Chapter 5 Table 5.1

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Panel A Part 1

Sector	Mitigation option	1 NO POVERTY (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	2 ZERO HUNGER (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	3 GOOD HEALTH AND WELL-BEING (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	4 QUALITY EDUCATION (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)
Industry	Accelerating energy efficiency improvement	**Reduces poverty** ↑ [+2] 🕮 ☺ ★ % of people living below poverty line declines from 49% to 18% in south african context *Altieri et al (2016)*	[0] No direct interaction, No literature	**air pollution reduction and better health (3.9)** ↑ [+2] 🕮🕮 ☺☺ ★★ People living in the deprived communities feel positive and predict considerable financial savings. Efficiency changes in the industrial sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in industrial demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. In extractive industries there is trade off unless strategically managed. Behavioral changes in the industrial sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in industrial demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. *Xi et al (2013), Zhang et al (2015), Vassolo and Doell (2005); Fricko et al. (2016); Holland et al. (2016); Nguyen et al (2014)*	**Technical education, vocational training (4.3, 4.4,4.5)** ↑ [+1] 🕮 ☺☺ ★★ Awareness, knowledge and technical and managerial capability are closely linked, energy audit , information for trade unions *Fernando et al (2016), Apeaning and Thollandar (2013)*
	Low-carbon fuel switch	[0] No direct interaction, No literature	[0] No direct interaction, No literature	**water and air pollution reduction and better health (3.9)** ↑ [+2] 🕮🕮 ☺☺ ★★ Industries are becoming supplier of energy, waste heat , water, roof tops for solar energy generation and hence helping in improving air and water quality. Vassolo and Doell (2005); Fricko et al. (2016); Holland et al. (2016); Nguyen et al (2014), Karner et al (2015)	**Technical education, vocational training (4.b)** ↑ [+1] 🕮🕮 ☺☺ ★★ New technplogy deployment creates demand for awareness, knowledge with technical and managerial capability otherwise acts as barrier for rapid expansion. *Fernando et al (2016), Apeaning and Thollandar (2013)*
	Decarbonisation/CCS/CCU	[0] No direct interaction, No literature	[0] No direct interaction, No literature	**Disease and Mortality (3.1/3.2/3.3/3.4)** ↓ [-1] 🕮🕮 ☺☺☺ ★★★ There is a risk of CO2 leakage both from geological formations as well as from the transportation infrastructure from source to sequestration locations. IPCC AR5 WG3 (2014); Atchley et al. (2013); Apps et al. (2010); Siirila et al. (2012); Wang and Jaffe (2004); Koorneef et al. (2011); Singh et al. (2011); Hertwich et al. (2008); Veltman et al. (2010); Corsten et al.(2013).	
Residential	Behaviorial response	**Poverty reduction via financial savings (1.1)** ↑ [+2] 🕮 ☺ ★ People living in the deprived communities feel positive and predict considerable financial savings. *Scott, Jones, and Webb (2014)*	[0] No direct interaction, No literature	**Improved warmth and comforts** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Home occupants reported warmth as the most important aspect of comfort which were largely temperature-related and low in energy costs. Residents living in the deprived areas expect improved warmth in their properties after energy efficiency measures are employed. *Scott, Jones, and Webb (2014); Huebner, Cooper, and Jones (2013); Yue, Long, and Chen (2013); Zhao et al. 2017*	
	Accelerating energy efficiency improvement	**Poverty and Development (1.1/1.2/1.3/1.4)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★★ Energy efficiency interventions lead to cost savings which are realized due to reduced energy bills that further lead to poverty reduction. Participants with low incomes experience greater benefits. 'Energy efficiency and biomass strategies benefitied poor more than wind and solar whose benefits are captured by industry. carbon mitigation can increase or decrease inequalitites. The distributional costs of new energy policies (e.g., supporting renewables and energy efficiency) are dependent on instrument design. If costs fall disproportionately on the poor, then this could impair progress toward universal energy access and, by extension, counteract the fight to eliminate poverty. (Quote from McCollum et al., in review) *Maidment et al. (2014); Scott, Jones, and Webb (2014); Berrueta et al. (2017); McCollum et al. (in review); Cameron et al. (2016); Casillas and Kammen (2012); Fay et al. (2015); Hallegate et al. (2016); Hirth and Ueckerdt (2013); Jakob and Steckel (2014); Casillas et al (2012)*	**Food Security** ↑ [+2] 🕮 ☺ ★ Using the improved stoves supports local food security and has significantly impacted on food security. By making fuel lasting longer, the improved stoves also help improve food security and provide a better buffer against fuel shortages induced by climate change-related events such as droughts, floods or hurricanes (Berrueta et al. 2017). *Berrueta et al. (2017)*	**Healthy lives and well-being for all at all ages(3.2, 3.9)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Efficient cookstove improves health especially for indigenous and poor rural communities. Household energy efficiency has positive health impacts on children's respiratory health, weight, and susceptibility to illness, and the mental health of adults. Household energy efficiency improves winter warmth, lowers relative humidity with benefits for cardiovascular and respiratory health. Further improved Indoor Air Quality by thermal regulation and occupant comfort are realised. However in one instance negative health impacts (asthma) of increased household energy efficiency were also noted when housing upgrades take place without changes in occupant behaviours. Home occupants reported warmth as the most important aspect of comfort which were largely temperature-related and low in energy costs. Residents living in the deprived areas expect improved warmth in their properties after energy efficiency measures are employed. *Berrueta et al., 2017; Maidment et al., 2014; Willand, Ridley, and Maller, 2015; Wells et al., 2015; Cameron, Taylor, and Emmett, 2015; Liddell and Guiney, 2015; Sharpe et al., 2015; Derbez, 2014; Djamila, Chu, Kumaresan, 2013, Scott, Jones, and Webb (2014); Huebner, Cooper, and Jones (2013); Yue, Long, and Chen (2013); Zhao et al. 2017, Bhojvaid Vasundhara et al (2014)*	**Reducing school absences** ↑ [+2] 🕮 ☺ ★ Household energy efficiency measures reduce school absences for children with asthma. *Maidment et al. (2014)*
	Improved access & fuel switch to modern low-carbon energy	**Poverty and Development (1.1/1.2/1.3/1.4)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★★ Access to modern energy forms (electricity, clean cook-stoves, high-quality lighting) is fundamental to human development since the energy services made possible by them help alleviate chronic and persistent poverty. Strength of the impact varies in the literature. (Quote from McCollum et al., in review) *McCollum et al. (in review); Bonan et al. (2014); Burlig and Preonas (2016); Casillas and Kammen (2010); Cook (2011); Kirubi et al. (2009); Pachauri et al. (2012); Pueyo et al. (2013); Rao et al. (2014); Zulu and Richardson, 2013; Pode, 2013*	**Food Security and Agricultural Productivity (2.1/2.4)** ~/↓ [0,-1] 🕮🕮 ☺☺☺ ★★ Modern energy access is critical to enhance agricultural yields/productivity, decrease post-harvest losses, and mechanize agri-processing - all of which can aid food security. However, large-scale bioenergy and food production may compete for scarce land and other inputs (e.g., water, fertilizers), depending on how and where biomass supplies are grown and the indirect land use change impacts that result. If not implemented thoughtfully, this could lead to higher food prices glo (Quote from McCollum et al., in review)bally, and thus reduced access to affordable food for the poor. Enhanced agricultural productivities can ameliorate the situation by allowing as much bioenergy to be produced on as little land as possible. *McCollum et al. (in review);* Asaduzzaman et al. (2010); Cabraal et al. (2005); Finco and Doppler (2010); Hasegawa et al. (2015); Lotze-Campen et al. (2014); Msangi et al. (2010); Smith et al. (2013); Smith, P. et al. (2014); Sola et al. (2016); Tilman et al. (2009); van Vuuren et al. (2009)	**Disease and Mortality (3.1/3.2/3.3/3.4)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★★ Access to modern energy services can contribute to fewer injuries and diseases related to traditional solid fuel collection and burning, as well as utilization of kerosene lanterns. Access to modern energy services can facilitate improved health care provision, medicine and vaccine storage, utilization of powered medical equipment, and dissemination of health-related information and education. Such services can also enable thermal comfort in homes and contribute to food preservation and safety. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Aranda et al. (2014); Lam et al. (2012); Lim et al. (2012); Smith et al (2013)	**Equal Access to Educational Institutions (4.1/4.2/4.3/4.5)** ↑ [+1] 🕮 ☺☺☺ ★★ Access to modern energy is necessary for schools to have quality lighting and thermal comfort, as well as modern information and communication technologies. Access to modern lighting and energy allows for studying after sundown and frees constraints on time management that allow for higher school enrollment rates and better literacy outcomes. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Lipscomb et al. (2013); van de Walle et al. (2013)

Panel A Part 1

Transport	**Behavioural response**			**Road Traffic Accidents (3.4/3.6)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★ Active travel modes' (such as walking and cycling) represent strategies not only for boosting energy efficiency but also, potentially, for improving health and well-being (e.g., lowering rates of diabetes, obesity, heart disease, dementia, and some cancers). However, a risk associated with these measures is that they could increase rates of road traffic accidents, if the provided infrastructure is unsatisfactory. Overall health effects will depend on the severity of the injuries sustained from these potential accidents relative to the health benefits accruing from increased exercise. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Creutzig et al. (2012); Haines and Dora (2012); Saunders et al. (2013); Shaw et al. (2014); Woodcock et al. (2009), Shaw et al (2017),Chakrabarti and Shin (2017), Hunag et al (2017)	
	Accelerating energy efficiency improvement			**Reduce illnesses from hazardous air, water and soil pollution (3.9)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Locally relevant policies targetting traffic reductions and ambitious diffusion of electric vehicles results in measured changes in non-climatic population exposure included ambient air pollution, physical activity, and noise. The transition to low-carbon equitable and sustainable transport can be fostered by numerous short- and medium-term strategies that would benefit energy security, health, productivity, and sustainability. Evidence-based approach that takes into account greenhouse gas emissions, ambient air pollutants, economic factors (affordability, cost optimisation), social factors (poverty alleviations, public health benefits), and political acceptability is needed tackle these challenges. (Schucht et al., 2015);(Figueroa, Lah, Fulton, McKinnon, & Tiwari, 2014);(Peng, Yang, Wagner, & Mauzerall, 2017); (Klausbruckner et al., 2016)	
	Improved access & fuel switch to modern low-carbon energy	**End Poverty in all its forms everywhere (1.1,1.4,1.a, 1.b)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★★ Climate change threatens to worsen poverty, therefor pro-poor mitigation policies are needed to reduce this threat; for example investing more and better in infrastructure by leveraging private resources and using designs that account for future climate change and the related uncertainty. Communities in poor areas cope with and adapt to multiple-stressors including climate change. Coping strategies provide short-term relief but in the long-term may negatively affect development goals. And responses generate a trade-off between adaptation, mitigation and development . African cities with slums and due to high commuting costs many walk to work places which limit access. In Latin america tripple informality leading to low productivity and living standards. In Sweden decarbonisation of public bus is receiving attention more than efficiency improvment. With more electrification electricity price goes up and affordibility can worsen for poor unless redistributive policies are in place. *(Hallegate et al, 2015); (Suckall, Tompkins, & Stringer, 2014), Lall, Henderson, & Venables, 2017, (Corporacion Andina de Fomento, 2017), Xylia et al (2017), Klausbruckner, Annegarn, Henneman, & Rafaj, 2016*	**Ensure Access to Food Security (2.1, 2.3, 2.a, 2.b,2.c)** ~ [0] 🕮 ☺ ★ 21 Projects aiming at resilient transport infrastructure development to improve access (e.g. C40 Cities Clean Bus Declaration, UITP Declaration on Climate Leadership, Cycling Delivers on the Global Goals, Global Sidewalk Challenge) do not substantially contribute to realizing the (indirect) transport targets with mostly a rural focus: Agricultural Productivity (SDG 2) and Access to Safe Drinking Water (SDG 6) *Partnership on Sustainable Low Carbon Transport, 2017*	**Reduce illnesses from hazardous air pollution (3.9)** ↑ [+2] 🕮 ☺ ★ Projects aiming at resilient transport infrastructure development (e.g. C40 Cities Clean Bus Declaration, UITP Declaration on Climate Leadership, Cycling Delivers on the Global Goals, Global Sidewalk Challenge) are targetting at reducing airpollution, Electric vehicles using electricity from renewables or low carbon sources combined with e-mobility options such as trolleybuses, metros, trams and electro buses, as well as promote walking and biking, especially for short distances need consieration *Partnership on Sustainable Low Carbon Transport, 2017, Ajanovic (2015)*	

