

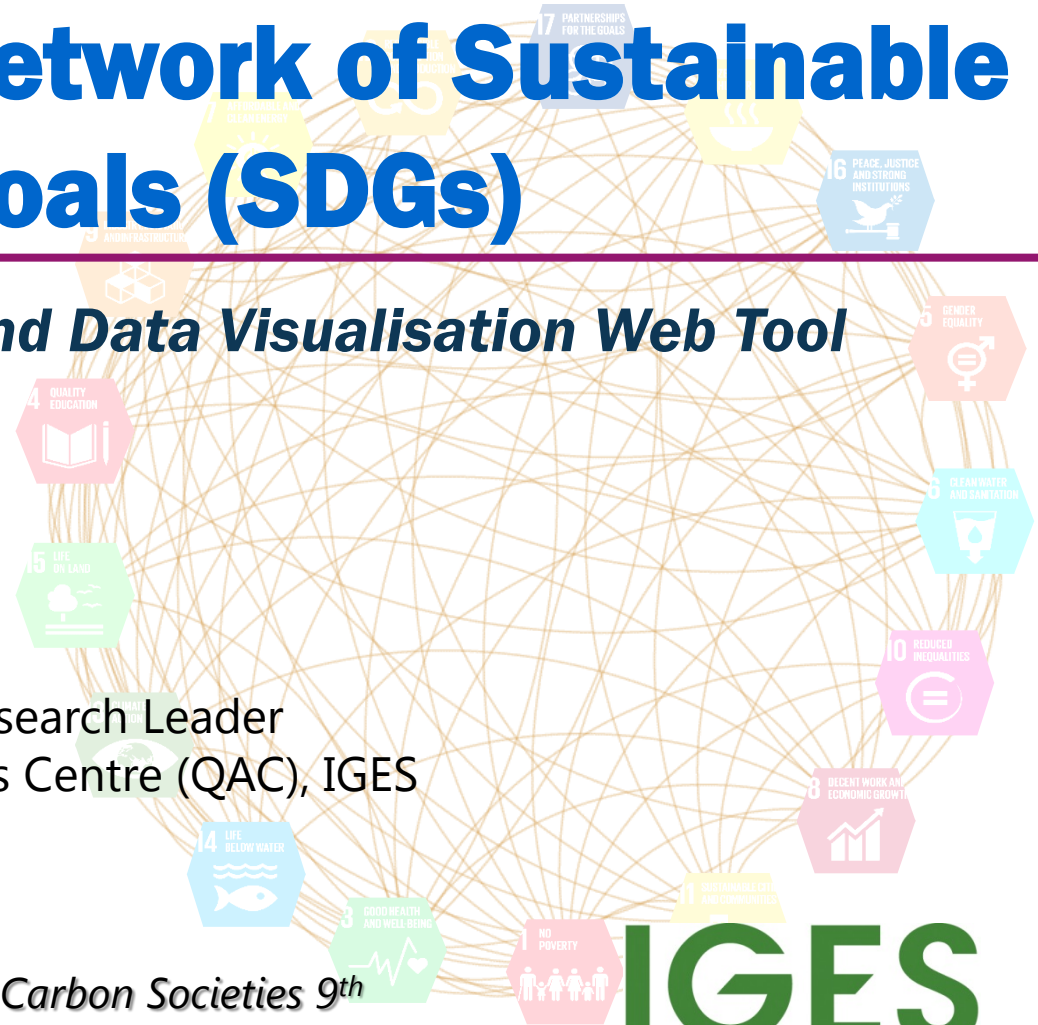
Energy in the Network of Sustainable Development Goals (SDGs)

IGES SDG Interlinkages and Data Visualisation Web Tool

Dr. Xin Zhou

Principal Policy Researcher and Research Leader
Strategic and Quantitative Analysis Centre (QAC), IGES

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Introduction

- 17 SDGs and 169 targets inherently connect with each other forming an indivisible network for delivering sustainable development from a systemic perspective.
- The existence of potential synergies and trade-offs between SDG targets requires integrated institutional arrangements and policy coherence.
- There are knowledge gaps in the existing SDG interlinkages analysis.
- IGES developed the SDG Interlinkages and Data Visualization Web Tool to help fill in the gaps and provide as a practical tool supporting institutional and policy integration for SDG implementation.

