeing
		Cost Saving
	Infrastructure	Employment
	Monitor	Work
	Cooking Systems	Burden (Women)
	Financing	Convenience
	Asset Finance	Hygiene
	Microfinance	Social Inclusion
	Results Based Financing	Social Capital
	Marketing	Social Status
	After Sales Service	Aspiration
	Branding	Modern Lifestyle
	Business Model	
	Capacity Building	
	Impact Investing	

	Venture Capital	
	Business Environment	
	Experiment	
	Co-benefits	
	Incentives	
	Willingness to pay, WTP	
	Revealed preference	
	Policy	
	Legislation	

Annex 2 – Evidence sources suggested at stakeholder workshops

African universities
BCAS - Bangladesh Centre for advanced studies
Berkeley air monitoring
BP?
ceew - India based think tank
CGIAR
Check local NGO websites
Clean Cooking Alliance
Dalberg
Deloitte
Development Banks – AsDB, AfDB
Duke University
Energia
ESD - energy for sustainable development -
Univ. Cape Town
FAO
Faraday Institute - batteries
Gates Foundation
GIZ - energising development
GLPGP
Gogla
GSMA development utilities
HIVOS
<http://kippra.or.ke/>
<http://www.hedon.info/HomePage>
https://cdkn.org/organisations/ids-nepal/?loclang=en_gb
https://cdkn.org/organisations/panos/?loclang=en_gb
<https://lilacs.bvsalud.org/en/>
<https://www.3ieimpact.org>
<https://www.africalics.org/>
<https://www.ait.ac.th>
<https://www.carbontrust.com/tea/news/2019/03/tea-learning-partnership/>
<https://www.pauwes.dz>
<https://www.tata.com>
<https://www.teriin.org/>
Initiative for sustainable energy policy
International energy agency
IRENA
MCC - millennium challenge corporation

McKinsey
Measure evaluation
NBER - national bureau of economic research
Nexleaf analytics
OECD
Practical Action
Private sector - publically funded
Rockefeller foundation
Rocky Mountain Institute
SEI
Shell foundation
SNV
Solar cookers international
SSRN
Susana.org - sanitation
Sustainable energy for all (UN)
Swedish embassy
TERI - The energy resources institute
UCT
UN Stats
UN Women
UNDP
UNHCR
University of Michigan - southern africa
USAID
WFP

Information Networks

- Sustainable energy transitions initiative
- Environment for development initiative
- Global energy partnership
- UN climate and clean air coalition
- ICRW
- Safe network
- African academy of sciences
- European academy of sciences
- American academy of sciences
- Sustainable transitions research network
- IIASA (Austria)

Annex 3 – Trials of keyword combinations suggested at stakeholder meetings (reverse chronological order)

9/1/2019

Creating set of additional records when including word 'constraint' into barriers/drivers concept.
Scopus – 1792 records to review

((TITLE-ABS-KEY (barrier OR driver OR constraint)) AND (TITLE-ABS-KEY (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR "clean cooking" OR ((cook* OR stove) AND fuel OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas")) OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*) AND (TITLE-ABS-KEY ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale))) AND NOT ((TITLE-ABS-KEY (barrier OR driver)) AND (TITLE-ABS-KEY (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR cooking OR ((cook* OR stove) AND fuel OR biogas OR gasifier AND orpellets OR briquettes OR kerosene OR jiko OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas")) OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*) AND (TITLE-ABS-KEY ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale)))) 12/12/2019

Re-run following feedback from AG - returned 5422

(TITLE-ABS-KEY (barrier OR driver)) AND (TITLE-ABS-KEY (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR cooking OR ((cook* OR stove) AND fuel OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas")) OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*) AND (TITLE-ABS-KEY ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale)))

WoS - returned 6,414

((TS=(barrier OR driver)) AND (TS= (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR cooking OR ((cook* OR stove) AND (fuel OR ethanol OR "LPG" OR "LP gas" OR "liquid petroleum gas" OR "liquefied petroleum gas" OR "liquefied petroleum gas")) OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phonete" OR smartphone OR telecom*)) AND (TS=("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TS= (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale)))

22/11/2019

ran search again to **yield 9744**.