Panel A Part 1

Panel A Part 2

		SDG	Target	INTERACTION	NILSSON SCORE	EVIDENCE	AGREEMENT	CONFIDENCE	Text	References
Replacing coal	Non-biomass renewables solar, wind, hydro	1 No Poverty		↑	[+2]	📖📖📖	☺☺☺	★★★	Deployment of renewable energy and improvements in energy efficiency globally will aid climate change mitigation efforts, and this, in turn, can help to reduce the exposure of the world's poor to climate-related extreme events, negative health impacts, and other environmental shocks. (Quote from McCollum et al., in review)	*McCollum et al. (in review); Hallegatte et al. (2016); IPCC (2014); Riahi et al. (2012)*
		2 Zero Hunger								
		3 Good Health and Well-Being	Air Pollution (3.9)	↑	[+2]	📖📖📖	☺☺☺	★★★★	Promoting most types of renewables and boosting efficiency greatly aid the achievement of targets to reduce local air pollution and improve air quality; however, the order of magnitude of the effects, both in terms of avoided emissions and monetary valuation, varies significantly between different parts of the world. Benefits would especially accrue to those living in the dense urban centers of rapidly developing countries. Utilization of biomass and biofuels might not lead to any air pollution benefits, however, depending on the control measures applied. In addition, household air quality can be significantly improved through lowered particulate emissions from access to modern energy services. (Quote from McCollum et al., in review)	*McCollum et al. (in review);* Anenberg et al. (2013); Chaturvedi and Shukla (2014); Haines et al. (2007); IEA (2016); Kaygusuz (2011); Nemet et al. (2010); Rafaj et al. (2013); Rao et al (2013); Rao et al (2016); Riahi et al. (2012); Rose et al. (2014); Smith and Sagar (2014); van Vliet et al. (2012); West et al. (2013)
		4 Quality Education		↑	[+1]	📖	☺	★	Decentralized renewable energy systems (e.g., home- or village-scale solar power) can support education and vocational training.	Anderson A., Loomba P., Orajaka I., Numfor J., Saha S., Janko S., Johnson N., Podmore R., Larsen R. (2017)
	Increased use of biomass	1 No Poverty		↑/↓	[+2,-2]	📖📖	☺☺	★	Large-scale bioenergy production could lead to the creation of agricultural jobs, as well higher farm wages and more diversified income streams for farmers. Modern energy access can make marginal lands more cultivable, thus potentially generating on-farm jobs and incomes; on the other hand, greater farm mechanization can also displace labor. On the other hand, large-scale bioenergy production could alter the structure of global agricultural markets in a way that is, potentially, unfavorable to small-scale food producers. see SDG2 (Quote from McCollum et al., in review)	McCollum et al. (in review); Balishter et al. (1991); Creutzig et al. (2013); de Moraes et al. (2010); Gohin (2008); Rud (2012); Satolo and Bacchi (2013); van der Horst and Vermeylen (2011); Corbera and Pascual (2012); Creutzig et al. (2013); Davis et al. (2013); van der Horst and Vermeylen (2011); Muys et al. (2014); Ertem F.C., Kappler B., Neubauer P. (2017)
		2 Zero Hunger	Farm Employment and Incomes (2.3)	↑/↓	[+2,-2]	📖📖📖	☺☺☺	★★★	Large-scale bioenergy production could lead to the creation of agricultural jobs, as well higher farm wages and more diversified income streams for farmers. Modern energy access can make marginal lands more cultivable, thus potentially generating on-farm jobs and incomes; on the other hand, greater farm mechanization can also displace labor. On the other hand, large-scale bioenergy production could alter the structure of global agricultural markets in a way that is, potentially, unfavorable to small-scale food producers. The distributional effects of bioenergy production are underexplored in the literature. (Quote from McCollum et al., in review)	*McCollum et al. (in review);* Balishter et al. (1991); Creutzig et al. (2013); de Moraes et al. (2010); Gohin (2008); Rud (2012); Satolo and Bacchi (2013); van der Horst and Vermeylen (2011); Corbera and Pascual (2012); Creutzig et al. (2013); Davis et al. (2013); van der Horst and Vermeylen (2011); Muys et al. (2014); Ertem F.C., Kappler B., Neubauer P. (2017)
		3 Good Health and Well-Being	Disease and Mortality (3.1/3.2/3.3/3.4), Air Pollution (3.9)	↑	[+2]	📖📖📖	☺☺☺	★★★	Replacing coal by biomass can reduce adverse impacts of upstream supply-chain activities, in particular local air and water pollution, and prevent coal mining accidents. Improvements to local air pollution in power generation compared to coal-fired power plants depend on the technology and fuel of biomass powerplants, but could be significant when switching from outdated coal combustion technologies to state-of-the-art biogas power generation.	IPCC AR5 WG3 (2014); Koorneef et al. (2011); Singh et al. (2011); Hertwich et al. (2008); Veltman et al. (2010); Corsten et al.(2013); Ashworth et al. (2012); Einsiedel et al. (2013); IPCC (2005); Miller et al. (2007); de Best-Waldhober et al. (2009); Shackley et al. (2009); Wong-Parodi and Ray (2009); Waööquist et al. (2009, 2010); Reiner and Nuttall (2011); Epstein et al. (2010); Burgherr et al. (2012); Chen et al. (2012); Chan and Griffiths (2010); Asfaw et al. (2013).
		4 Quality Education								
	Nuclear/Advanced Nuclear	1 No Poverty								
		2 Zero Hunger								
		3 Good Health and Well-Being	Disease and Mortality (3.1/3.2/3.3/3.4)	↓	[-1]	📖📖📖	☺☺☺	★★★	In spite of the industry's overall safety track record, a non-negligible risk for accidents in nuclear power plants and waste treatment facilities remains. The long-term storage of nuclear waste is a politically fraught subject, with no large-scale long-term storage operational worldwide. Negative impacts from upstream uranium mining and milling are comparable to those of coal, hence replacing fossil fuel combustion by nuclear power would be neutral in that aspect. Increased occurrence of childhood leukaemia in popoulations living within 5 km of nuclear power plants was identified by some studies, even though a direct causal relation to ionizing radiation could not be established and other studies could not confirm any correlation (low evidence/agreement in this issue).	IPCC AR5 WG3 (2014); Cardis et al. (2006); Balonov et al. (2011); Moomaw et al. (2011a); WHO (2013); Abdelouas (2006); Al-Zoughool and Kewski (2009) cited in Sathaye et al. (2011a); Smith et al. (2013); Schnelzer et al. (2010); Tirmarche (2012); Brugge and Buchner (2011); Møller et al. (2012); Hiyama et al. (2013); Mousseau and Møller (2013); Møller and Mousseau (2011); Møller et al. (2011); von Stechow et al. (2016); Heinävaara et al. (2010), Kaatsch et al. (2008); Sermage-Faure et al. (2012), Hoeve and Jacobson (2012).
		4 Quality Education								
	CCS: Bio energy	1 No Poverty		↑/↓	[+2,-2]	📖📖	☺☺	★	See effects of increased bioenergy use.	
		2 Zero Hunger	Farm Employment and Incomes (2.3)	↑/↓	[+1,-2]	📖📖📖	☺☺☺	★★★	See increased use of biomass efects. In addition, the concern that more bioenergy (for BECCS) necessarily leads to unacceptably high food prices is not founded on large agreement in the literature. AR5, for example, finds a significantly lower effect of large-scale bioenergy deployment on food prices by mid-century than the effect of climate change on crop yields. Also, Muratori et al. (2016) show that BECCS reduces the upward pressure on food crop prices by lowering carbon prices and lowering the total biomass demand in climate change mitigation scenarios.	*See literature on increased biomass use + Muratori et al. (2016), IPCC AR5 (2014)*
		3 Good Health and Well-Being	Disease and Mortality (3.1/3.2/3.3/3.4)	↑/↓	[+2,-1]	📖📖	☺☺☺	★★★	See positive impacts of increased biomass use. On the other hand, there is a non-negligible risk of CO2 leakage both from geological formations as well as from the transportation infrastructure from source to sequestration locations.	IPCC AR5 WG3 (2014); Atchley et al. (2013); Apps et al. (2010); Siirila et al. (2012); Wang and Jaffe (2004); Koorneef et al. (2011); Singh et al. (2011); Hertwich et al. (2008); Veltman et al. (2010); Corsten et al.(2013).
		4 Quality Education								
Advanced coal	CCS: Fossil	1 No Poverty							No literature	
		2 Zero Hunger							No literature	
		3 Good Health and Well-Being	Disease and Mortality (3.1/3.2/3.3/3.4)	↓	[-1]	📖📖	☺☺☺	★★★	The use of fossil CCS imply continued adverse impacts of upstream supply-chain activities in the coal sector, and because of lower efficiency of CCS coal power plants, upstream impacts and local air pollution are likely to be exacerbated. Furthermore, there is a non-negligible risk of CO2 leakage from geological stoage the CO2 transport infrastructure from source to sequestration location.	IPCC AR5 WG3 (2014); Atchley et al. (2013); Apps et al. (2010); Siirila et al. (2012); Wang and Jaffe (2004); Koorneef et al. (2011); Singh et al. (2011); Hertwich et al. (2008); Veltman et al. (2010); Corsten et al.(2013).
		4 Quality Education							No literature	

Panel A Part 2

Panel A Part 3

Sector	Measure	1 NO POVERTY INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	2 ZERO HUNGER INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	3 GOOD HEALTH AND WELL-BEING INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	4 QUALITY EDUCATION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Agriculture & Livestock	**Behaviourial response: Sustainable healthy diets and reduced food waste**	**Poverty and Development (1.1/1.2/1.3/1.4)** ~ / ↓ | [0,-1] | 📖📖 | ☺☺☺ | ★★ Cutting livestock consumption can increase food security for some if land grows food not feed, but can also undermine livelihoods and culture where livestock has long been the best use of land such as in parts of SSA IPCC WGIII, 2014	**Food Security and promotion of Sustainable Agriculture(2.1/2.4/2a)** ↑ | [+2] | 📖📖📖📖 | ☺☺☺☺ | ★★★★ Curbing consumer waste of major food crops (i.e., wheat, rice, and vegetables) and meats (i.e., beef, pork, and poultry) in China , USA and India alone could feed ~413 million people per year . (Quoted from West et al.(2014)) One billion extra people could be fed if food crop losses could be halved. (Quoted from Kummu et al. (2012)) Reducing waste, especially from meat and dairy could play a role in delivering food security and reduce the need for sustainable intensification. (Quoted from Smith, P. (2013)). Dietary change toward global healthy diets could improve nutritional health, food security and reduce emissions West et al.(2014), Kummu et al. (2012), Smith, P. (2013), Beddington et al. (2012), Lamb et al. (2016), Garnett, T., 2011; Bajželj et al., 2014; Tilman & Clark, 2014)	**Tobacco Control (3.a/ 3.a.1)** ↑ | [+1] | 📖 | ☺ | ★ Consume fewer foods with low nutritional value e.g. Alcohol(These foods are not needed in our diet and need not be produced), (Quoted from Garnett, T. (2011)). Demand-side measures aimed at reducing the proportion of livestock products in human diets, where the consumption of animal products is higher than recommended, are associated with multiple health benefits, especially in industrialized countries (Quoted from Bustamante, M., et al. (2014)) Garnett, T. (2011), Bustamante, M., et al. (2014)	No literature
	Land based greenhouse gas reduction and soil carbon sequestration		**Food Security, sustainable agriculture and Improved nutrition** ↑ | [+2] | 📖📖📖📖 | ☺☺☺☺ | ★★★★ Safe application of biotechnology, both conventional and mordern methods can help to improve agricultural productivity,improving crops adaptability thereby catering to food security. Reducing tillage,eliminating fallow and keeping the soil covered with residue, cover crops or perennial vegetation help prevent soil erosion and has the potential to increase Soil Organic Matter (SOC).Efficient land management techniques can help in increasing crop yield and hence food security issues can be addressed. Yield projections are actually higher for developing countries than for developed countries, reflecting the fact that they have more ‘‘catch-up’’ potential.(Quoted from Evenson, R. E. (1999)) Action is needed throughout the food system, on moderating demand, reducing waste, improving governance and producing more food. (Quoted from Godfray, H. C. J., & Garnett, T. (2014).) Improving cropland management is the key to increase crop productivity without further degrading soil and water resources. (Quoted from Branca, G., et al. (2011)). Climatee Smart Agriculture practices increases productivity and priotizes food security Mtui, G. Y. (2011),Harvey, C. A., et al. (2014), Campbell et al. (2014), West, T. O., & Post, W. M. (2002). Johnson et al. (2007),Harvey, C. A., et al. (2014), Evenson, R. E. (1999), Godfray, H. C. J., & Garnett, T. (2014),Branca, G., et al. (2011), McCarthy, N., Lipper, L., &Branca, G. (2011). Behnassi, M., Boussaid, M., &Gopichandran, R. (2014), Lipper, L., et al. (2014).Steenwerth, K. L., (2014))	**Ensure healthy lives (3.c)** ↑ / ↓ | [+2,-2] | 📖📖 | ☺☺ | ★★ Growing crops such as cassava, sorghums and millets even in harsh conditions are important to the diets of very poor people. The policy scenarios show that reduced research support, delayed industrialization, delayed biotechnology, and climate change will delay progress in reducing malnutrition of children. The ‘‘global’’ effects are small, but local effects for some countries, e.g., Bangladesh and Nigeria, are significant. (Quoted from Evenson, R. E. (1999)) Godfray, H. C. J., & Garnett, T. (2014), Evenson, R. E. (1999),	**Ensure inclusive and quality education(4.4/4.7)** ↑ / ↓ | [+2,-2] | 📖📖 | ☺ | ★ Science-based actions within CSA is required to integrate data sets and sound metrics for testing hypotheses about feedback regarding climate, weather data products and agricultural productivity, such as the nonlinearity of temperature effects on crop yield and the assessment of trade-offs and synergies that arise from different agricultural intensification strategies. (Quoted from Steenwerth, K. L., (2014)). Low commodity prices have led to declining investment in research and development, farmer education, etc (Quoted from Lamb, A., et al. (2016)) Steenwerth, K. L., (2014),Lamb, A., et al. (2016)
	Greenhouse gas reduction from improved livestock production and manure management systems	**Poverty reduction and minimize exposure to risk (1.5)** ↑ | [+2] | 📖 | ☺ | ★ Mixed-farming systems, can not only farmers mitigate risks by producing a multitude of commodities, but they can also increase the productivity of both crops and animals in a more profitable and sustainable way, (Quoted from Sansoucy, R. (1995)) Sansoucy, R. (1995)	**Food Security and promotion of Sustainable Agriculture(2.1/2.4/2a)** ↑ | [+2] | 📖📖📖📖 | ☺☺☺☺ | ★★★★ Fostering transitions toward more productive livestock production systems targeting land-use change appears to be the most efficient lever to deliver food availability outcomes. (Quoted from Havlík, P., et al. (2014)) Genomic selection should be able to at least double the rate of genetic gain in the dairy industry (Quoted from Thornton, P. K. (2010)). Given the prevalence of mixed crop–livestock systems in many parts of the world, closer integration of crops and livestock in such systems can give rise to increased productivity and increased soil fertility. (Quoted from Thornton, P. K. (2010)). Managing the indirect effects of livestock systems intensification is critical for the sustainability of the global food system: like improving productivity and their close link to land sparing.(Quoted from Herrero, M., & Thornton, P. K. (2013)). In East Africa pastoralists have shifted from cows to camels, which are better-adapted to survive periods of water scarcity and able to consistently provide more milk. (Steenwerth, K. L et al. (2014) Scenarios where zero human-edible concentrate feed is use for livestocks soil erosion potential reduces by 12% Havlík, P., et al. (2014), Steenwerth, K. L. (2014), Thornton, P. K. (2010), Herrero, M., & Thornton, P. K. (2013), Steenwerth, K. L et al. (2014), Schader, C., et al. (2015)	**Ensure healthy lives (3.c)** ↑ / ↓ | [+2,-2] | 📖📖 | ☺☺ | ★★ Bio-digestion which has positive public-health aspects, particularly where toilets are coupled with the bio-digester, and the anaerobic conditions kill pathogenic organisms as well as digest toxins. Separation processes can improve or worsen health risks related to food crops or to livestock. Sansoucy, R. (1995), Burton, C. H. (2007).	No literature