IGES approach on SDG interlinkages analysis and visualisation

Identification of the interlinkages

- Identification of the interlinkages between SDG targets based on:
 - knowledge obtained from international consultation processes on SDG indicators; and
 - literature review.

Indicators and data collection

- Identification of the indicators for SDG targets with trackable data;
- Collection of time series data (2001-2014) for the indicators for nine Asian countries.

Quantification of the interlinkages

- Statistical treatment of data;
- Quantification of the interlinkages between SDG targets based on the correlation analysis of the corresponding indicators using time-series data.

Analysis and visualisation of the interlinkages

- Creation of a quantified network of the interlinkages between SDG targets for each country;
- Use of the Social Network Analysis to analyse the structure of the interlinkages and identify strategic targets based on the measurements of centrality;
- Development of a web tool to view the indicator-level data and visualise the interlinkages between SDG targets.

Source: Zhou, X., Moinuddin, M., 2017. IGES Research Report on SDG interlinkages.

https://sdginterlinkages.iges.jp/files/IGES_Research%20Report_SDG%20Interlinkages_Publication.pdf

Identification of the interlinkages between SDG targets

The SDG interlinkages between targets are identified as the union of ten sets of reference interlinkages $U = \cup_i Set_i$

No.	Reference code	SDGs coverage	Type of interlinkages/Goal-Goal, Goal-Target, Target-Goal, Target-Target
1	IAEG-SDGs	All	T-T
2	SDSN-1	All	T-T through shared indicators.
3	SDSN-Shared indicators	All	T-T through shared indicators.
4	ESCAP-SDG6	SDG6	T-T
5	WEF-Nexus	SDG2, SDG6 and SDG7.	T-T
6	UNECOSOC	All	G-T (for all SDGs except SDG17), G-G (SDG17)
7	UNCTAD-Trade	Trade-related SDGs	T-T (trade-related targets link with each other)
8	IOM-Migration	Migration-related SDGs	T-T (migration-related targets link with each other)
9	Stakeholder Forum_1	All except for SDG17	G-G, T-G, T-T
10	Stakeholder Forum_SDG12	SDG12	T-T

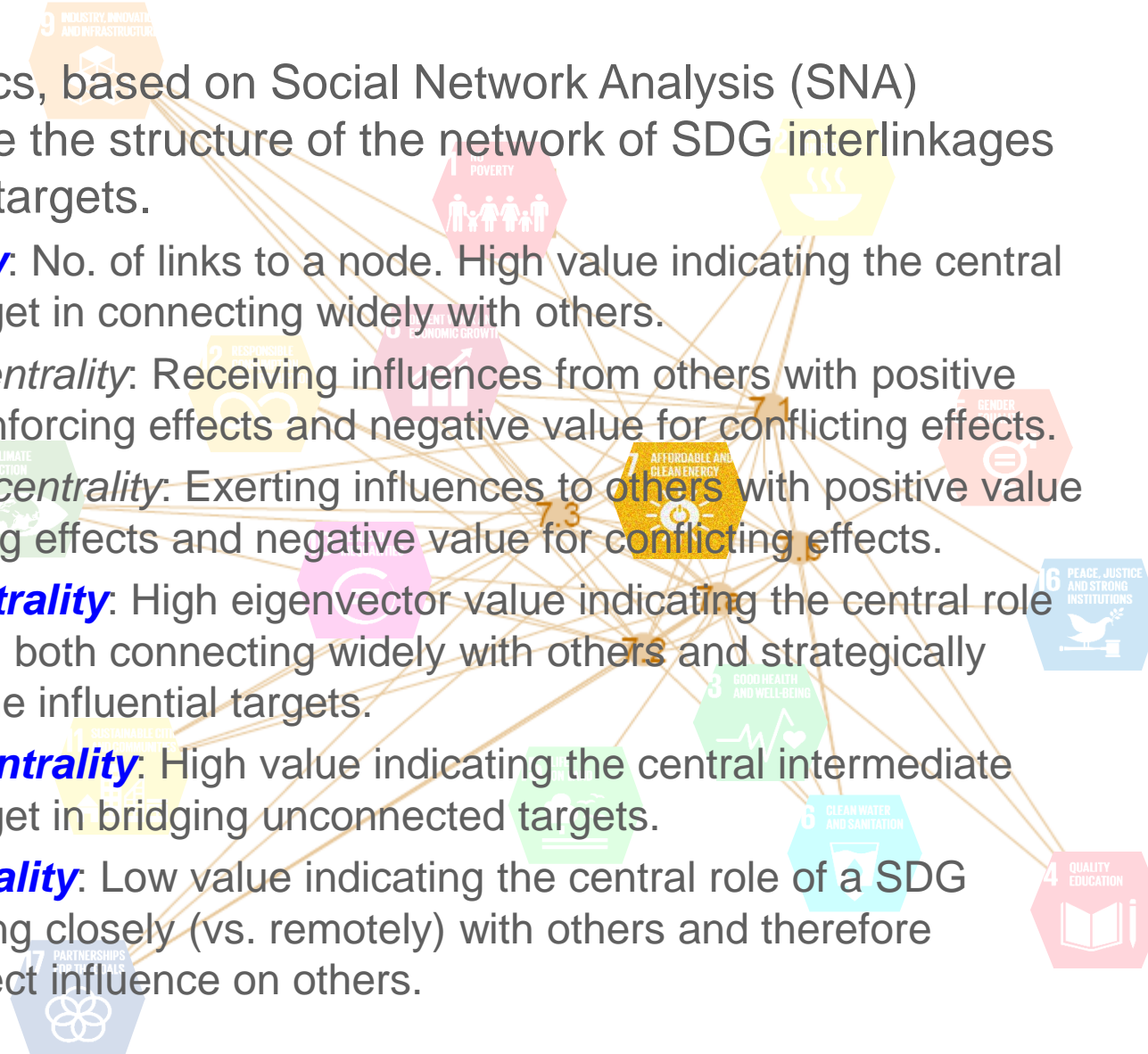
Source: Zhou, X., Moinuddin, M., 2017. IGES Research Report on SDG interlinkages.
https://sdginterlinkages.iges.jp/files/IGES_Research%20Report_SDG%20Interlinkages_Publication.pdf