Putting the concept of 'scale' back in with our urban, regional, etc. terms (plus the term 'scale') halves the search result -to 4891. I then added in sanitation, which increased it slightly to 4914. Adding mobile phone or smartphone again slightly increased to 4946. This is encouraging as a lot of the sanitation and phone literature was already being picked up, but we added another 100. I then added in 'toilet OR "clean water" OR telecom*', which nudged it up a little to 5012. Putting in 'water' instead of "clean water" pushed it right up again, so this is not going to be added - it is far too general and will give us a lot of noise.

So, the final search could be this one:

(TITLE-ABS-KEY (barrier OR driver)) AND (TITLE-ABS-KEY (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR "clean cooking" OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phone" OR smartphone OR telecom*)) AND (TITLE-ABS-KEY ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale))

WOS = 6315

((TS=(barrier OR driver)) AND (TS= (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR "clean cooking" OR electrification OR "clean energy" OR sanitation OR toilet OR "clean water" OR "mobile phonete" OR smartphone OR telecom*)) AND (TS=("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up)) AND (TS= (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village OR scale)))

Date 18/11/2019

CABI = 184 ((barrier or driver).ab,bt,cc,hw,id,ot,ti. AND (initiative or intervention or technology or microgrid or "energy conversion" or "energy program" or "modern energy" or "energy transition" or

"clean cooking" or electrification or "clean energy").ab,bt,cc,hw,id,ot,ti.) AND ("pathways to change" or transition or uptake or adopt or rollout or scale-up).ab,bt,cc,hw,id,ot,ti.))

Date 15/11/2019

Realising that 15,000 records is simply too large, I went back to focus on the *transition* aspect of any sector (but again focus on energy) and the barriers or drivers. I think with snowballing we can justify this. Scopus - returns 9729

(TITLE-ABS-KEY (barrier OR driver)) AND (TITLE-ABS-KEY (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR "clean cooking" OR electrification OR "clean energy")) AND (TITLE-ABS-KEY ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up))

Date 15/11/2019

WoS = 11802

(TS = (barrier OR driver)) AND (TS = (initiative OR intervention OR technology OR microgrid OR "energy conversion" OR "energy program" OR "modern energy" OR "energy transition" OR "clean cooking" OR electrification OR "clean energy")) AND (TS = ("pathways to change" OR transition OR uptake OR adopt OR rollout OR scale-up))

Date: 14/11/2019

SCOPUS - AMENDED SEARCH FOLLOWING DISCUSSION THAT THE STUDY SHOULD NOT BE LIMITED TO COOKING.

Returns - 15,465 records.

It is now looking for transitions in any sector (technology added) but some words from 'transition' column removed as they were returning pure chemistry/physics papers.

(((TITLE-ABS-KEY (adoption OR transition OR uptake OR rollout OR dissemination OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR turnaround OR transition)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village))) AND (TITLE-ABS-KEY (sustained OR sustainable))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating OR lighting OR technology OR infrastructure))

2. Further refining that by hard-wiring programme/project/ policy gives 8422.

(TITLE-ABS-KEY (programme OR program OR initiative OR intervention OR project OR policy)) AND ((((TITLE-ABS-KEY (adoption OR transition OR uptake OR rollout OR dissemination OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR turnaround OR transition)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village)))) AND (TITLE-ABS-KEY (sustained OR sustainable))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating OR lighting OR technology OR infrastructure)))

3. Then after discussion with Marcos (who sent an interesting paper) I add the word 'access' to the transition words. That gave an additional **1844 papers** and the following amended search:

(TITLE-ABS-KEY (programme OR program OR initiative OR intervention OR project OR policy)) AND ((((TITLE-ABS-KEY (access OR adoption OR transition OR uptake OR rollout OR dissemination OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR turnaround OR transition)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village)))) AND (TITLE-ABS-KEY (sustained OR sustainable))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating OR lighting OR technology OR infrastructure)))