Panel A Part 3

Forest	**Reduced deforestation, REDD+**		**Food Security and promotion of Sustainable Agriculture(2.1/2.4/2a)** ↑/↓ [+1,-2] 🕮🕮 ☺ ★ Food security, may lead to the conversation of productive land under forest, including community forests, into agricultural production. In a similar fashion, the production of biomass for energy purposes(SDG 7) may reduce land available for food production and/or for community forest activities (Quoted from Katila, P., et al. (2017)). Efforts by the Government of Zambia to reduce emissions byREDD+, have contributed erosion control, ecotourism and pollination valued at 2.5% of the country's GDP (Quoted from Katila, P., et al. (2017)), Turpie, Warr, & Ingram, (2015),Epstein, A. H., & Theuer, S. L. H. (2017).		**Ensure inclusive and quality education(4.4/4.7)** ↑ [+1] 🕮 ☺ ★ Local forest users learn to understand laws, regulations and policies which facilitate their participation in the society. Education and capacity building provide technical skill and knowledge. (Quoted from Katila, P., et al. (2017)) (Quoted from Katila, P., et al. (2017))
	Afforestation and reforestation	**Poverty and Development (1.1/1.2/1.3/1.4)** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★★ CDM-AR can have different implications on local community livelihoods. Willingness to adopt afforestation is influenced in particular by Australian landholder's perceptions of its potential to provide a diversified income stream, and its impacts on flexibility of land management (Quoted from Schirmer, J., & Bull, L. (2014)). Land sparing would have far reaching implications for the UK countryside and would affect landowners, rural communities (Quoted from Lamb et al. (2016)) Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008), Schirmer, J., & Bull, L. (2014), Lamb et al. (2016)	**Food Security (2.1)** ↑/↓ [+1,-1] 🕮 ☺ ★ CDM-AR can have different implications on local to regional food security and local community livelihoods. Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008).		**Promote knowledge and skill to promote SD (4.7)** ↓ [-1] 🕮 ☺ ★ Most landholders reported having low levels of knowledge about tree planting for carbon sequestration–particularly available programmes, prices and markets, and government rules and regulations (Quoted from Schirmer, J., & Bull, L. (2014)) Schirmer, J., & Bull, L. (2014)
	Behaviourial response (responsible sourcing)				
Oceans	**Ocean iron fertilization**		**Food Security (2.2/2.3)** ↑/↓ [+1,-1] 🕮🕮 ☺ ★ OIF can have different implications on fish stocks and aquaculture, it might actually increase food availability for fish stocks (inceasing yields) but potentially at the cost of reducing the yields of fisheries outside the enhancement region by depleting other nutrients. Smetacek and Naqvi (2008), Lampitt et al. (2008), Williamson et al. (2012)		
	Blue carbon	**Poverty and Development (1.1/1.2/1.5)** ↑ [+3] 🕮🕮🕮 ☺☺☺ ★★★ avoiding loss of mangroves and maintaining the 2000 stock could save a value of ecosystem services from mangroves in Southeast Asia of approximately US$2.16 billion until 2050 (2007prices), with a 95% prediction interval of US$1.58–2.76 billion (case study area South East Asia); Seaweed aquaculture will enhance carbon uptake and provide employment; traditional management systems provide benefits for blue carbon and support livelihoods for local communities; Greening of aquaculture can significantly enhance carbon storage; PES schemes could help capture the benefits derived from multiple ecosystem services beyond carbon sequestration; Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008), Schirmer, J., & Bull, L.	**Food Production (2.3/2.4)** ↑ [+3] 🕮🕮🕮 ☺☺☺ ★★★ avoiding loss of mangroves and maintaining the 2000 stock could save a value of ecosystem services from mangroves in Southeast Asia including fisheries; Seaweed aquaculture will provide employment; traditional management systems provide livelihoods for local communities; Greening of aquaculture can increase income and well-being; Mariculture is a promising approach for China; Brander et al. (2012); Sondak et al. (2017); Vierros (2017); Ahmed et al. (2017a); Ahmed		
	Enhanced Weathering				

Panel A Part 3

Panel B Part 1

Sector	Mitigation option	SDG 5 Gender Equality (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	SDG 10 Reduced Inequalities (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	SDG 16 Peace, Justice and Strong Institutions (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)	SDG 17 Partnerships for the Goals (INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE)
Industry	**Accelerating energy efficiency improvement**	No literature	No literature	No literature	
	Low-carbon fuel switch	No literature	No literature		
	Decarbonisation/CCS/CCU				**Environmental justice (17.6, 17.7** ↑ / [+2] / 🕮 / ☺☺☺ / ★★★ EPI plants are capital intensive and are mostly operated by multinational with long investment cycles. In developed countries new innovation investments are happening in brown fields . Such large innovation investmets need strong collaboration among partners/competitors which can be facilitated by public fund, They happen at national ,supra national scale, across sectors, needs fresh revisit at IPR issues. Wesseling, J.H., S. Lechtenböhmer, M. Åhman, L.J. Nilsson, E. Worrell, L. Coenen (2017)
Residential	**Behaviorial response**			**Environmental justice** ↑ / [+2] / 🕮 / ☺ / ★ Hult et al. found that consumption perspective strengthens the environmental justice discourse (as it claims to be a more just way of calculating global and local environmental effects) while possibly also increasing the environmental discourse. *Hult and Larsson (2016)*	
	Accelerating energy efficiency improvement	**Gender equality and Women empowerment (5.1, 5.4)** ↑ / [+2] / 🕮 / ☺☺ / ★★ Efficient cookstoves lead to empowerment of rural and indigenous women. *Berrueta et al. (2017), Bhojvaid Vasundhara et al (2014)*	**Empowerment and Inclusion (10.1/10.2/10.3/10.4)** ↑/↓ / [1,-1] / 🕮🕮🕮 / ☺☺☺ / ★★★ Energy efficiency measures and the provision of energy access can free up resources that can then be put towards other productive uses (e.g., educational and employment opportunities), especially for women and children in poor, rural areas. The distributional costs of new energy policies are dependent on instrument design. If costs fall disproportionately on the poor, then this could work against the promotion of social, economic and political equality for all. The impacts of energy efficiency measures and policies on inequality can be both positive (if they reduce energy costs) or negative (if mandatory standards increase the need for purchasing more expensive equipment and appliances). (Quote from McCollum et al., in review) *McCollum et al. (in review);* Cameron et al. (2016); Casillas and Kammen (2012); Fay et al. (2015); Hallegate et al. (2016); Hirth and Ueckerdt (2013); Jakob and Steckel (2014); Cayla and Osso (2013); Dinkelman (2011); Pachauri et al. (2012); Pueyo et al. (2013)		
	Improved access & fuel switch to modern low-carbon energy	**Women's Safety & Worth (5.1/5.2/5.4) / Opportunities for Women (5.1/5.5)** ↑ / [+1] / 🕮🕮 / ☺☺ / ★★ Improved access to electric lighting can improve women's safety and girls' school enrollment. Cleaner cooking fuel and lighting access can reduce health risks and drudgery, which are disproportionately faced by women. Access to modern energy services has the potential to empower women by improving their income-earning and entrepreneurial opportunities and reducing drudgery. Participating in energy supply chains can increase women's opportunities and agency and improve business outcomes. (Quote from McCollum et al., in review) McCollum et al. (in review); Anenberg et al. (2013); Chowdhury (2010); Haves (2012); Matinga (2012); Pachauri and Rao (2013); Chowdhury (2010); Clancy et al (2011); Dinkelman (2011); Haves (2012); Kaygusuz (2011); Kohlin et al. (2011); Pachauri and Rao (2013); Burney J., Alaofè H., Naylor R., Taren D. (2017)		**Institutional Capacity and Accountability (16.1/16.3/16.5/16.6/16.7/16.8)** ↑ / [+2] / 🕮🕮🕮 / ☺☺☺ / ★★★★ Institutions that are effective, accountable, and transparent are needed at all levels of government (local to national to international) for providing energy access, promoting modern renewables, and boosting efficiency. Strengthening the participation of developing countries in international institutions (e.g., international energy agencies, United Nations organizations, World Trade Organization, regional development banks and beyond) will be important for issues related to energy trade, foreign direct investment, labor migration, and knowledge and technology transfer. Reducing corruption, where it exists, will help these bodies and related domestic institutions maximize their societal impacts. (Quote from McCollum et al., in review) Limiting armed conflict and violence will aid most efforts related to sustainable development, including progress in the energy dimension. *McCollum et al. (in review);* Acemoglu (2009); Acemoglu et al. (2014); ICSU, ISSC (2015); Tabellini (2010)	**Promote transfer and diffusion of technology (17.6,17.7)** ↑ / [+2] / 🕮 / ☺ / ★ Green building technology in Kazakhstan was based on transfer of knowledge among various parties Kim et al (2017)
Transport	**Behavioural response**		**Reduce Inequality (10.2)** ↑ / [+2] / 🕮🕮 / ☺☺ / ★★ The equity impacts of climate change mitigation measures for transport, and indeed of transport policy intervention overall, are poorly understood by policymakers. This is in large part because standard assessment of these impacts is not a statutory requirement of current policy making. Managing transport energy demand growth will have to be advanced alongside efforts in passenger travel toward reducing the deep inequalities in access to transport services that currently affect the poor worldwide. Lucas & Pangbourne, 2014, Figueroa, Lah, Fulton, McKinnon, & Tiwari, 2014	**Ensure safety on road (16.1)** ↑/↓ / [+1, -1] / 🕮 / ☺ / ★ With behaviourial change towards walking for short distance pedestrian safety on the road might reduce unless public policy is appropriately formulated *Partnership on Sustainable Low Carbon Transport, 2017*	**Help promote global partnership(17.1, 17.3,17.5,17.6,17.7)** ↑ / [+2] / 🕮 / ☺ / ★ Projects aiming at resilient transport infrastructure development (e.g. C40 Cities Clean Bus Declaration, UITP Declaration on Climate Leadership, Cycling Delivers on the Global Goals, Global Sidewalk Challenge) are happening through multistakeholder coalition *Partnership on Sustainable Low Carbon Transport, 2017*
	Accelerating energy efficiency improvement			**Ensure responsive, inclusive, participatory decision making (16.7)** ↑ / [+2] / 🕮🕮 / ☺☺ / ★★ In transport mitigation is necessartb to conduct need assessment and stakeholder consultation to determine plausible challenges, prior to introducing a desired planning reforms. Further, the involved personnel should actively engage transport-based stakeholders during policy identification and its effective implementation to achieve desired results. User behaviour and stakeholder integration is key for successful transport policy implementation Aggarwal, 2017, AlSabbagh, Siu, Guehnemann, & Barrett, 2017	**Help promote global partnership(17.1, 17.3,17.5,17.6,17.7)** ↑ / [+2] / 🕮 / ☺ / ★ Projects aiming at resilient transport infrastructure development and technology adoption (e.g. C40 Cities Clean Bus Declaration, UITP Declaration on Climate Leadership, Cycling Delivers on the Global Goals, Global Sidewalk Challenge) are happening through multistakeholder coalition *Partnership on Sustainable Low Carbon Transport, 2017*
	Improved access & fuel switch to modern low-carbon energy		**Reduce Inequality (10.2)** ↑ / [+2] / 🕮🕮 / ☺☺ / ★★ The equity impacts of climate change mitigation measures for transport, and indeed of transport policy intervention overall, are poorly understood by policymakers. This is in large part because standard assessment of these impacts is not a statutory requirement of current policy making. Managing transport energy demand growth will have to be advanced alongside efforts in passenger travel toward reducing the deep inequalities in access to transport services that currently affect the poor worldwide. (Lucas & Pangbourne, 2014)(Figueroa, Lah, Fulton, McKinnon, & Tiwari, 2014)	**Ensure responsive, inclusive, participatory decision making (16.7)** ↑/↓ / [+1, -1] / 🕮 / ☺ / ★ Formal transport infrastrcuture improvement in many cities in developing countries lead to eviction from infromal settlements which need appropriate redistributive policies and cooperation and partnership with all. Colenrander et al 2017)	**Help promote global partnership(17.1, 17.3,17.5,17.6,17.7)** ↑ / [+2] / 🕮 / ☺ / ★ Projects aiming at resilient transport infrastructure development (e.g. C40 Cities Clean Bus Declaration, UITP Declaration on Climate Leadership, Cycling Delivers on the Global Goals, Global Sidewalk Challenge) are happening through multistakeholder coalition *Partnership on Sustainable Low Carbon Transport, 2017*

Panel B Part 2

		5 GENDER EQUALITY INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	10 REDUCED INEQUALITIES INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	16 PEACE, JUSTICE AND STRONG INSTITUTIONS INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	17 PARTNERSHIPS FOR THE GOALS INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Replacing coal	**Non-biomass renewables** solar, wind, hydro	↑ [+1] 🕮 ☺ ★ Decentralized renewable energy systems (e.g., home- or village-scale solar power) can reduce the burden on girls and women of procuring traditional biomass. Schwerhoff G., Sy M. (2017)	**Empowerment and Inclusion (10.1/10.2/10.3/10.4)** ↑ [+1] 🕮🕮 ☺☺ ★★ Decentralized renewable energy systems (e.g., home- or village-scale solar power) can enable a more participatory, democratic process for managing energy-related decisions within communities. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Cass et al. (2010); Cumbers (2012); Kunze and Becker (2015); Walker and Devine-Wright (2008)	**Energy justice** ↑ [+2] 🕮 ☺ ★ The energy justice framework serves as an important decision-making tool in order to understand how different principles of justice can inform energy systems and policies. Islar et al. (2017) states that off-grid and micro-scale energy development offers an alternative path to fossil-fuel use and top-down resource management as they democratize the grid and increase marginalized communities' access to renewable energy, education and health care. *Islar et al. (2017)*	**International Cooperation (all goals)** ↑ / ~ [+2,0] 🕮🕮 ☺☺ ★★ International cooperation (in policy) and collaboration (in science) is required for the protection of shared resources. Fragmented approaches have been shown to be more costly. Specific to SDG7, to achieve the targets for energy access, renewables, and efficiency, it will be critical that all countries: (i) are able to mobilize the necessary financial resources (e.g., via taxes on fossil energy, sustainable financing, foreign direct investment, financial transfers from industrialized to developing countries); (ii) are willing to disseminate knowledge and share innovative technologies between each other; (iii) follow recognized international trade rules while at the same time ensuring that the least developed countries are able to take part in that trade; (iv) respect each other's policy space and decisions; (v) forge new partnerships between their public and private entities and within civil society; and (vi) support the collection of high-quality, timely, and reliable data relevant to the furthering their missions. There is some disagreement in the literature on the effect of some of the above strategies, such as free trade. Regarding international agreements, ""no-regrets options"", where all sides gain through cooperation, are seen as particularly beneficial (e.g., nuclear test ban treaties). (Quote from McCollum et al., in review) *McCollum et al. (in review);* Clarke et al. (2009); Eis et al. (2016); Montreal Protocol (1989); New Climate Economy (2015); O'Neill et al. (2017); Ramaker et al. (2003); Riahi et al. (2015); Riahi et al. (2017)
	Increased use of biomass				
	Nuclear/Advanced Nuclear			**Reduce illicit arms trade (16.4)** ↓ [-1] 🕮🕮 ☺☺ ★★ Continued use of nuclear power poses a constant risk of proliferation. IPCC AR5 WG3 (2014); von Hippel et al. (2011, 2012); Sagan (2011); Yim and Li (2013); Adamantiades and Kessides (2009); Rogner (2010).	
	CCS: Bio energy		No literature		
Advanced coal	**CCS: Fossil**	No literature	No literature	No literature	