Indicators and data collection for Asian countries

- Selection of indicators based on SDSN's 100 Global Monitoring Indicators (SDSN, 2015).
- 51 indicators identified with trackable data at the national level mapping with 108 targets.
- Time-series data (2001-2014) from various sources (mainly UN or international organisations) collected for nine countries (KHM, BGD, CHN, IDN, IND, JPN, KOR, PHL, VNM).
- For missing data, statistical method used to generate the full set of time-series data.

Network analysis of SDG interlinkages

Using centrality metrics, based on Social Network Analysis (SNA) techniques, to analyse the structure of the network of SDG interlinkages and identify strategic targets.

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- **Degree centrality:** No. of links to a node. High value indicating the central role of a SDG target in connecting widely with others.
 - ✓ *In-degree centrality:* Receiving influences from others with positive value for reinforcing effects and negative value for conflicting effects.
 - ✓ *Out-degree centrality:* Exerting influences to others with positive value for reinforcing effects and negative value for conflicting effects.
 - **Eigenvector centrality:** High eigenvector value indicating the central role of a SDG target in both connecting widely with others and strategically connecting with the influential targets.
 - **Betweenness centrality:** High value indicating the central intermediate role of a SDG target in bridging unconnected targets.
 - **Closeness centrality:** Low value indicating the central role of a SDG target in connecting closely (vs. remotely) with others and therefore exerting more direct influence on others.

IGES SDG Interlinkages and Data Visualisation Web Tool (free online at <https://sdginterlinkages.iges.jp/>)

SDG Interlinkages and Data Visualisation

1 Select One Country

- ☐ Bangladesh
- ☐ Cambodia
- ☐ China
- ☐ India
- ☐ Indonesia
- ☒ Japan
- ☐ Republic of Korea
- ☐ Philippines
- ☐ Viet Nam

How to use

1. Select only one country.
2. Select one or more Goals.
3. Select/Deselect SDG Target(s) and related Indicator(s) for the selected Goal(s).
4. Your selected Target(s) and related Indicator(s) appear here. You can select/deselect Target(s) and Indicator(s) from this list.
5. You can view and download the data (as CSV file) on your selected Indicator(s) by clicking on "Export Table".