Then a further refinement to increase sustainable/long-term words, based on the paper Marcos sent over that was still not being picked up. **Returned 14,557**

(TITLE-ABS-KEY (programme OR program OR initiative OR intervention OR project OR policy)) AND ((((TITLE-ABS-KEY (access OR adoption OR transition OR uptake OR rollout OR dissemination OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR turnaround OR transition OR pathway)) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village)))) AND (TITLE-ABS-KEY (sustained OR longterm OR achieve OR sustainable))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating OR lighting OR technology OR infrastructure)))

Date 12/11/2019 - 16:30)

Strict search imposing the notion of sustained/sustainable on the general search...in Scopus = 9753

(TITLE-ABS-KEY (sustained OR sustainable)) AND (((((TITLE-ABS-KEY (adoption OR transition OR uptake OR rollout OR dissemination OR conversion OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR diffusion OR turnaround OR transition)) AND

(TITLE-ABS-KEY (energy OR cooking OR fuel OR heating))) AND (TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighbourhood))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating)))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating)))

Amended search Scopus 12/11/2019 17:00 –

10,261 records - exported to ris and uploaded into Drive.

(TITLE-ABS-KEY (rural OR sub-urban OR urban OR national OR regional OR sub-national OR city OR district OR state OR rural OR peri-urban OR periurban OR community OR neighbourhood OR national OR ngo OR community OR neighborhood OR village)) AND (((TITLE-ABS-KEY (adoption OR transition OR uptake OR rollout OR dissemination OR mechanisation OR delivery OR conversion OR "Scale Up" OR "scaling up" OR "scales up" OR accept* OR innovat* OR diffusion OR turnaround)) AND (TITLE-ABS-KEY (sustained OR sustainable))) AND (TITLE-ABS-KEY (energy OR cooking OR fuel OR heating)))

WoS

#10,408 - TS=("Energy Transition" OR "energy turn around" OR "Household energy transition" OR "Household Energy" OR "Public energy mobility" OR "energy programm*" OR "national program*" OR "regional program*" OR "subnational program*" OR "sub-national program*" OR "subregional program*" OR "sub-regional program*")

Date 12/11/2019 - 13:00

Rural OR “Sub-Urban” OR Urban OR National OR Regional OR “Sub-Regional” OR City OR District OR State OR “Peri-Urban” OR Community OR Neighbourhood OR (National OR Regional OR Subnational OR Subregional OR NGO) AND (Program*) OR “Wood-Primary markets” OR “High-Level Action Group” OR Purchasing OR Buy OR Companies OR Enterprises OR “Private Sector” OR Entrepreneur OR “Energy Markets”

AND

“Technology Adoption” OR Transition OR Uptake OR Rollout OR Dissemination OR Mechanisation OR Delivery OR Conversion OR “Scale Up” OR “Scaling up” OR Accept OR Innovat OR Diffusion OR “Energy Turnaround” OR “Household Energy Transition” OR “Household Energy” OR “Public Mobility” OR Mobility OR Decarbonization OR “Whole-Systems approach” OR “Industrial Production” OR “Semi-Industrial Production” OR “Pay-As-You-Go Gas Consumption” OR “Modern Energy” OR Sanitation OR “Mobile phones” OR Smartphones OR Subsidies OR Sensors OR Measurements OR Infrastructure OR Monitor OR “Cooking Systems” OR Financing OR “Asset Finance” OR Microfinance OR “Results Based Financing” OR Marketing OR “After Sales Service” OR Branding OR “Business Model” OR “Capacity Building” OR “Impact Investing” OR “Venture Capital” OR “Business Environment” OR Experiment OR Policy OR Legislation