		5 GENDER EQUALITY INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	10 REDUCED INEQUALITIES INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	16 PEACE, JUSTICE AND STRONG INSTITUTIONS INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	17 PARTNERSHIPS FOR THE GOALS INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Agriculture & Livestock	**Behaviourial response: Sustainable healthy diets and reduced food waste**	No literature	No literature	**Strong and effective institutions and responsive decision making (16.6/ 16.7 / 16.a)** ↑/↓ / [+1,-1] / 🕮🕮🕮 / ☺☺ / ★★ Appropriate incentives to reduce food waste may require some policy innovation and experimentation, but a strong commitment for devising and monitoring them seems essential. (Quoted from Bajželj et al.(2014)) A financial incentive to minimise waste could be created through effective taxation (e.g. by taxing foods with the highest wastage rates, or by increasing taxes on waste disposal) Decision makers should try to integrate agricultural,environmental and nutritional objectives through appropriate policy measures to achieve sustainable healthy diets coupled with reduction in food waste. It is surprising that politicians and policy makers demonstrate little regarding the need of having strategies to reduce meat consumption and to encourage more sustainable eating practices in Netherlands. Bajželj et al.(2014), Lamb et al. (2016), Garnett, T. (2011), Dagevos, H., & Voordouw, J. (2013).	**Resource mobilization and Strenghten Partnership (17.1/17.14)** ↑/↓ / [+1,-1] / 🕮 / ☺ / ★ Decision makers should try to integrate agricultural,environmental and nutritional objectives through appropriate policy measures to achieve sustainable healthy diets coupled with reduction in food waste. It is surprising that politicians and policy makers demonstrate little regarding the need of having strategies to reduce meat consumption and to encourage more sustainable eating practices in Netherlands. Garnett, T. (2011), Dagevos, H., & Voordouw, J. (2013).
	Land based greenhouse gas reduction and soil carbon sequestration	No literature	No literature	**Build effective, accountable and inclusive institutions (16.6/ 16.7/16.8)** ~/↓ / [0,-1] / 🕮🕮🕮 / ☺☺ / ★★ Action is needed throughout the food system for improving governance and producing more food. (Quoted from Godfray, H. C. J., & Garnett, T. (2014)). CSA requires policy intervention for careful adjustment of agricultural practices to natural conditions, a knowledge-intensive approach, huge financial investment etc, so having strong institutional framework is very important. The main source of climate finance for CSA in developing countries is the public sector. Lack of institutional capacity (as a means for securing creation of equal institutions amongsocial groups and individuals) can reduce feasibility of AFOLU mitigation measures in the near future, especially in areas where small-scale farmers or forest users are the mainstakeholders (Quoted from Bustamante, M., (2014)) Godfray, H. C. J., & Garnett, T. (2014),Behnassi, M., Boussaid, M., &Gopichandran, R. (2014),Steenwerth, K. L., (2014), Lipper, L., et al. (2014), Bustamante, M., (2014)	**Resource mobilization and Strenghten multi-stakeholder Partnership** ↑ / [+2] / 🕮🕮🕮 / ☺☺☺ / ★★★ Climate Smart Agriculture requires more careful adjustment of agricultural practices to natural conditions, a knowledge-intensive approach, huge financial investment, and policy and institutional innovation, etc. Besides private investment quality of public investment is also important. (Quoted from Behnassi, M., Boussaid, M., &Gopichandran, R. (2014)). Sources of climate finance for CSA in developing countries, including bilateral donors, multilateral financial institutions besides public sector finance. CSA is committed to new ways of engaging in participatory research and partnerships with producers (Quoted from Steenwerth, K. L., (2014)) Behnassi, M., Boussaid, M., &Gopichandran, R. (2014), Lipper, L., et al. (2014), Steenwerth, K. L., (2014)
	Greenhouse gas reduction from improved livestock production and manure management systems	No literature	No literature	**Responsible decision making (16.7)** ↑ / [+1] / 🕮 / ☺ / ★ To minimize the economic and social cost, policies should target emissions at their source—on the supply side—rather than on the demand side as supply-side policies have lower calorie cost than demand-side policies.The role of livestock system transitions in emission reductions depends on the level of the carbon price and which emissions sector is targeted by the policies (Quoted from Havlík, P., et al. (2014)) Havlík, P., et al. (2014)	**Improve domestic capacity for tax collection (17.1)** ↑ / [+2] / 🕮🕮 / ☺☺ / ★★ The role of livestock system transitions in emission reductions depends on the level of the carbon price and which emissions sector is targeted by the policies (Quoted from Havlík, P., et al. (2014)) Mechanisms for effecting behavioral change in livestock systems need to be better understood by implementing combinations of incentives and taxes simultaneously in different parts of the world (Quoted from Herrero, M., & Thornton, P. K. (2013)) Havlík, P., et al. (2014), Herrero, M., & Thornton, P. K. (2013).

Forest	**Reduced deforestation, REDD+**	**Opportunities for Women (5.1/5.5)**	**Reduced inequality, empowerment and inclusion (10.1/10.2/10.3/10.4)**	**Build effective, accountable and inclusive institutions, Responsible decision making (16.6/ 16.7/16.8)**	**Resource mobilization and Strenghten multi-stakeholder Partnership (17.1/ 17.3/17.5/17.17)**
		↑/↓ [+1,-1] 🕮 ☺ ★	↑ [+2] 🕮 ☺ ★	↑ [+2] 🕮🕮 ☺☺☺ ★★★	↑/↓ [+1,-1] 🕮 ☺ ★
		Women have been less involved in REDD+ initiative (pilot project) design decisions and processes than men. Girls and women have an important role in forestry activities, related to fuel-wood, forest-food and medicine. Their empowerment contributes to sustainable forestry as well as reducing inequality (Quoted from Katila, P., et al. (2017))	Urges developed country to support, through multilateral and bilateral channels, the development of REDD+ national strategies or action plans and implementation (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)). Girls and women have an important role in forestry activities, related to fuel-wood, forest-food and medicine. Their empowerment contributes to sustainable forestry as well as reducing inequality (Quoted from Katila, P., et al. (2017))	Institutional building (National Forest Monitoring Systems, Safeguard Information Systems, etc.), with full and effective participation of all relevant countries (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)). REDD+ actions also deliver non-carbon benefits (e.g. local socioeconomic benefits, governance improvements) (Quoted from Lima, M. B., et al. (2015)) Forest governance is another central aspect in recent studies, including debate on decentralization of forest management, logging concessions in public owned commercially valuable forests, and timber certification, primarily in temperate forests. (Quoted from Bustamante, M et al. (2014))	To provide finance and technology to developing countries to support emissions reductions. Be supported by adequate and predictable financial and technology support, including support for capacity-building. (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)) . Partnerships in the form of significant aid money from, e.g., Norway, other bilateral donors, and the World Bank's Forest Carbon Partnership Facility (FCPF) are forthcoming. (quoted from Andrew, D. (2017)). Estimates of opportunity cost for REDD are very low. Lower costs and/or higher carbon prices could combine to protect more forests, including those with lower carbon content. Conversely, where the cost of action is high, a large amount of additional funding would be required for the forest to be protected.(Quoted from Miles, L., & Kapos, V. (2008)). Forest governance is another central aspect in recent studies, including debate on decentralization of forest management, logging concessions in public owned commercially valuable forests, and timber certification, primarily in temperate forests. (Quoted from Bustamante, M et al. (2014))
		Brown 2011, Larson et al. 2015, (Quoted from Katila, P., et al. (2017))	(Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)), (Quoted from Katila, P., et al. (2017))	(Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)), Lima, M. B., et al. (2015)) , Bustamante, M et al. (2014)	(Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)), Andrew, D. (2017),Miles, L., & Kapos, V. (2008), Bustamante, M et al. (2014)
	Afforestation and reforestation			**Responsible decision making (16.7)**	**Resource mobilization and Strenghten Partnership (17.1/17.14)**
				↑ [+1] 🕮 ☺ ★	↑ [+2] 🕮🕮 ☺☺ ★★
				Land-related mitigation, such as biofuel production, as well as conservation and reforestation action can increase competition for land and natural resources so these measures should be accompanied by complementary policies.(Quoted from Epstein, A. H., & Theuer, S. L. H. (2017))	Financing at the national and international level is required to grow more Seedlings/sapling, restore land, create awareness education factsheets, providing training of local communities regarding the benefits of af-forestation and reforestation. Article 12 of the Kyoto Protocol further sets a Clean Development Mechanism through which countries in Annex I earn 'certified emissions reductions' through projects implemented in developing countries.(Quoted from Montanarella, L., & Alva, I. L. (2015)). Afforestation and reforestation in India are being carried out under various programmes, namely social forestry initiated in the early 1980s, Joint Forest Management Programme initiated in 1990, afforestation under National Afforestation and Eco-development Board (NAEB) programmes since 1992, and private farmer and industry initiated plantation forestry.If the current rate of afforestation and reforestation is assumed to continue, the carbon stock could increase of 11% by 2030 (Quoted from Ravindranath, N. H., Chaturvedi, R. K., & Murthy, I. K. (2008))
				Epstein, A. H., & Theuer, S. L. H. (2017).	Kibria, G. (2015), Montanarella, L., & Alva, I. L. (2015), Ravindranath, N. H., Chaturvedi, R. K., & Murthy, I. K. (2008)
	Behavioural response (responsible sourcing)			**Responsible decision making (16.7)**	**Finance and trade (17.1/17.10)**
				↑ [+1] 🕮🕮 ☺☺ ★★	↑ [+1] 🕮🕮 ☺☺ ★★
				Indonesian factories may seek advantages through non-price competition—perhaps by highlighting decent working conditions or the existence of a union—or to see trade associations or government agencies promoting the country as a responsible sourcing location.(Quoted from Bartley, T. (2010)) In the absence of domestic legal instruments providing incentives to improve sustainability of sourcing, it appears that initiatives to engage the major importing enterprises in developing responsible sourcing practices and policies is a practical approach. Unless initiatives involve all the major importers, they are unlikely to be successful since the high costs associated with accreditation would increase production costs for these firms relative to their competitors.((quoted fromHuang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013)).	Private certification initiatives for wood product and biomass sourcing may extend their schemes with criteria for "leakage" (external GHG effects).Also Recycling of waste wood in pellets is not yet practiced, due to unclear rules in the EU Waste Directive about overseas shipping.(Quoted from Sikkema, R., et al. (2014)) Engagement of Chinese government and private sector stakeholders in supply country sustainability initiatives may be the best way to support this gradual process of improvement. (quoted fromHuang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013)). Although carrying out due diligence in timber sourcing can require considerable internal resources, it may be substantially less of a financial burden than the potential fines and reputational damage resulting from sourcing unknown or controversial timber. (quoted fromHuang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013))
				Bartley, T. (2010), Huang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013)	Sikkema, R., et al. (2014), Huang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013),
Oceans	**Ocean iron fertilization**				
	Blue carbon				
	Enhanced Weathering				

Panel B Part 3

Panel C Part 1

Sector	Option	6 CLEAN WATER AND SANITATION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	12 RESPONSIBLE CONSUMPTION AND PRODUCTION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	14 LIFE BELOW WATER INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	15 LIFE ON LAND INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Industry	**Accelerating energy efficiency improvement**	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-1] 🕮🕮 ☺☺ ★★ Efficiency and behavioural changes in the industrial sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in industrial demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Likewise, reducing material inputs for industrial processes through efficiency and behavioural changes will reduce water inputs in the material supply chains. In extractive industries there can be a trade off with production unless strategically managed.and wastewater, resulting in more clean water for other sectors and the environment. In extractive industries there is trade off unless strategically managed. Behavioral changes in the industrial sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in industrial demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Vassolo and Doell (2005); Fricko et al. (2016); Holland et al. (2016); Nguyen et al (2014)	**Sustainable and Efficient resource (12.2,12.5, 12.6, 12.7 , 12 a)** ↑ [+1] 🕮🕮🕮 ☺☺☺ ★★★ Once started leads to chain of actions within the sector and policy space to sustain the effort. Help in expansion of sustainable industrial production (Ghana) Apeaning and Thollandar (2013), Fernando et al(2017)	No literature	No literature
	Low-carbon fuel switch	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★★ A switch to low-carbon fuels can lead to a reduction in water demand and wastewater if the existing higher-carbon fuel is associated with a higher water intensity than the lower-carbon fuel. However, in some situations the switch to a low-carbon fuel such as e.g., biofuel could increase water use compared to existing conditions if the biofuel comes from a water-intensive feedstock. Hejazi et al. (2015); Song et al. (2016); Fricko et al. (2016)	**Sustainable production (12.2.,12.3, 12.a)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Circular economy instead of liner global economy can achieve climate goal and can help in economic growth through industrialisation which saves on resources, enviornment and supports small, edium and even large industries, can lead to employment generation. so new regulations, incentives, tax regime can help in achieving the goal especially in newly emerging developing cpuntries although applicable for large indsutrialised countries also. Supino et al (2015), Fan et al (2017), Leider et al (2015), Zheng et al (2016), Shi et al (2017), Liu et al (2014), Stahel (2017)		**Sustainable production (15.1,15.5,15.9,15.10)** ↑/↓ [+1,-1] 🕮 ☺ ★ Circular economy instead of liner global economy can achieve climate goal and can help in economic growth through industrialisation which saves on resources, enviornment and supports small, edium and even large industries, can lead to employment generation. so new regulations, incentives, tax regime can help in achieving the goal especially in newly emerging developing cpuntries although applicable for large indsutrialised countries also. Shi et al (2017)
	Decarbonisation/CCS/CCU	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-1] 🕮🕮🕮 ☺ ★★ CCU/S requires access to water for cooling and processing which could contribute to localized water stress. CCS/U process can potentially be configured for increased water efficiency compared to a system without carbon capture via process integration. Meldrum et al. (2013); Fricko et al. (2016); Byers et al. (2016); Brandl et al. (2017)	**Sustainable production and consumption (12.1,12.6 12.a)** ↑ [+2] 🕮 ☺☺☺☺ ★★★★ EPI plants are capital intensive and are mostly operated by multinational with long investment cycles. In developed countries new investments are happening in brown fields , while in developing countries these are in green fields. Collaboration among partners and user demand change, policy change are essential for encouraging these large risky investments. Wesseling, J.H., S. Lechtenböhmer, M. Åhman, L.J. Nilsson, E. Worrell, L. Coenen (2017)		
Residential	**Behaviorial response**	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑ [+2] 🕮🕮 ☺☺☺ ★★★ Behavioral changes in the residential sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in residential demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Bartos and Chester (2014); Fricko et al. (2016) Holland et al. (2016)	**Responsible and sustainable consumption** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Technological improvements alone are not sufficient to increase energy savings. Zhao et al. (2017) findings indicate that building technology and occupant behaviors interact with each other and finally affect energy consumption from home. They found that occupant habits could not take advantage of more than 50 percent of energy efficiency potential allowed by an efficient building. In the electronic segment product obsolescence represents a key challenge for sustainability. Echegaray (2015) discusses the dissonance between consumers' product durability experience, orientations to replace devices before terminal technical failure, and perceptions of industry responsibility and performance. The results from their urban sample survey indicate that technical failure is far surpassed by subjective obsolescence as a cause for fast product replacement. At the same time Liu, Oosterveer, and Spaargaren (2017) suggest that we need to go beyond individualist and structuralist perspectives to analyse sustainable consumption (i.e. combines both human agency paradigm and social structural perspective). *Zhao et al. 2017; Somerfeld, Buys, and Vine, 2017; Isenhour and Feng, 2016; He, Xiong, and Lin, 2016; Hult and Larsson, 2016; Sluisveld et al., 2016; Allen et al., 2015; Sweeney et al., 2013; Webb et al., 2013*		
	Accelerating energy efficiency improvement	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Efficiency changes in the residential sector that lead to reduced energy demand can lead to reduced requirements on energy supply. As water is used to convert energy into useful forms, the reduction in residential demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. A switch to low-carbon fuels in the residential sector can lead to a reduction in water demand and wastewater if the existing higher-carbon fuel is associated with a higher water intensity than the lower-carbon fuel. However, in some situations the switch to a low-carbon fuel such as e.g., biofuel could increase water use compared to existing conditions if the biofuel comes from a water-intensive feedstock. 'As water is used to convert energy into useful forms, energy efficiency is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Subsidies for renewables are anticipated to lead to the benefits and tradeoffs outlined when deploying renewables. Subsidies for renewables could lead to improved water acccess and treatment if subsidies support projects that provide both water and energy services (e.g., solar desalination). Hendrickson et al. (2014); Bartos and Chester (2014); Fricko et al. (2016); Holland et al. (2016); Bartos and Chester (2014); Bilton et al. (2011); Scott et al. (2011); Kumar et al. (2012); Kern et al. (2014); Meldrum et al. (2014), Kim et al (2017)	**Sustainable Practices and Lifestyles (12.6/12.7/12.8)** ↑ [+1] 🕮🕮🕮 ☺☺☺ ★★★ Sustainable practices adopted by public and private bodies in their operations (e.g., for goods procurement, supply chain management, and accounting) create an enabling environment in which renewable energy and energy efficiency measures may gain greater traction. (Quote from McCollum et al., in review) *McCollum et al. (in review);* CDP (2015); European Climate Foundation (2014); Khan et al. (2015); New Climate Economy (2015); Stefan and Paul (2008),		**Reduced deforestation (15.2)** ↑ [+2] 🕮🕮 ☺☺☺ ★★★ Improved cook stove help halting deforestation in rural India Bhojvaid Vasundhara et. al. (2014)
	Improved access & fuel switch to modern low-carbon energy	**Access to improved water and sanitation (6.1/6.2), Water efficiency and pollution** ↑/↓ [+2,-1] 🕮🕮 ☺☺ ★★★ A switch to low-carbon fuels in the residential sector can lead to a reduction in water demand and wastewater if the existing higher-carbon fuel is associated with a higher water intensity than the lower-carbon fuel. However, in some situations the switch to a low-carbon fuel such as e.g., biofuel could increase water use compared to existing conditions if the biofuel comes from a water-intensive feedstock. Improved access to energy can support clean water and sanitation technologies. If energy access is supported with water-inensive energy sources, there could be tradeoffs with water efficiency targets. Hejazi et al. (2015); Song et al. (2016); Fricko et al. (2016); Rao and Pachauri (2017); Cibin et al. (2016)			**Healthy Terrestrial Ecosystems (15.1/15.2/15.4/15.5/15.8)** ↑ [+2] 🕮🕮 ☺☺☺ ★★★ Ensuring that the world's poor have access to modern energy services would reinforce the objective of halting deforestation, since firewood taken from forests is a commonly used energy resource among the poor. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Bailis et al. (2015); Bazilian et al (2011); Karekezi et al. (2012); Winter et al. (2015)