4 Select or Deselect SDG Targets & Indicators

- ☒ 7.1 Universal access to energy
Access to electricity
- ☒ 7.2 Increase renewable energy
Data not available.
- ☒ 7.3 Double energy efficiency
Primary energy intensity
- ☒ 7.a Enhance international cooperation on clean ene...
Net official development assistance (ODA) received
- ☒ 7.b Expand energy infrastructure
Access to electricity

2 Select Sustainable Development Goals (SDGs)

3 Select SDG Targets & Indicators (See more)

- ☒ Goal 7. Affordable and clean energy
 - ☒ 7.1 Universal access to energy
Access to electricity
 - ☒ 7.2 Increase renewable energy
Data not available.
 - ☒ 7.3 Double energy efficiency
Primary energy intensity
 - ☒ 7.a Enhance international cooperation on clean energy R&D
Net official development assistance (ODA) received
 - ☒ 7.b Expand energy infrastructure

5 Data display [Country: Japan]

NO.	INDICATORS/SHORTNAME	UNIT	2001	2002	2003	2004	2005	2006	2007
1	Access to electricity	percent	100						
2	Primary energy intensity	MJ/\$2011 PPP GDP	5.22	5.2	5.07	5.11	5.03	4.94	

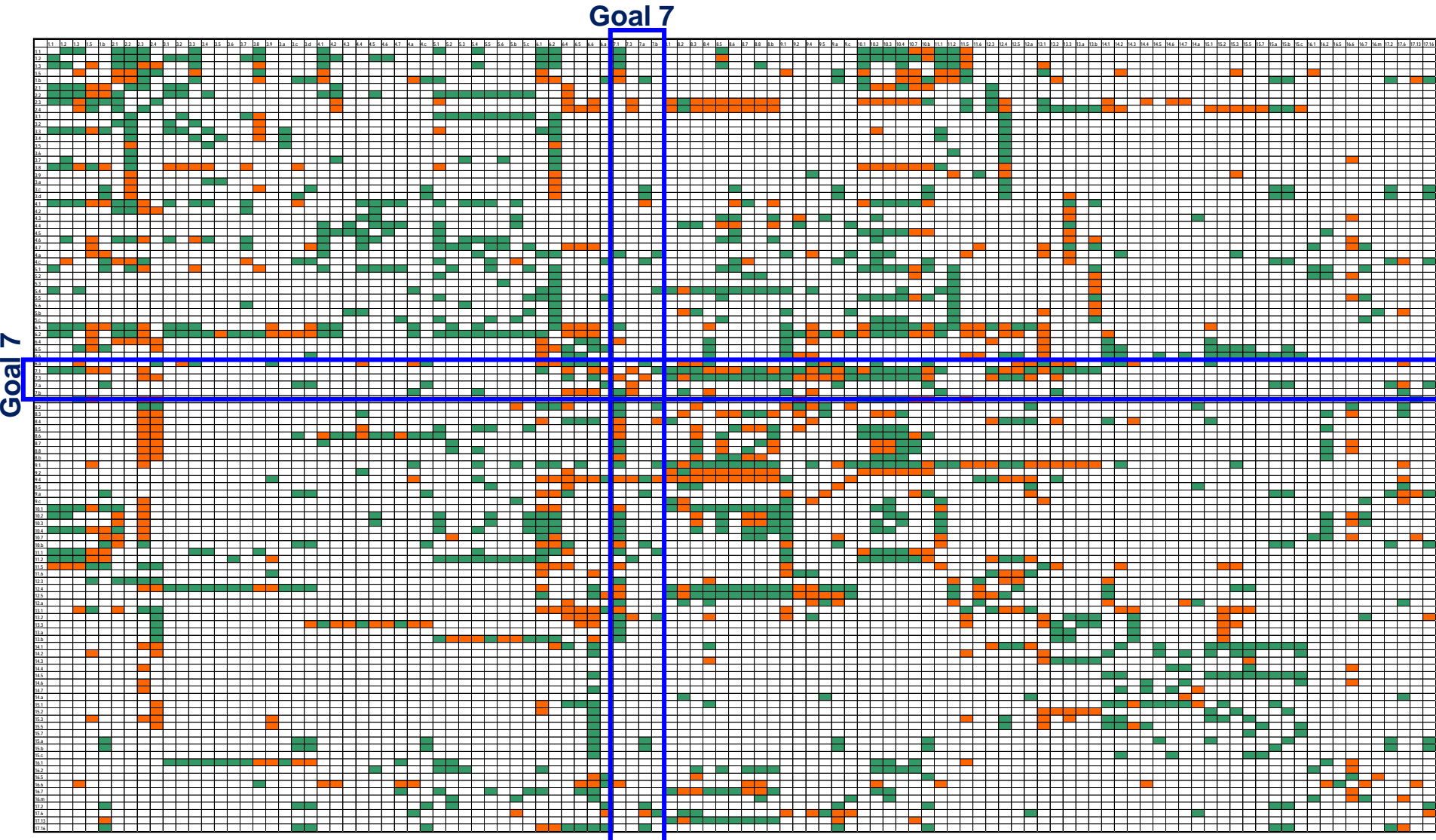
6 Visualisation of interlinkages in a network