AND

“Sustained Use” OR Number* of Uptake OR Widespread OR “Energy Per Capita” OR “Power Per Capita” OR “CO2 Equivalent” OR Particulates OR “Carbon Dioxide Equivalent” OR “Carbon Monoxide” OR “Carbon Dioxide” OR “Nitrogen Oxide” OR “Environmental Impact” OR “Emissions Within Homes” OR Health OR “Time Savings” OR “Quality of Life Metrics” OR Income OR Expenditure OR Productivity OR Safety OR “Gender Equity” OR Education OR Drudgery OR Deforestation OR Climate OR “End-User Perception” OR “Supply-Chain Costs” OR Electrification OR “Job Creation” OR “Gender Imbalance” OR “Behavior Change” OR “Behaviour Change” OR “Society Perception” OR “Risk Perception” OR “Downstream Fuels” OR “Network Coverage” OR “Sustained Public Funding” OR “Vertical Integration” OR Welfare OR Wellbeing OR “Cost Saving” OR Employment OR Work OR Burden OR Convenience OR Hygiene OR “Social Inclusion” OR “Social Capital” OR “Social Status” OR Aspiration OR “Modern Lifestyle”

159,881 records in Scopus

((TITLE-ABS-KEY ("Sustained Use" OR number* AND of AND uptake OR widespread OR "Energy Per Capita" OR "Power Per Capita" OR "CO2 Equivalent" OR particulates OR "Carbon Dioxide Equivalent" OR "Carbon Monoxide" OR "Carbon Dioxide" OR "Nitrogen Oxide" OR "Environmental Impact" OR "Emissions Within Homes" OR health OR "Time Savings" OR "Quality of Life Metrics" OR income OR expenditure OR productivity OR safety OR "Gender Equity" OR education OR drudgery OR deforestation OR climate OR "End-User Perception" OR "Supply-Chain Costs" OR electrification OR "Job Creation" OR "Gender Imbalance" OR "Behavior Change" OR "Behaviour Change" OR "Society Perception" OR "Risk Perception" OR "Downstream Fuels" OR "Network Coverage" OR "Sustained Public Funding" OR "Vertical Integration" OR welfare OR wellbeing OR "Cost Saving" OR employment OR work OR burden OR convenience OR hygiene OR "Social Inclusion" OR "Social Capital" OR "Social Status" OR aspiration OR "Modern Lifestyle"))) AND ((TITLE-ABS-KEY ("Wood-Primary markets" OR "High-Level Action Group" OR purchasing OR buy OR companies OR enterprises OR "Private Sector" OR entrepreneur OR "Energy Markets"))) OR ((TITLE-ABS-KEY (rural OR "Sub-Urban" OR urban OR national OR regional OR "Sub-Regional" OR city OR district OR state OR "Peri-Urban" OR community OR neighbourhood))) OR ((TITLE-ABS-KEY (program*))) AND ((TITLE-ABS-KEY (national OR regional OR subnational OR subregional OR ngo)))) AND ((TITLE-ABS-KEY ("Technology Adoption" OR transition))) OR ((TITLE-ABS-KEY (uptake OR rollout OR dissemination OR mechanisation OR delivery OR conversion))) OR ((TITLE-ABS-KEY ("Scale Up" OR "Scaling up"))) OR ((TITLE-ABS-KEY (accept OR innovat OR diffusion OR "Energy Turnaround" OR "Household Energy Transition"))) OR ((TITLE-ABS-KEY ("Household Energy" OR "Public Mobility"))) OR ((TITLE-ABS-KEY (mobility OR decarbonization OR "Whole-Systems approach" OR "Industrial Production"))) OR ((TITLE-ABS-KEY ("Semi-Industrial Production" OR "Pay-As-You-Go Gas Consumption" OR "Modern Energy"))) OR ((TITLE-ABS-KEY (sanitation OR "Mobile phones" OR smartphones OR subsidies OR sensors OR measurements OR infrastructure OR monitor))) OR ((TITLE-ABS-KEY ("Cooking Systems" OR financing OR "Asset Finance" OR microfinance OR "Results Based Financing"))) OR ((TITLE-ABS-KEY (marketing OR "After Sales Service" OR branding OR "Business Model" OR "Capacity Building" OR "Impact Investing" OR "Venture Capital" OR "Business Environment" OR experiment OR policy OR legislation)))