Transport	**Behavioural response**	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑ **[+2]** 🕮🕮 ☺☺ ★★ Behavioral changes in the transport sector that lead to reduced transport demand can lead to reduced transport energy supply. As water is used to produce a number of important transport fuels, the reduction in transport demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Vidic et al. (2013); Tiedemann et al. (2016); Fricko et al. (2016); Holland et al. (2016)	**Ensure Sustainable Consumption& Production patterns (12.3)** ↑ **[+2]** 🕮🕮 ☺☺ ★★ Urban carbon mitigation must consider the supply chain management of imported goods, the production efficiency within the city, the consumption patterns of urban consumers, and the responsibility of the ultimate consumers outside the city. Important for climate policy of monitoring the CO_2 clusters that dominate CO_2 emissions in global supply chains because they offer insights on where climate policy can be effectively directed. (Lin, Hu, Cui, Kang, & Ramaswami, 2015); (Kagawa et al., 2015), Felix et al (2016)		
	Accelerating energy efficiency improvement	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑ **[+2]** 🕮🕮🕮 ☺☺☺ ★★★ Similar to behavioral changes, efficiency measures in the transport sector that lead to reduced transport demand can lead to reduced transport energy supply. As water is used to produce a number of important transport fuels, the reduction in transport demand is anticipated to reduce water consumption and wastewater, resulting in more clean water for other sectors and the environment. Vidic et al. (2013); Tiedemann et al. (2016); Fricko et al. (2016); Holland et al. (2016)	**Sustainable Consumption (12.2/12.8)** ↑ **[+2]** 🕮🕮🕮 ☺☺☺ ★★★ Relational complex transport behavior resulting in significant growth in energy-inefficient car choices, as well as differences in mobility patterns (distances driven, driving styles) and actual fuel consumption between different car segments all affect the non-progress on transport decarbonisation. Consumption choices, and individual lifestyles are situated tied to the form of the surrounding urbanization. Major behavioral changes and emissions reductions requires understanding of this relational complexity, consideration of potential interactions with other policies and the local context and implementation of both command-and-control as well as market-based measures. *(Stanley, Hensher, & Loader, 2011);(Heinonen, Jalas, Juntunen, Ala-Mantila, & Junnila, 2013); (Gallego, Montero, & Salas, 2013); (Aamaas & Peters, 2017); Gössling & Metzler, 2017; Azevedo & Leal, 2017*		
	Improved access & fuel switch to modern low-carbon energy	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ **[+2,-1]** 🕮🕮 ☺☺ ★★★ A switch to low-carbon fuels in the transport sector can lead to a reduction in water demand and wastewater if the existing higher-carbon fuel is associated with a higher water intensity than the lower-carbon fuel. However, in some situations the switch to a low-carbon fuel such as e.g., biofuel could increase water use compared to existing conditions if the biofuel comes from a water-intensive feedstock. Transport electricfication could lead to tradeoffs with water use if the electicity is provided with water intensive power generation. Hejazi et al. (2015); Song et al. (2016); Fricko et al. (2016)	**Ensure Sustainable Consumption& Production patterns (12.3)** ↑ **[+2]** 🕮🕮🕮 ☺☺☺ ★★★ Due to persistent reliance on fossil fuels, it is posited that transport is more difficult to decarbonize than other sectors. This study partially confirms that transport is less reactive to a given carbon tax than the non-transport sectors: in the first half of the century, transport mitigation is delayed by 10–30 years compared to non-transport mitigation. The extent to which earlier mitigation is possible strongly depends on implemented technologies and model structure. *(Pietzcker et al., 2013); (Figueroa, Lah, Fulton, McKinnon, & Tiwari, 2014); IPCC AR5 WG3 (2014); (Creutzig et al., 2015)*		

Panel C Part 1

Panel C Part 2

		6 CLEAN WATER AND SANITATION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	12 RESPONSIBLE CONSUMPTION AND PRODUCTION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	14 LIFE BELOW WATER INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	15 LIFE ON LAND INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Replacing coal	**Non-biomass renewables** solar, wind, hydro	**Water efficiency and pollution prevention (6.3/6.4/6.6) / Access to improved water** ↑/↓ [+2,-2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Wind/solar renewable energy technologies are associated with very low water requirements compared to existing thermal power plant technologies. Widespread deployment is therefore anticipated to lead to improved water efficiency and avoided thermal pollution. However, managing wind and solar variability can increase water use at thermal power plants and can cause poor water quality downstream from hydropower plants. Access to distributed renewables can provide power to improve water access, but could also lead to increased groundwater pumping and stress if mismanaged. Developing dams to support reliable hydropower production can fragment rivers and alter natural flows reducing water and ecosystem quality. Developing dams to support reliable hydropower production can result in disputes for water in basins with up- and down-stream users. Storing water in reservoirs increases evaporation, which could offset water conservation targets and reduce availability of water downstream. However, hydropower plays an important role in energy access for water supply in developing regions, can support water security, and has the potential to reduce water demands if used without reservoir storage to displace other water intensive energy processes. Bilton et al. (2011); Scott et al. (2011); Kumar et al. (2012); Kern et al. (2014); Meldrum et al. (2014); Fricko et al. (2016); Ziv et al. (2012); Grill et al. (2015); Grubert et al. (2016); Fricko et al. (2016); De Stefano et al. (2017)	**Natural Resource Protection (12.2/12.3/12.4/12.5)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★★ Renewable energy and energy efficiency slow the depletion of several types of natural resources, namely coal, oil, natural gas, and uranium. In addition, the phasing-out of fossil fuel subsidies encourages less wasteful energy consumption; but if that is done, then the policies implemented must take care to minimize any counteracting adverse side-effects on the poor (e.g., fuel price rises). (Quote from McCollum et al., in review) *McCollum et al. (in review);* Banerjee et al. (2012); Bhattacharyya et al. (2016); Cameron et al. (2016); Riahi et al. (2012); Schwanitz et al. (2014)	**Marine Economies (14.7) / Marine Protection (14.1/14.2/14.4/14.5)** ↑/↓ [2,-1] 🕮🕮 ☺☺☺ ★★★ Ocean-based energy from renewable sources (e.g., offshore wind farms, wave and tidal power) are potentially significant energy resource bases for island countries and countries situated along coastlines. Multi-use platforms combining renewable energy generation, aqua-culture, transport services and leisure activities can lay the groundwork for more diversified marine economies. Depending on the local context and prevailing regulations, ocean-based energy installations could either induce spatial competition with other marine activities, such as tourism, shipping, resources exploitation, and marine and coastal habitats and protected areas, or provide further grounds for protecting those exact habitats, therefore enabling marine protection. (Quote from McCollum et al., in review). Hydropower disrupts the integrity and connectivity of aquatic habitats and impact the productivity of inland waters and their fisheries *McCollum et al. (in review);* Buck and Krause (2012); Michler-Cieluch et al. (2009); WBGU (2013); Inger et al. (2009); Matthews N., Mccartney M. (2017); Cooke S.J., Allison E.H., Beard T.D., Jr., Arlinghaus R., Arthington A.H., Bartley D.M., Cowx I.G., Fuentevilla C., Leonard N.J., Lorenzen K., Lynch A.J., Nguyen V.M., Youn S.-J., Taylor W.W., Welcomme R.L. (2016)	**Healthy Terrestrial Ecosystems (15.1/15.2/15.4/15.5/15.8)** ↓ [-1] 🕮🕮🕮 ☺☺☺ ★★★ landscape and wildlife impact for wind, habitat impact for hydropower Wiser et al. (2011); Lovich and Ennen (2013); Garvin et al. (2011); Grodsky et al. (2011); Dahl et al. (2012); de Lucas et al. (2012); Dahl et al. (Dahl et al., 2012); Jain et al. (2011); Kumar et al. (2011); Alho (2011); Kunz et al. (2011); Smith et al. (2013); Ziv et al. (2012); Matthews N., Mccartney M. (2017)
	Increased use of biomass	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-2] 🕮🕮🕮🕮 ☺☺ ★★★★ Biomass expansion could lead to increased water stress when irrigated feedstocks and water-intensive processing steps are used. Bioenergy crops can alter flow over land and through soils as well as require fertilizer and this can reduce water availability and quality. Planting bioenergy crops on marginal lands or in some situations to replace existing crops can lead to reductions in soil erosion and fertilzer inputs, improving water quality. Hejazi et al. (2015), Bonsch et al. (2016), Cibin et al. (2016); Song et al. (2016); Gao et al. (2017); Taniwaki (2017); Woodbury et al. (2017); Griffiths et al. (2017); Ha et al. (2017)			**Healthy Terrestrial Ecosystems (15.1/15.2/15.4/15.5/15.8)** ↑/↓ [+1,-2] 🕮 ☺☺☺ ★★ Protecting terrestrial ecosystems, sustainably managing forests, halting deforestation, preventing biodiversity loss and controlling invasive alien species could potentially clash with renewable energy expansion, if that would mean constraining large-scale utilization of bioenergy or hydropower. Good governance, cross-jurisdictional coordination, and sound implementation practices are critical for minimizing trade-offs. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Smith et al. (2010); Smith et al. (2014); Acheampong M., Ertem F.C., Kappler B., Neubauer P. (2017)
	Nuclear/Advanced Nuclear	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★★ Nuclear power generation requires water for cooling which can lead to localized water stress and the resulting cooling effluents can cause thermal pollution in rivers and oceans Webster et al. (2013); Fricko et al. (2016); Raptis et al. (2016); Holland et al. (2016)			**Healthy Terrestrial Ecosystems (15.1/15.2/15.4/15.5/15.8)** ↓ [-1] 🕮🕮 ☺☺ ★★ Safety and waste concerns, uranium mining and milling IPCC AR5 WG3 (2014); Visschers and Siegrist (2012); Greenberg (2013a); Kim et al.
	CCS: Bio energy	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-2] 🕮🕮 ☺ ★★ CCU/S requires access to water for cooling and processing which could contribute to localized water stress. However, CCS/U process can potentially be configured for increased water efficiency compared to a system without carbon capture via process integration. The bioenergy component adds the additional tradeoffs associated with bioenergy use. Meldrum et al. (2013); Fricko et al. (2016); Byers et al. (2016); Brandl et al. (2017)			**Healthy Terrestrial Ecosystems (15.1/15.2/15.4/15.5/15.8)** ↑/↓ [+1,-2] 🕮 ☺☺☺ ★★ Protecting terrestrial ecosystems, sustainably managing forests, halting deforestation, preventing biodiversity loss and controlling invasive alien species could potentially clash with renewable energy expansion, if that would mean constraining large-scale utilization of bioenergy or hydropower. Good governance, cross-jurisdictional coordination, and sound implementation practices are critical for minimizing trade-offs. (Quote from McCollum et al., in review) *McCollum et al. (in review);* Smith et al. (2010); Smith et al. (2014); Acheampong M., Ertem F.C., Kappler B., Neubauer P. (2017)
Advanced coal	**CCS: Fossil**	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-2] 🕮🕮🕮 ☺ ★★ CCU/S requires access to water for cooling and processing which could contribute to localized water stress. However, CCS/U process can potentially be configured for increased water efficiency compared to a system without carbon capture via process integration. Coal mining to support clean coal CCS will negatively impact water resources due to the associated water demands, wastewater and land-use requirements. Meldrum et al. (2013); Fricko et al. (2016); Byers et al. (2016); Brandl et al. (2017)		s	