Japan

Note: i) Each node represents one SDG Target, e.g. Target 1.1, with yellow ones indicating the selected targets.
 ii) Each line with an arrow linking two nodes represents a directional/causal link between two Targets, e.g. from Target 1.1 to Target 1.2.
 The value over the line (by putting the cursor on the line) indicates the strength of the linear relation between the pair of targets.
 iii) A line in black represents a positive link and a line in red represents a negative link.

Source: A snapshot taken from IGES SDG Interlinkages and Data Visualisation Web Tool on Goal 7 Affordable and Clean Energy and interlinkages with other targets for Japan. Zhou, et al. (<https://sdginterlinkages.iges.jp/>).

A dashboard for Japan indicating potential synergies (in green) and trade-offs (in red) between SDG targets



Source: Zhou, X., Moinuddin, M., 2017. IGES Research Report on SDG interlinkages.

https://sdginterlinkages.iges.jp/files/IGES_Research%20Report_SDG%20Interlinkages_Publication.pdf

Top 20 strategic targets (including 7.1 and 7.a) ranked by degree centrality measures for KHM, CHN, PHL and KOR

Top 20 targets	KHM			CHN			PHL			KOR		
	Weighted in-degree	Weighted out-degree	Weighted degree	Weighted in-degree	Weighted out-degree	Weighted degree	Weighted in-degree	Weighted out-degree	Weighted degree	Weighted in-degree	Weighted out-degree	Weighted degree
1	10.3	6.2	10.2	10.4	6.2	10.4	10.3	9.1	2.3	7.1	9.1	7.1
2	10.2	12.4	10.3	2.3	1.2	1.2	2.3	7.1	7.1	6.1	7.1	9.1
3	2.3	4.6	12.4	1.1	9.1	6.2	10.2	12.4	12.4	10.2	12.4	6.1
4	12.4	9.1	6.2	12.4	1.3	1.1	12.4	2.3	10.3	9.1	6.1	12.4
5	8.5	1.2	7.1	11.1	12.4	12.4	6.6	17.2	10.2	10.3	11.2	10.2
6	5.1	10.2	2.3	1.2	1.1	9.1	7.1	2.4	9.1	11.1	7.3	11.1
7	7.1	4.1	5.1	6.6	4.1	2.3	13.3	7.3	17.2	9.a	16.1	11.2
8	11.2	7.1	1.2	5.4	6.1	1.3	8.4	14.1	2.4	10.b	1.b	10.3
9	6.2	11.2	11.2	10.3	10.4	4.1	17.2	6.2	13.3	6.6	12.5	9.a
10	8.b	10.3	4.1	1.3	17.2	11.1	7.a	10.2	7.a	12.4	11.1	1.b
11	8.6	5.1	4.6	10.2	7.1	7.1	8.5	17.16	8.4	1.b	1.2	10.b
12	6.6	2.3	8.6	7.1	11.1	5.4	4.c	7.a	17.16	11.2	6.2	4.c
13	5.5	8.6	9.1	4.1	16.6	6.1	10.1	13.b	14.1	10.7	7.a	7.a
14	17.2	16.7	8.5	3.1	11.2	17.2	17.16	10.3	10.1	4.c	5.1	6.6
15	4.c	3.1	17.2	4.c	3.3	10.2	8.b	13.3	13.b	10.1	4.c	5.1
16	4.1	17.2	7.a	6.2	5.4	10.3	2.4	15.b	6.6	7.a	9.a	1.2
17	1.2	14.1	16.7	10.7	2.3	16.6	15.5	15.a	8.6	3.d	17.2	10.1
18	7.a	6.1	17.16	9.1	3.8	3.3	13.b	10.1	15.a	8.2	5.5	6.2
19	13.3	7.a	5.c	3.4	4.6	3.8	8.1	8.4	15.5	12.a	17.16	17.16
20	4.2	4.4	1.1	5.b	14.1	5.1	8.6	3.d	8.5	5.1	10.1	12.5

Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all



- 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services
- 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
- 7.3 By 2030, double the global rate of improvement in energy efficiency
- 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
- 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

Goal 7 and interactions with other SDGs

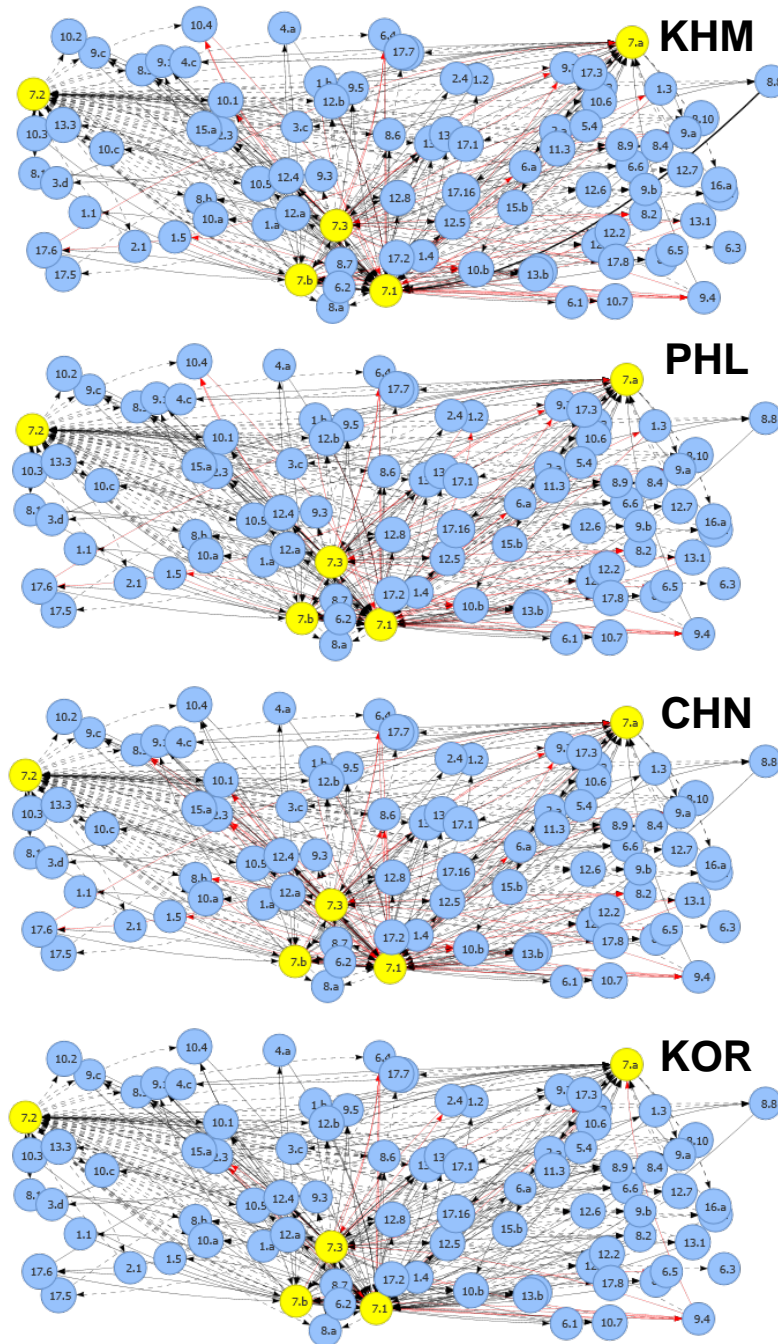
SDG	No. of Goals Connected	SDGs connected
Goal 7	15	All SDGs except for Goal 14
Target 7.1	13	Goals 1, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17
Target 7.2	9	Goals 2, 6, 7, 8, 9, 10, 12, 13
Target 7.3	10	Goals 2, 6, 7, 8, 9, 10, 11, 12, 13, 17
Target 7.a	13	Goals 1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 15, 16, 17
Target 7.b	9	Goals 4, 5, 6, 7, 8, 9, 11, 13, 17



Goal 7 and cross-country comparison

- Achieving Goal 7 may potentially impact on achieving **102 targets** (including targets under Goal 7 itself).
- More synergies in KOR** in particular in achieving **Target 7.1** (universal access to energy) and **7.a** (Enhance international cooperation on clean energy R&D) but **more trade-offs in CHN** in particular in achieving **Target 7.1** and **7.3** (double energy efficiency).