Limit by (Barrier* or driver*):

20,230 documents in Scopus

(((TITLE-ABS-KEY ("Sustained Use" OR number* AND of AND uptake OR widespread OR "Energy Per Capita" OR "Power Per Capita" OR "CO2 Equivalent" OR particulates OR "Carbon Dioxide Equivalent" OR "Carbon Monoxide" OR "Carbon Dioxide" OR "Nitrogen Oxide" OR "Environmental Impact" OR "Emissions Within Homes" OR health OR "Time Savings" OR "Quality of Life Metrics" OR income OR expenditure OR productivity OR safety OR "Gender Equity" OR education OR drudgery OR deforestation OR climate OR "End-User Perception" OR "Supply-Chain Costs" OR electrification OR "Job Creation" OR "Gender Imbalance" OR "Behavior Change" OR "Behaviour Change" OR "Society Perception" OR "Risk Perception" OR "Downstream Fuels" OR "Network Coverage" OR "Sustained Public Funding" OR "Vertical Integration" OR welfare OR wellbeing OR "Cost Saving" OR employment OR work OR burden OR convenience OR hygiene OR "Social Inclusion" OR "Social Capital" OR "Social Status" OR aspiration OR "Modern Lifestyle"))) AND ((TITLE-ABS-KEY ("Wood-Primary markets" OR "High-Level Action Group" OR purchasing OR buy OR companies OR enterprises OR "Private Sector" OR entrepreneur OR "Energy Markets")) OR ((TITLE-ABS-KEY (rural OR "Sub-Urban" OR urban OR national OR regional OR "Sub-Regional" OR city OR district OR state OR "Peri-Urban" OR community OR neighbourhood)) OR ((TITLE-ABS-KEY (program*)) AND (TITLE-ABS-KEY (national OR regional OR subnational OR subregional OR ngo))))) AND ((TITLE-ABS-KEY ("Technology Adoption" OR transition)) OR (TITLE-ABS-KEY (uptake OR rollout OR dissemination OR mechanisation OR delivery OR conversion)) OR (TITLE-ABS-KEY ("Scale Up" OR "Scaling up")) OR (TITLE-ABS-KEY (accept OR innovat OR diffusion OR "Energy Turnaround" OR "Household Energy Transition")) OR (TITLE-ABS-KEY ("Household Energy" OR "Public Mobility")) OR (TITLE-ABS-KEY (mobility OR decarbonization OR "Whole-Systems approach" OR "Industrial Production")) OR (TITLE-ABS-KEY ("Semi-Industrial Production" OR "Pay-As-You-Go Gas Consumption" OR "Modern Energy")) OR (TITLE-ABS-KEY (sanitation OR "Mobile phones" OR smartphones OR subsidies OR sensors OR measurements OR infrastructure OR monitor)) OR (TITLE-ABS-KEY ("Cooking Systems" OR financing OR "Asset Finance" OR microfinance OR "Results Based Financing")) OR (TITLE-ABS-KEY (marketing OR "After Sales Service" OR branding OR "Business Model" OR "Capacity Building" OR "Impact Investing" OR "Venture Capital" OR "Business Environment" OR experiment OR policy OR legislation)))) AND ((driver*) OR (barrier*))

Original test of search string used by Puzzolo et al (2013), which looked at a narrower question than the current proposal, but is of high relevance to developing the search strategy: Clean fuels for resource-poor settings: A systematic review of barriers and enablers to adoption and sustained use

Tasks

- Paragraph on Machine Learning and specialist SLR tools - Colandr vs SysRev (Leo)
- - worked with colandr creators for admin access to developer side export info regarding background/medical tags
- Snowballing (from reviews and from stakeholder meeting lists)
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