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Sector	Measure	6 CLEAN WATER AND SANITATION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	12 RESPONSIBLE CONSUMPTION AND PRODUCTION INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	14 LIFE BELOW WATER INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	15 LIFE ON LAND INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Agriculture & Livestock	**Behaviourial response: Sustainable healthy diets and reduced food waste**	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-1] 📖📖📖📖 ☺☺☺☺ ★★★★ Reduced food waste avoids direct water demand and wastewater for crops and food processing, and avoids water used for energy supply by reducing agricultural, food processing and waste management energy inputs. Healthy diets will support water efficiency targets if the shift towards healthy foods results in food supply chains that are less water intensive than the supply chains supporting the historical dietary pattern. Khan et al. (2009); Bajzelj et al. (2014); Ran et al. (2016); Villarroel Walker et al. (2014); Mekonnen et al. (2013); Bajzelj et al. (2014),Ingram, J. (2011), Kummu et al. (2012), Tilman, D. & Clark, M. (2014)	**Ensure Sustainable Consumption& Production patterns, Sustainable** ↑ [+2] 📖📖📖📖 ☺☺☺☺ ★★★★ **Reduce loss and waste in food systems**, processing, distribution and by changing household habits. To reduce environmental impact of livestock both production and consumption trends of this sector should be traced.Livestock production needs to be intensified in a responsible way (i.e., be made more efficient in the way that it uses natural resources) Wasted food represents a waste of all the emissions generated during the course of producing and distributing .that food. Mitigation measures include:Eat no more than needed to maintain a healthy body weight, Eat seasonal, robust, field grown vegetables rather than protected, fragile foods prone to spoilage and requiring heating and lighting in their cultivation, refrigeration stage, Consume fewer foods with low nutritional value e.g. Alcohol, tea, coffee, chocolate, bottled water (These foods are not needed in our diet and need not be produced), Shop on foot or over the internet (Reduced energy use).Reduction in food waste will not only pave the path for sustainable production but will also help in achieving sustainable consumption (Quoted from Garnett, T. (2011)) Reduce meat consumption to encourage more **sustainable eating practices.** Beddington et al. (2012), Steinfeld, H., & Gerber, P. (2010),Bajželj et al.(2014),Ingram, J. (2011), Garnett, T. (2011), West et al.(2014), Kummu et al. (2012),Hedenus, F. (2014), Stehfest, E. (2009),Dagevos, H., & Voordouw, J. (2013), Bellarby et al. (2013),Tilman, D. & Clark, M. (2014), Smith, P. (2013), Lamb et al. (2016), Hiç et al. 2016)		**Conservation of Biodiversity and restoration of land (15.1/ 15.5/15.9)** ↑ [+1] 📖 ☺ ★ Reducing food waste has secondary benefits like protecting soil from degradation, and decreasing pressure for land conversion into agriculture and thereby protecting biodiversity. The agricultural area that becomes redundant through the dietary transitions can be used for other agricultural purposes such as energy crop production, or will revert to natural vegetation.A global food transition to less meat, or even a complete switch to plant-based protein food have a dramatic effect on land use. Up to 2,700 Mha of pasture and 100 Mha of cropland could be abandoned (Quoted from Stehfest et al. (2009)) Kummu et al. (2012), Stehfest et al. (2009)
	Land based greenhouse gas reduction and soil carbon sequestration	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-1] 📖📖📖 ☺☺ ★★★ Soil carbon sequestration can alter the capacity of soils to store water, which impacts the hydrological cycle and could be positive or negative from a water perspective, dependent on existing conditions. Climate Smart Agriculture enrich linkages across sectors including management water resources. Minimum tillage systems have been reported to reduce water erosion and thus sedimentation of water courses. (Quoted from Bustamante, M., (2014)) Smith (2016),Behnassi, M., Boussaid, M., &Gopichandran, R. (2014), Bustamante, M., (2014)	**Ensure Sustainable Production patterns(12.3)** ↑ [+1] 📖 ☺ ★ Yield of millet or sorghum can double as compared with unimproved land more than 1 tonne per hectare due to sustainable intensification. An integrated approach to safe applications of both conventional and modern agricultural biotechnologies will contribute to increased yield.(Quoted from Lakshmi et. al (2015)) Campbell et al. (2014), Lakshmi et. al (2015)		**Conservation of Biodiversity and restoration of land (15.1/ 15.5/15.9)** ↑/↓ [+1,-1] 📖📖📖 ☺☺☺ ★★★ Agricultural intensification can promote conservation of biological diversity by reducing deforestation, and by rehabilitation and restoration of biodiverse communities on previously developed farm or pasture land. However, planting monocultures on biodiversity hot spots can have adverse side-effects, reducing biodiversity. Genetically modified crops reduces demand for cultivated land. Adoptation of integrated landscape approaches can provide various ecosystem services. CSA enrich linkages across sectors including management of land and bio-resources. Land sparing has the potential to be beneficial for biodiversity, including for many species of conservation concern, but benefits will depend strongly on the use of spared land. In addition, high yield farming involves trade-offs and is likely to be detrimental for wild species associated with farmland.(Quoted from Lamb, A., et al. (2016)) IPCC WGIII, 2014, Lamb, A., et al. (2016), Lybbert T, Sumner D (2010), Harvey, C. A., et al. (2014), Behnassi, M., Boussaid, M., &Gopichandran, R. (2014), Lamb, A., et al. (2016)
	Greenhouse gas reduction from improved livestock production and manure management systems	**Water use efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-1] 📖📖📖 ☺☺☺ ★★★ Livestock efficiency measures are expected to reduce water required for livestock systems as well as associated livestock wastewater flows. However, efficiency measures that include agricultural intensification could increase water demands locally, leading to increased water stress if the intensification is mismananged. Scenarios where zero human-edible concentrate feed is use for livestocks freshwater use reduces by 21%. Mekonnen et al. (2013); Kong et al. (2016); Ran et al. (2016), Schader, C., et al. (2015)	**Ensure Sustainable Production patterns and restructing taxation(12.3/12c)** ↑ [+1] 📖📖 ☺☺ ★★ In the future, many developed countries will see a continuing trend in which livestock breeding focuses on other attributes in addition to production and productivity, such as product quality, increasing animal welfare, disease resistance (Quoted from Thornton, P. K. (2010)) . Diet composition and quality are key determinants of the productivity and feed-use efficiency of farm animals (Quoted from Herrero, M., et al. (2013)), Mechanisms for effecting behavioral change in livestock systems need to be better understood by implementing combinations of incentives and taxes simultaneously in different parts of the world (Quoted from Herrero, M., & Thornton, P. K. (2013)). Reducing the amount of human-edible crops that are fed to livestock represents a reversal of the current trend of steep increases in livestock production, and especially of monogastrics, so would require drastic changes in production and consumption (Quoted from Schader, C., et al. (2015)) Thornton, P. K. (2010), Herrero, M., et al. (2013), Herrero, M., & Thornton, P. K. (2013)., Schader, C., et al. (2015)		**Restoration of land (15.1)** ↑ [+1] 📖 ☺ ★ Grasslands Are Precious, but improved management is required as grass accounts for close to 50% of feed use in livestock systems (Quoted from Herrero, M., et al. (2013)). The scenario with 100% reduction of Food-Competing-Feedstuffs resulted in a 335 Mha decrease in arable land area, which corresponds to a decrease of 22% in arable and 7% in the total agricultural area. (Quoted from Schader, C., et al. (2015)) Herrero, M., et al. (2013), Schader, C., et al. (2015)

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Forest	Reduced deforestation, REDD+	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+1,-1] 🕮🕮 ☺☺ ★★ Forest management alters the hydrological cycle which could be positive or negative from a water perspective and is dependent on existing conditions. Conservation of ecosystem services—indirectly could help countries maintain watershed integrity Forests provide sustainable and regulated provision and helps in water purification Bonsch et al. (2016); Griffiths et al. (2016); Gao et al (2017), Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008), Kibria, G. (2015), Katila, P., et al. (2017)	**Ensure Sustainable consumption(12.3)** ↑ [+1] 🕮 ☺ ★ Reduce the human pressure on forests, including actions to address drivers of deforestation(Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)) (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017))		**Conservation of Biodiversity, sustainability of terrestrial ecosystems** ↑ [+1] 🕮🕮🕮 ☺☺☺ ★★★ Policies and programs for reducing deforestation and forest degradation, for rehabilitation and restorationof degraded lands can promote conservation of biological diversity. Reduce the human pressure on forests, including actions to address drivers of deforestation IPCC WGIII, 2014, Lima, M. B., et al. (2015). Miles, L., & Kapos, V. (2008), Katila, P., et al. (2017), Turpie, Warr, & Ingram, (2015),Epstein, A. H., & Theuer, S. L. H. (2017).
	Afforestation and reforestation	**Enhance water quality (6.3)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★★ Similar to REDD+, forest management alters the hydrological cycle which could be positive or negative from a water perspective and is dependent on existing conditions. Forest landscape restoration can have a large impact water cycles. Strategic placement of tree belts in lands affected by dryland salinity can remediate the affected lands by modifying landscape water balances.Watershed scale reforestation can result in the restoration of water quality. Kibria, G. (2015), Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008), Lamb, A., et al. (2016) , Bustamante, M., et al. (2014)		**Marine Economies (14.7) / Marine Protection and income generation** ↑ [+2] 🕮 ☺ ★ Mangroves would help to enhance fisheries, tourism business Kibria, G. (2015).	**Conservation of Biodiversity and restoration of land (15.1/ 15.5/15.9)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Identified large amounts of land (749 Mha) globally as biophysically suitable and meeting the CDM-AR eligibility criteria(Quoted from Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008)). Forest landscape restoration can conserve biodiversity and reduce land degradation. Mangroves reduce impacts of disasters (cyclones/storms/floods) acting as live seawalls,enhance forest resources /biodiversity. Forest loss goal can conserve/ restore 3.9 – 8.8 m ha / year average, 77.2 – 176.9 m ha in total and 7.7 – 17.7 m ha / year in 2030 of forest area by 2030 (Quted from Wolosin, M. (2014)) Forest and biodiversity conservation, protected area formation, and forestry-based afforestation are practices enhance resilience of forest ecosystems to climate change (IPCC, 2014b). Strategic placement of tree belts in lands affected by dryland salinity can remediate the affected lands by modifying landscape water balances and protect livestock.It can restore biologically diverse communities on previously developed farmland (Quoted from Bustamante, M., et al. (2014)). Large-scale restoration is likely to benefit ecosystem service provision, including recreation biodiversity conservationand flood mitigation Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008),Kibria, G. (2015), Wolosin, M. (2014), (IPCC, 2014b), Epstein, A. H., & Theuer, S. L. H. (2017), Bustamante, M., et al. (2014), Lamb et al. 2016
	Behaviourial response (responsible sourcing)	**Water efficiency and pollution prevention (6.3/6.4/6.6)** ↑/↓ [+2,-1] 🕮 ☺☺ ★★ Responsible sourcing will have co-benefits for water efficiency and pollution prevention if the sourcing strategies incorporate water metrics. There is a risk that shifting supply sources could lead to increased water use in another part of the economy. van Oel et al. (2012); Launiainen et al. (2014)			**Sustainability manage forest (15.2/15.3)** ↓ [-1] 🕮 ☺ ★ At the macro level, forest certification has done little to stem the tide of forest degradation, conversion of forest land to agriculture, and illegal logging—all of which remain serious threats to Indonesian forests (Quoted from Bartley, T. (2010)). Bartley, T. (2010)
Oceans	Ocean iron fertilization			**Nutrient Pollution, Ocean Acidification, Fish Stocks, MPAs, SISD** ↑/↓ [+1,-2] 🕮🕮🕮 ☺☺ ★ OIF could exacerbate or reduce nutrient pollution, increase the likelihood of mid-water deoxygenation, increases ocean acidification, might contribute to the rebuilding of fish stocks in producing plankton, generating therefore benefits for SISD, but might be in conflict with designing MPAs. Gnanadesikan et al. (2003), Jin and Gruber (2003), Denman (2008), Smetacek and Naqvi (2008), Lampitt et al. (2008), Oschlies et al. (2010), Güssow et al. (2010), Trick et al. (2010), Williamson et al. (2012)	
	Blue carbon	**Integrated water resources management (6.3/6.5)** ↑ [+2] 🕮 ☺ ★ Development of blue carbon resources (coastal and marine vegetated ecosystems) can lead to coordinated management of water in coastal areas. Vierros et al. (2013)		**Ocean Acidification, Nutrient Pollution (14.3, 14.1)** ↑/~ [+2,0] 🕮 ☺☺☺ ★★★ Mangroves could buffer acidification it their immediate vicinity; Seaweeds have not been able to mitigate the effect on ocean foraminifera Sippo et al. (2016); Pettit et al. (2015)	**conservation of Biodiversity and restoration of land (15.1, 15.2, 15.3, 15.4, 15.9)** ↑ [+3] 🕮 ☺☺☺☺ ★★★★ average difference of 31 mm per year in elevation rates between areas with seagrass and unvegetated areas (case study areas Scotland, Kenya, Tanzania and Saudi Arabia); Potouroglou et al (2017); Alongi (2012)
	Enhanced Weathering			**Ocean Acidification, Nutrient Pollution (14.3, 14.1)** ↑/↓ [+2,-1] 🕮🕮🕮 ☺☺☺ ★★★ Enhanced weathering (either by spreading lime or quicklime (in combination with CCS) over the ocean or olivine at beaches or the catchment area of rivers) opposes ocean acidification. "End-of-century ocean acidification is reversed under RCP4.5 and reduced by about two-thirds under RCP8.5; additionally, surface ocean aragonite saturation state, a key control on coral calcification rates, is maintained above 3.5 throughout the low latitudes, thereby helping maintain the viability of tropical coral reef ecosystems (Tick et al. 2010)" However, also marine biology would be affected, in particular if spreading olivine is used which actually works rather like ocean (iron) fertilization. Köhler et al. (2010), Hartmann et al. (2013), Köhler et al. (2013), Paquay und Zeebe (2013), Taylor et al. (2015), Smith et al. (2015)	**Protect inland freshwater systems (14.1)** ↓ [-1] 🕮 ☺ ★ Olivine can contain toxic metals such as nickel which could accumulate in the environment or disrupt the local ecosystem by changing the pH of the water (in case of spreading in the catchment area of rivers). Hartmann et al. (2013).