Total links with other SDGs		102
KHM	Synergies (of 174)	72%
	Trade-offs (of 174)	28%
PHL	Synergies (ibid)	73%
	Trade-offs (ibid)	27%
CHN	Synergies (ibid)	68%
	Trade-offs (ibid)	32%
KOR	Synergies (ibid)	88%
	Trade-offs (ibid)	12%



Source: Snapshots taken from IGES SDG Interlinkages and Data Visualisation Web Tool (<https://sdginterlinkages.iges.jp/>).

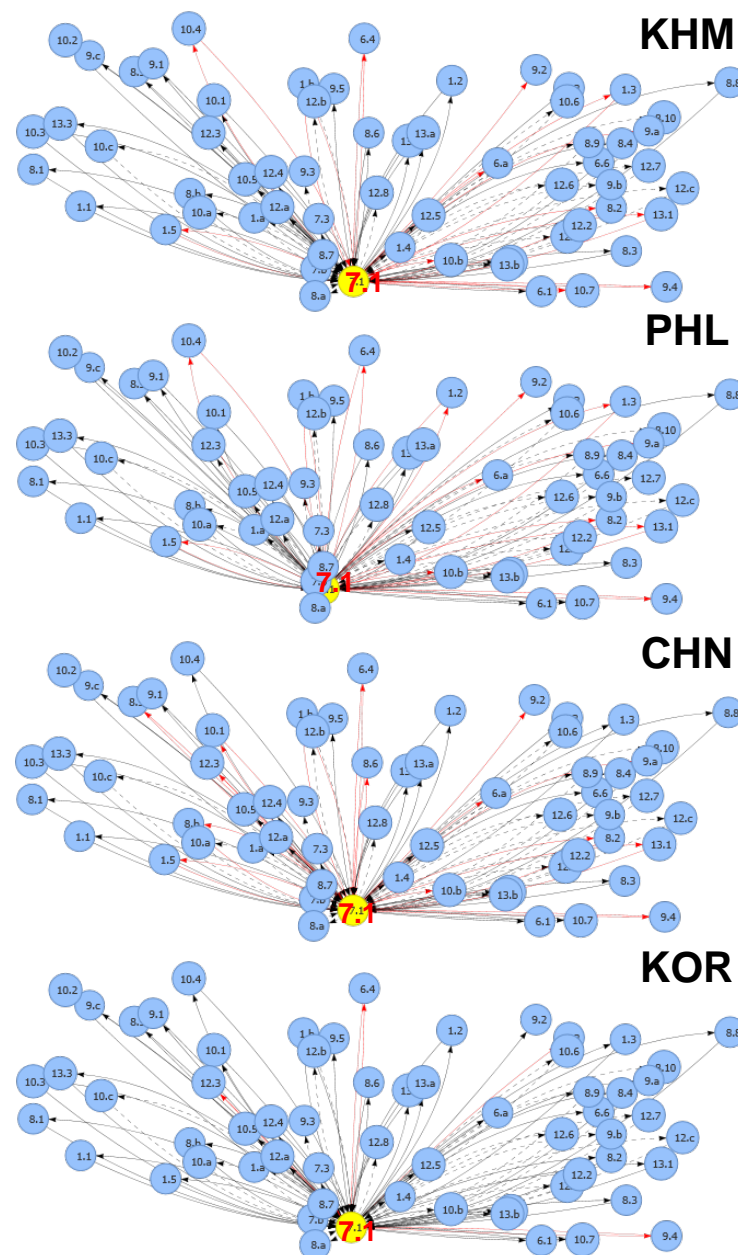
Target 7.1 on universal access to energy and cross-country comparison

- Achieving **Target 7.1** may potentially impact on achieving **43 targets** (including other targets under Goal 7).
- More synergies in KOR** but **more trade-offs in CHN** in particular with the targets under **Goal 8** (decent work and economic growth) and **Goal 9** (industry, innovation and infrastructure).