Panel C Part 3

Panel D Part 1

		7 AFFORDABLE AND CLEAN ENERGY INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	8 DECENT WORK AND ECONOMIC GROWTH INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	11 SUSTAINABLE CITIES AND COMMUNITIES INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Industry	**Accelerating energy efficiency improvement**	**Energy savings (7.1, 7.3, 7a, 7b)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺ ★★★★ Energy Efficiency lead to reduced relatively less energy demand and hence energy supply and energy security, reduces import. Positive rebound effect can raise demand but to a very less extent due to low rebound effect in industry sector in amny countries and by appropriate mix of indsutries (china) can maintain energy savings gain. supplying surplus energy to cities is also happening.proving mtenance culture, Switching off idle equipment help saving energy (e.g Ghana) Apeaning and Thollandar (2013), Zhang et al (2015), IPCC WGIII (2014), Chakravarty et al. (2013), karner et al(2015) , Fernando et al (2017), Li et al (2016), Wesseling et al 2017	**Reduces Unemployment (8.2,8.3,8.4,8.5, 8.6)** ↑ [+1] 🕮🕮 ☺☺☺ ★★★ Unemployment rate reduction from 25% to 12% in south africa. Enhances firm productivity and technical and managerial capapcity of the employees Altieri et al (2016), Fernando et al(2017)	**Infrastructure renewal (9.1/9.3/9.5,9a)** ↑ [+1] 🕮🕮 ☺☺ ★★ Transitioning to a more renewably-based energy system that is highly energy efficient is well aligned with the goal of upgrading energy infrastructure and making the energy industry more sustainable. In the reverse direction, infrastructure upgrades in other parts of the economy, such as modernized telecommunication networks, can create the conditions for a successful expansion of renewable energy and energy efficiency measures (e.g., smart-metering and demand-side management). (Quote from McCollum et al., in review) *Apeaning and Thollandar (2013), McCollum et al. (in review);* Bhattacharyya et al. (2016); Goldthau (2014); Meltzer (2016); Riahi et al. (2012)	**Sustainable cities (15.6,15.8,15.9)** ↑ [+2] 🕮 ☺ ★ Industries are becoming supplier of energy, waste heat , water, to neighbourial human settlements and hence reduced primary energy demand also and make towns and cities grow sustainably Karner et al (2015)
	Low-carbon fuel switch	**Sustainable and modern (7.2, 7.a)** ↑ [+2] 🕮 ☺ ★ Industries are becoming supplier of energy, waste heat , water, roof tops for solar energy generation and hence reduced primary energy demand Karner et al (2015)	**Economic growth with decent employment (8.1,8.2,8.3,8.4)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Circular economy instead of liner global economy can achieve climate goal and can help in economic growth through industrialisation which saves on resources, enviornment and supports small, edium and even large industries, can lead to employment generation. so new regulations, incentives, tax regime can help in achieving the goal. Supino et al (2015),Fan et al (2017), Leider et al (2015), Zheng et al (2016), Shi et al (2017), Liu et al (2014), Stahel (2017)	**Innovation and new infrastrcutture (9.2,9.3,9.4,9.5.9.a)** ↑ [+2] 🕮🕮🕮🕮 ☺☺☺☺ ★★★★ Circular economy instead of liner global economy is helping new innovation and infrastrcuture can achieve climate goal and can help in economic growth through industrialisation which saves on resources, enviornment and supports small, edium and even large industries, can lead to employment generation. so new regulations, incentives, tax regime can help in achieving the goal. Supino et al (2015),Fan et al (2017), Leider et al (2015), Zeng et al (2016), Shi et al (2017), Liu et al (2014), Stahel (2017)	**Sustainable cities (15.6,15.8,15.9)** ↑ [+2] 🕮 ☺ ★ Industries are becoming supplier of energy, waste heat , water, roof tops for solar energy generation and supply to neighbourial human settlements and hence reduced primary energy demand also and make towns and cities grow sustainably Karner et al (2015)
	Decarbonisation/CCS/CCU	**Affordable and sustainable energy sources** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★ CCS for EPIs can be incremental but needs additional space and can need additional energy sometimes compensating for higher efficiency otherwise, Recirculating Blast R Furnace & CCS for iron steel means high energy demand, electric melting in glass can mean higher electricity prices, in paper industry new separation and drying technologies are key to reduce the energy intensity, allowing for carbon neutral operation in the future , bio refineries can reduce petrorefineries, DRI in iron and steel with H2 encourages innovation in hydrogen infrastructure, in chemicals industry also encourage renewable electricity and hydrogen, biobased polymers can increase biomass price. Wesseling, J.H., S. Lechtenböhmer, M. Åhman, L.J. Nilsson, E. Worrell, L. Coenen (2017)	**Progressively decouple growth from env degradation (8.1, 8.2, 8.4)** ↑ [+2] 🕮🕮 ☺☺☺ ★★★ EPI s are important players for economic growth. Deep decarbonisation of EPI through radical innovation is consistent with well below 2C scenario Wesseling, J.H., S. Lechtenböhmer, M. Åhman, L.J. Nilsson, E. Worrell, L. Coenen (2017) , Åhman M et al 2016, Denis-Ryan A et al 2016	**Innovation and new infrastrcutture (9.2,9.4,9.5)** ↑ [+2] 🕮 ☺☺☺☺ ★★★★ Deep decarbonisation through radical technological change in EPI will lead to radical innovations e.g.,in completely changing industries' innovation stratgey, plant and equipment , skill, production technique, design and so on. Radical CCS will need new infrastructure to transport CO2. Wesseling, J.H., S. Lechtenböhmer, M. Åhman, L.J. Nilsson, E. Worrell, L. Coenen (2017), Åhman M et al 2016, Denis-Ryan A et al 2016	
Residential	**Behaviorial response**	**Saving energy, Improvement in Energy efficiency (7.3, 7a, 7b)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Lifestyle change measures and adoption behavior affect residential energy use and implementation of efficient technologies as residential HVAC systems. Also social influence can drive energy savings in users exposed to energy consumption feedback. Effect of autonomous motivation on energy savings behaviour is greater than that of other more established predictors such as intentions, subjective norms, perceived behavioural control and past behaviour. Use of a hybrid engineering approach using social psychology and economic behaviour models are suggested for Residential peak electricity demand response. However, some take back in energy savings can happen due to rebound effect unless managed appropriately or accounted for welfare improvement. Adjusting Thermostat helps in saving energy . *Yue, Yang, and Chen , 2013; Somerfeld, Buys, and Vine, 2017; Zhao et al. (2017); de Koning et al., 2016; Isenhour and Feng, 2016; Sluisveld et al., 2016; Noonan et al. 2015; Allen et al., 2015; Jain et al. 2013a; Hori et al., 2013; Sweeny et al. 2013; Webb et al., 2013; Huebner et al. (2013); Gyamfi, Krumdieck, and Urmee (2013), Chakravarty et al (2013), Santarius (2016), Song et al (2016).Anda et al (2014)*	**Progressively improve resource efficiency (8.4)** ↑ [+2] 🕮 ☺ ★ Behaviourial change programmes help in sustaining energy savings through new infrastructuer develoment Anda et al (2014)	**Innovation and new infrastrcutture (9.2,9.4,9.5)** ↑ [+2] 🕮 ☺ ★ Adoption of smart meter and smart grid following community based social marketing help in infrastructure expansion Anda et al 2014	
	Accelerating energy efficiency improvement	**Increase in energy savings (7.3)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ There is high agreement among researchers based on large number of evidence across various countries that energy efficiency improvement reduce energy consumption and hence lead to energy savings. Efficient cookstove saves bioenergy. Efficient cookstove saves bioenergy. *Berrueta et al., 2017; Cameron, Taylor, and Emmett, 2015; Liddell and Guiney, 2015; McLeod, Hopfe, and Kwan, 2013; Noris et al. 2013; Salvalai et al. 2017; Yang, Yan, and Lam, 2014; Kwong, Adam, and Sahari, 2014; Holopainen et al., 2014, Bhojvaid Vasundhara et al. (2014), Kim et al (2017)*	**Employment Opportunities (8.2/8.3/8.5/8.6) / Strong Financial Institutions (8.10)** ↑/↓ [+2,-1] 🕮🕮 ☺ ★★ Deploying renewables and energy-efficient technologies, when combined with other targeted monetary and fiscal policies, can help spur innovation and reinforce local, regional, and national industrial and employment objectives. Gross employment effects seem likely to be positive; however, uncertainty remains regarding the net employment effects due to several uncertainties surrounding macro-economic feedback loops playing out at the global level. Moreover, the distributional effects experienced by individual actors may vary significantly. Strategic measures may need to be taken to ensure that a large-scale switch to renewable energy minimizes any negative impacts on those currently engaged in the business of fossil fuels (e.g., government support could help businesses re-tool and workers re-train). To support clean energy and energy efficiency efforts, strengthened financial institutions in developing country communities are necessary for providing capital, credit, and insurance to local entrepreneurs attempting to enact change. (Quote from McCollum et al., in review) *Berrueta et al. (2017); McCollum et al. (in review); Aether (2016); Babiker and Eckaus (2007); Bertram et al. (2015); Blyth et al. (2014); Borenstein (2012); Creutzig et al. (2013); Clarke et al. (2014); Dechezleprêtre and Sato (2014); Dinkelman (2011); Fankhauser et al. (2008); Ferroukhi et al. (2016); Frondel et al. (2010); Gohin (2008); Guivarch et al. (2011); Jackson and Senker (2011); Johnson et al. (2015)*		**Urban Environmental Sustainability (11.3/11.6, 11.b,11.c)** ↑ [+2] 🕮🕮 ☺☺☺ ★★★★ Renewable energy technologies and energy-efficient urban infrastructure solutions (e.g., public transit) can also promote urban environmental sustainability by improving air quality and reducing noise. Efficient transportation technologies powered by renewably-based energy carriers will be a key building block of any sustainable transport system. (Quote from McCollum et al., in review), Green buildings help in sainable construction. *McCollum et al. (in review);* Bongardt et al. (2013); Creutzig et al. (2012); Grubler and Fisk (2012); Kahn Ribeiro et al. (2012); Raji et al. (2015); Riahi et al. (2012), Kim et al (2017)
	Improved access & fuel switch to modern low-carbon energy	**Meeting energy demand** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Renewable energies could potentially serve as the main source of meeting energy demand in the rapidly growing developing country cities. Ali e et al. (2015) estimated the potential of solar, wind and biomass renewable energy options to meet part of the electrical demand in Karachi, Pakistan. *Creutzig et al., 2014; Connolly et al., 2014; Islar et al, 2017; Mittlefehldt, 2016; Bilgily et al., 2017; Ozturk et al., 2017; Mahony and Dufour, 2015; Byravan et al., 2017; Abanda et al. 2016; Peng and Lu, 2013; Pietzcker, 2013; Ali et al. (2015); Li, Yang, and Lam, 2014; Yanine and Sauma, 2013; Pode, 2013; Zulu and Richradson (2013)*	**Sustainable economic growth and employment** ↑ [+2] 🕮🕮 ☺☺☺ ★★ Creutzig et al. 2014 assessed the potential for renewable energies in the European region. They found that a European energy transition with a high-level of renewable energy installations in the periphery could act as an economic stimulus, decrease trade deficits, and possibly have positive employment effects. Provision of energy access can play a critical enabling role for new productive activities , livelihoods and employment. Reliable access to modern energy services can have an important influence on productivity and earnings. (Quote from McCollum et al., in review) *Creutzig et al., 2014; Byravan et al., 2017; Ali et al., 2015; McCollum et al. (in review); Bernard and Torero (2015); Chakravorty et al. (2014); Grogan and Sadanand (2013); Pueyo et al. (2013); Rao (2013);*		**Housing and Transport (11.1/11.2)** ↑ [+3] 🕮🕮🕮 ☺☺☺ ★★★★ Ensuring access to basic housing services implies that households have access to modern energy forms. (Quote from McCollum et al., in review), roof top solar in Macau make cities sustainable with transport. *McCollum et al. (in review);* Bhattacharya et al. (2016); UN (2016c), Song et al (2016)

Transport	**Behavioural response**	**Energy savings (7.3, 7a, 7b)** ↑ [+2] 🕮🕮 ☺☺ ★★ Behavioural response will reduce the volume of transport needs and, by extension, energy demand. Ahmad S., Puppim de Oliveira J.A., 2016; Figueroa M.J., Ribeiro S.K., 2013	**Promote Sustained, inclusive economic growth (8.3)** ↓ [-2] 🕮🕮🕮 ☺☺☺ ★★★ Policy contradictions (e.g. standards, efficient technologies leading to increased electricity prices leading the poor to switch away from clean(er) fuels); unintended outcomes (e.g.redistribution of income generated by carbon taxes) results in contradiction to the primary aims of (productive) job creation and poverty alleviation, and in trade-offs between mitigation adaptation and development policies. Detailed assessment of consequences of mitigation policies requires developing methods and reliable evidence to enable policymakers to more systematically identify how different social groups may be affected by the different available policy options. (Klausbruckner, Annegarn, Henneman, & Rafaj, 2016); (Lucas & Pangbourne, 2014);(Suckall, Tompkins, & Stringer, 2014)		**Make cities & Human settelments inclusive, safe, resilient (11.2)** ↑ [+2] 🕮🕮 ☺☺ ★★ Climate change threatens to worsen poverty, therefore pro-poor mitigation policies are needed to reduce this threat; for example investing more and better in infrastructure by leveraging private resources and using designs that account for future climate change and the related uncertainty Hallegate et al, 2015, Ahmad S., Puppim de Oliveira J.A., 2016
	Accelerating energy efficiency improvement	**Energy savings (7.3, 7a, 7b)** ↑ [+2] 🕮 ☺ ★ Accelrating efficiency in tourism transport reduces energy demand (china) Shukxin et al (2016)	**Promote Sustained, inclusive economic growth (8.3)** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★ Significant opportunities to slow travel growth and improve efficiency exist and, similarly, alternatives to petroleum exist but have different characteristics in terms of availability, cost, distribution, infrastructure, storage, and public acceptability. Production of new technologies, fuels and infrastructure can favour economic growth, however, efficient financing of increased capital spending and infrastructure is critical. **(Gouldson et al., 2015)**;(Karkatsoulis, Siskos, Paroussos, & Capros, 2016)	**Build Resilient Infrastructure (9.1)** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★ Combining promotion of mass transportation, integrating train lines, a tram line, BRTs, gondola lift systems, a bicycle-sharing systems and hybrid buses and telecommuting, reduce traffic and significantly contribute to meet climate targets a comprehensive package of complementary mitigation options is necessary for deep and sustained emission reductions . In sweden public bus fleet is aiming more towards decarbonisation compared to efficiency **(Dulac, 2013)**(Aamaas & Peters, 2017); (Martínez-Jaramillo, Arango-Aramburo, Álvarez-Uribe, & Jaramillo-Álvarez, 2017), Xylia et al (2017)	**Make cities sustainable (11.2,11.3)** ↑ [+2] 🕮 ☺ ★ Two most important elements of making cities sustianble are efficient building and transport (case of Macau) Song et al (2016)
	Improved access & fuel switch to modern low-carbon energy	**Increase share of renewable (7.2)** ↑ [+2] 🕮🕮 ☺☺ ★★ Biofuel increase share of renewables but can perform poorly if too many countries increase their use of biofuel, whereas electrification performs best when many other countries implement this technology. The strategies are not mutually exclusive and simultaneous implementation of some provides synergies for national energy security. Therefore, important to consider result of material and contextual factors that co-evolve.Electric vehicles using electricity from renewables or low carbon sources combined with e-mobility options such as trolleybuses, metros, trams and electro buses, as well as promote walking and biking, especially for short distances need consideration *(Månsson, 2016), Ajanovic (2015), Wolfram et al 2017, Alahakoon, (2017)*	**Promote Sustained, inclusive economic growth (8.3)** ↑/↓ [+2,-2] 🕮🕮 ☺☺ ★★ the decarbonisation of the freight sector tends to occur in the second part of the century and that the sector decarbonises by a lower extent than the rest of the economy. Decarbonising road freight on a global scale remains a challenge even when notable progress in biofuels and electric vehicles has been accounted for. *(Carrara & Longden, 2016); (F. Creutzig et al., 2015);IPCC AR5 WG3 (2014)*	**Help building inclusive infratsructure (9.1, 9.a)** ↑ [+2] 🕮🕮🕮 ☺☺☺ ★★★ Lack of appropriate infrastructure lead to limited access to job fro urban poor (africa, Latin America, India) *(Gouldson et al., 2015); (Figueroa, Fulton, & Tiwari, 2013), (Vasconcellos & Mendonça, 2016), Lall et al 2017*	**Make cities & Human settelments inclusive, safe, resilient (11.2)** ↑ [+2] 🕮🕮 ☺☺ ★★ in rapidly growing cities, the carbon savings from investments at scale, in cost-effective low-carbon measures could be quickly overwhelmed – in as little as 7 years – by the impacts of sustained population and economic growth, highlighting the need to build capacities that enable the exploitation not only of the economically attractive options in the short term but also of those deeper and more structural changes that are likely to be needed in the longer term. With hybrid electric vehicles, plug-in electric vehicles there is emerging new concepts in transportation such as electric highways *(Gouldson et al., 2015); (Figueroa, Fulton, & Tiwari, 2013), (Vasconcellos & Mendonça, 2016), Alahakoon (2017)*

Panel D Part 1

Panel D Part 2

7 AFFORDABLE AND CLEAN ENERGY

			INTERACTION	NILSSON SCORE	EVIDENCE	AGREEMENT	CONFIDENCE		
Replacing coal	Non-biomass renewables solar, wind, hydro		↑	[+3]	🕮🕮🕮	☺☺☺	★★★★	Decarbonization of the energy system through an up-scaling of renewables will greatly facilitate access to clean, affordable and reliable energy. Hydropower plays an increasingly important role for the global electricity supply. This mitigation option is in line with the targets of SDG7 under the caveat of a transition to modern biomass.	Cherian A. (2015), Rogelj (2013); Cherian A. (2015); Jingura R.M., Kamusoko R.(2016)
	Increased use of biomass		↑	[+3]	🕮🕮🕮	☺☺☺	★★★	Increased use of modern biomass will facilitate access to clean, affordable and reliable energy. This mitigation option is in line with the targets of SDG7.	Cherian A. (2015); Jingura R.M., Kamusoko R.(2016), Rogelj (2013)
	Nuclear/Advanced Nuclear		↑	[1]	🕮🕮	☺	★★	Increased use of nuclear power can provide stable baseload power supply and reduce price volatility.	IPCC AR5 WG3 (2014)
	CCS: Bio energy		↑	[+2]	🕮🕮🕮	☺☺☺	★★★	Increased use of modern biomass will facilitate access to clean, affordable and reliable energy.	IPCC AR5 WG3 (2014)
Advanced coal	CCS: Fossil		↑	[+2]	🕮🕮🕮	☺☺☺	★★★	Advanced and cleaner fossil-fuel technology is in line with the targets of SDG7.	IPCC AR5 WG3 (2014)

8 DECENT WORK AND ECONOMIC GROWTH

			INTERACTION	NILSSON SCORE	EVIDENCE	AGREEMENT	CONFIDENCE		
Replacing coal	Non-biomass renewables solar, wind, hydro	Innovation and Growth (8.1/8.2/8.4)	~	[0]	🕮🕮	☺☺	★★	Decarbonization of the energy system through an up-scaling of renewables and energy efficiency is consistent with sustained economic growth and resource decoupling. Long-term scenarios point towards slight consumption losses caused by a rapid and pervasive expansion of such energy solutions. Whether sustainable growth, as an overarching concept, is attainable or not is more disputed in the literature. Existing literature is also undecided as to whether or not access to modern energy services causes economic growth. (Quote from McCollum et al., in review)	*McCollum et al. (in review);* Bonan et al. (2014); Clarke et al. (2014); Jackson and Senker (2011); New Climate Economy (2014); OECD (2017); York and McGee (2017)
	Increased use of biomass		↑	[+1]	🕮	☺	★	Decarbonization of the energy system through an up-scaling of renewables will greatly facilitate access to clean, affordable and reliable energy.	Jingura R.M., Kamusoko R. (2016)
	Nuclear/Advanced Nuclear		↑	[1]	🕮🕮	☺	★★	Local employment impact and reduced price volatility	IPCC AR5 WG3 (2014)
	CCS: Bio energy		↑	[+1]	🕮	☺	★	See positive impacts of bio-energy use.	
Advanced coal	CCS: Fossil	Innovation and Growth (8.1/8.2/8.4)	↓	[-1]	🕮🕮🕮	☺☺☺	★★★	Lock-in of human and physical capital in the fossil-resources industry	IPCC AR5 WG3 (2014); Vergragt et al. (2011); Markusson et al. (2012); IPCC (2005); Benson et al. (2005); Fankhauser et al. (2008); Shackley and Thompson (2012); Johnson et al. (2015); Bertram et al. (2015).

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

			INTERACTION	NILSSON SCORE	EVIDENCE	AGREEMENT	CONFIDENCE		
Replacing coal	Non-biomass renewables solar, wind, hydro	Inclusive and Sustainable Industrialization (9.2/9.4)	~ / ↓	[0,-1]	🕮🕮	☺☺☺	★★	A rapid up-scaling of renewable energies could necessitate the early retirement of fossil energy infrastructure (e.g., power plants, refineries, pipelines) on a large-scale. The implications of this could in some cases be negative, unless targeted policies can help alleviate the burden on industry. (Quote from McCollum et al., in review)	*McCollum et al. (in review);* Bertram et al. (2015); Fankhauser et al. (2008); Guivarch et al. (2011); Johnson et al. (2015)
	Increased use of biomass		↑	[+1]	🕮🕮	☺☺☺	★★	Access to morden and sustainable energy will be critical to sustain economic growth.	Jingura R.M., Kamusoko R. (2016), Shahbaz M., Rasool G., Ahmed K., Mahalik M.K. (2016)
	Nuclear/Advanced Nuclear	Innovation and Growth (8.1/8.2/8.4)	↓	[-1]	🕮🕮	☺☺☺	★★★	Legacy cost of waste and abandoned reactors	IPCC AR5 WG3 (2014); Marra and Palmer (2011); Greenberg, (2013a); Schwenk-Ferrero (2013a); Skipperud et al. (2013); Tyler et al. (2013a).
	CCS: Bio energy		↑	[+1]	🕮	☺	★	See positive impacts of bio-energy use and CCS/CCU in industrial demand.	
Advanced coal	CCS: Fossil		↑	[+1]	🕮	☺	★	See positive impacts of CCS/CCU in industrial demand.	

11 SUSTAINABLE CITIES AND COMMUNITIES

			INTERACTION	NILSSON SCORE	EVIDENCE	AGREEMENT	CONFIDENCE		
Replacing coal	Non-biomass renewables solar, wind, hydro	Disaster Preparedness and Prevention (11.5)	↑	[+2]	🕮🕮🕮	☺☺	★★★	Deployment of renewable energy and improvements in energy efficiency globally will aid climate change mitigation efforts, and this, in turn, can help to reduce the exposure of people to certain types of disasters and extreme events. (Quote from McCollum et al., in review)	*McCollum et al. (in review); D* aut et al. (2013); Hallegatte et al. (2016); IPCC (2014); Riahi et al. (2012); Tully (2006)
	Increased use of biomass								
	Nuclear/Advanced Nuclear								
	CCS: Bio energy								
Advanced coal	CCS: Fossil								

Panel D Part 2

Panel D Part 3

Sector	Measure	7 AFFORDABLE AND CLEAN ENERGY INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	8 DECENT WORK AND ECONOMIC GROWTH INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE	11 SUSTAINABLE CITIES AND COMMUNITIES INTERACTION / NILSSON SCORE / EVIDENCE / AGREEMENT / CONFIDENCE
Agriculture & Livestock	Behavioural response: Sustainable healthy diets and reduced food waste	**Energy Efficiency, universal access (7.1,7.3)** ↑ [+1] 📖 ☺ ★ Reducing global food supply chain losses have several important secondary benefits like conserving energy. Kummu et al. (2012),	**Sustained and inclusive economic growth (8.2)** ↑ [+1] 📖📖📖 ☺☺☺ ★★★ 23–24% of total cropland and fertilisers are used to produce losses. So reduction in food losses will help to diversify these valuable resources into other productive activities. Kummu et al. (2012),(Hiç et al. 2016)	**Infrastructure building and promotion of inclusive industrialization (9.1/ 9.2)** ↑ [+1] 📖📖📖 ☺☺☺ ★★★ By targeting infrastructure,processing and distribution losses wastage in food systems can be minimized. 23–24% of total cropland and fertilisers are used to produce losses. So reduction in food losses will help to diversify these valable resources into other productive activities. Beddington et al. (2012),Ingram, J. (2011),Lamb et al. (2016), Kummu et al. (2012),Hiç et al. 2016)	No literature
	Land based greenhouse gas reduction and soil carbon sequestration	**Sustainable and modern energy (7.b)** ↑ [+1] 📖📖📖 ☺☺☺ ★★★ Conventional agricultural biotechnology methods such as energy-efficient farming can help in sequestration of soil carbon. Modern biotechnologies like green-energy, N-efficient GM crops can also help in C-sequestration. Biotech crops allow farmers to use less and environmental friendly energy and practice soil carbon sequestration.Biofuels, both from traditional and GMO crops such as sugarcane, oilseed, rapeseed, and jatropha can be produced. Green energy programs through plantations of perennial non edible oil-seed producing plants and production of biodiesel for direct use in the energy sector, or blending biofuels with fossil fuels in certain proportions thereby minimizing use of fossil fuels (Quoted from Lakshmi et. al (2015)). Genetically modified crops reduces demand fossil fuel-based inputs. Mtui, G. Y. (2011), Johnson et al. (2007), Lakshmi et. al (2015), Sarin et al. (2007), Treasury (2009), Lua et al. (2009), Jain and Sharma (2010), Lybbert T, Sumner D (2010).	**Sustainable Growth (8.2)** ↑/↓ [+2,-1] 📖📖 ☺☺ ★★ Many developing countries including Gulf States will benefit from CSA given the central role of agriculture in their economic and social development (Quoted from Behnassi, M., Boussaid,M., &Gopichandran, R. (2014)). Low commodity prices have reduced the incentive to invest in yield growth and have led to declining farm labour and farm capital investment.(Quoted from Lamb, A., et al. (2016)) Behnassi, M., Boussaid,M., &Gopichandran, R. (2014), Lamb, A., et al. (2016)	**Infrastructure building, promotion of inclusive industrialization and innovation (9.1/** ↑/↓ [+2,-2] 📖📖📖 ☺☺☺ ★★★ Reduced research support and delayed industrialization will have an adverse effect on food security and nourishment of children. Organic farming technologies utilizing bio-based fertilizers (composted humus and animal manure) are some of the conventional biotechnological options for reducing artificial fertilizer use.(Quoted from Lakshmi et. al (2015)). CSA requires huge financial investment and institutional innovation. CSA is committed to new ways of engaging in participatory research and partnerships with producers (Quoted from Steenwerth, K. L., (2014)). Technologies used on-farm and during food processing to increase productivity which also helps in adaptation and/or mitigation are new, so convincing potential customers are difficult. Also Low awareness of CSA and inaccessible language, high costs, lack of verified impact of technologies, hard to reach and train farmers, low consumer demand, unequal distribution of costs/benefits across supply chains are barriers of CSA technology adoption(Quoted from Long, T. B., Blok, V., &Coninx, I. (2016)) *evidence from the Netherlands, France, Switzerland and Italy. Low commodity prices have reduced the incentive to invest in yield growth and have led to declining investment in research and development etc.(Quoted from Lamb, A., et al. (2016)) Evenson, R. E. (1999), Lakshmi et. al (2015), Behnassi, M., Boussaid, M., &Gopichandran, R. (2014),Steenwerth, K. L., et al. (2014), Long, T. B., Blok, V.,	
	Greenhouse gas reduction from improved livestock production and manure management systems	**Energy Efficiency (7.3)** ↑ [+1] 📖 ☺ ★ Scenarios where zero human-edible concentrate feed is use for livestocks non-renewable energy use reduces by 36% Schader, C., et al. (2015)	**Sustainable Economic Growth (8.4)** ↑ [+1] 📖 ☺ ★ Exploiting the increasingly decoupled interactions between crops and livestock could be beneficial for promoting structural changes in the livestock sector and is a prerequisite for the sustainable growth of the sector. (Quoted from Herrero, M., & Thornton, P. K. (2013) Herrero, M., & Thornton, P. K. (2013)	**Technological upgradation and Innovation (9.2)** ↑ [+2] 📖📖📖 ☺☺☺ ★★★ Complete genome maps for poultry and cattle now exist, and these open up the way to possible advances in evolutionary biology, animal breeding and animal models for human diseases. Genomic selection should be able to at least double the rate of genetic gain in the dairy industry. (Quoted from Thornton, P. K. (2010)) Nanotechnology, biogas technology, separation technologies are a disruptive technology that enhance biogas production from anaerobic digesters or to reduce odours. Thornton, P. K. (2010), **Sansoucy, R. (1995), Burton, C. H. (2007)**	No literature
Forest	Reduced deforestation,	**Energy Efficiency (7.3)** ↑/↓ [+1,-1] 📖 ☺ ★ Consider the entire sinks and reservoirs of greenhouse gas while developing the nationally appropriate mitigations actions. For countries with a significant contribution of forest degradation (and GHG emissions)from wood fuels, this should be considered (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)). Biomass for energy is recognized as often being inefficient, and is often harvested in an unsustainable manner, but is a renewable energy source (Quoted from Lima, M. G. B., Kissinger, G., Visseren-Hamakers, I. J., Braña-Varela, J., & Gupta, A. (2017)), (Quoted from Katila, P., et al. (2017))	**Sustainable Economic Growth (8.4)** ↑ [+1] 📖 ☺ ★ Efforts by the Government of Zambia to reduce emissions byREDD+, have contributed erosion control, ecotourism and pollination valued at 2.5% of the country's GDP Turpie, Warr, & Ingram, (2015),Epstein, A. H., & Theuer, S. L. H. (2017).	**Infrastructure building ,promotion of inclusive industrialization (9.1/ 9.2/9.5)** ↑/↓ [+1,-1] 📖 ☺ ★ Expanding road net works are recognized as one of the main drivers of deforesting and forest degradation, diminishing forest benefits to communities, On the other hand, roads can enhance market access, thereby boosting local benefits (SDG 1) from the commercialization of forest products.(Quoted from Katila, P., et al. (2017)). Efforts by the Government of Zambia to reduce emissions byREDD+, have contributed erosion control, ecotourism and pollination valued at 2.5% of the country's GDP. (Quoted from Katila, P., et al. (2017)), Turpie, Warr, & Ingram,(2015), Epstein, A. H., & Theuer, S. L. H. (2017).	
	Afforestation and reforestation		**Decent job creation and Sustainable economic growth (8.3/8.4)** ↑ [+2] 📖📖 ☺☺ ★★ Many tree plantations worldwide have higher growth rates which can provide higher rates of returns for investors. Agroforestry initiatives that offer significant opportunities for projects to provide benefits to smallholder farmers can also help address land degradation through community based efforts in more marginal areas. Mangroves reduce impacts of disasters (cyclones/storms/floods) enhance water quality, fisheries, tourism business, and livelihoods. Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008), Kibria, G. (2015).		
	Behavioural response (responsible sourcing)	**Universal access (7.3)** ↑ [+1] 📖 ☺ ★ The trade of wood pellets from clean wood waste should be facilitated with less administrative barriers for the import by the EU, in order to have this new option seriously accounted for as a future resource for energy. (Quoted from Sikkema, R., et al. (2014)). Recommends further harmonization of legal harvesting, sustainable sourcing and cascaded use requirements for woody biomass for energy with the current requirements of voluntary SFM certification schemes.(Quoted from Sikkema, R., et al. (2014)) Sikkema, R., et al. (2014)	**Decent job creation and Sustainable economic growth (8.3/8.4)** ↑ [+2] 📖 ☺ ★ Some standards seek primarily to coordinate global trade, many purport to promote ecological sustainability and social justice or to institutionalize "corporate social responsibility" (CSR) e.g. labour standards developed in the wake of sweatshop and child labour scandals. Environmental standards for pollution control etc. Indonesian factories may seek advantages through non-price competition—perhaps by highlighting decent working conditions or the existence of a union—or to see trade associations or government promoting the country as a responsible sourcing location. Bartley, T. (2010).	**Technological upgradation and Innovation,promotion of inclusive industrialization** ↑ [+2] 📖📖 ☺☺ ★ Capacity for processing certified timber is often underutilized, due the limited supply available. As a result, manufacturing firms that are seeking to tap into green markets often turn to other sources of timber.(Quoted from Bartley, T. (2010)). Responsible sourcing, when integrated into business practices, can enable retailers to better manage brand value and reputation by avoiding negative public relations, as well as maintaining and enhancing brand integrity.(Quoted from Huang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013)) Bartley, T. (2010), Huang, W., Wilkes, A., Sun, X., & Terheggen, A. (2013),	
Oceans	Ocean iron fertilization				
	Blue carbon				
	Enhanced Weathering				