Total links with other SDGs

43

KHM	Synergies (of 43)	70%
	Trade-offs (of 43)	30%
PHL	Synergies (ibid)	70%
	Trade-offs (ibid)	30%
CHN	Synergies (ibid)	65%
	Trade-offs (ibid)	35%
KOR	Synergies (ibid)	91%
	Trade-offs (ibid)	9%

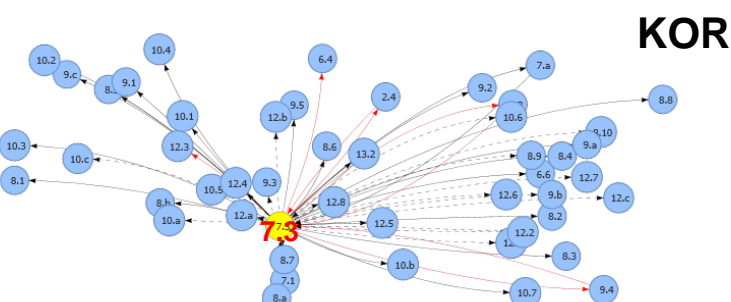
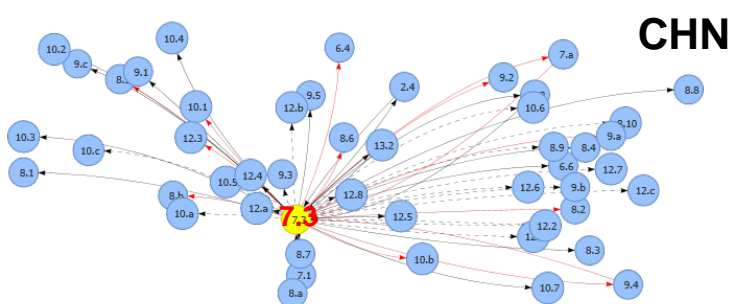
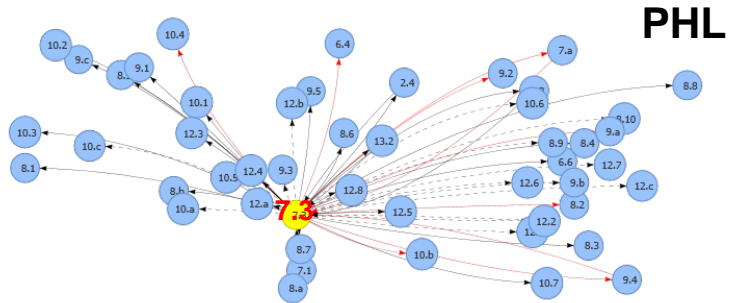
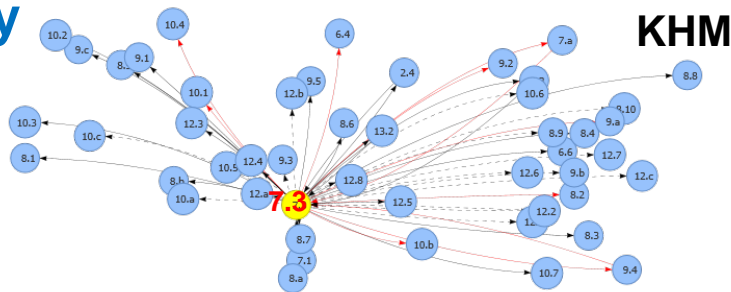


Source: Snapshots taken from IGES SDG Interlinkages and Data Visualisation Web Tool (<https://sdginterlinkages.iges.jp/>).

Target 7.3 on doubling energy efficiency and cross-country comparison

- Achieving **Target 7.3** may potentially impact on achieving **32 targets** (including other targets under Goal 7).
- Again, **more synergies in KOR** but **more trade-offs in CHN** with the targets under **Goal 8** (decent work and economic growth) and **Goal 9** (industry, innovation and infrastructure) similarly to achieving **Target 7.1**.

Total links with other SDGs		32
KHM	Synergies (of 32)	72%
	Trade-offs (of 32)	28%
PHL	Synergies (ibid)	75%
	Trade-offs (ibid)	25%
CHN	Synergies (ibid)	63%
	Trade-offs (ibid)	37%
KOR	Synergies (ibid)	84%
	Trade-offs (ibid)	16%

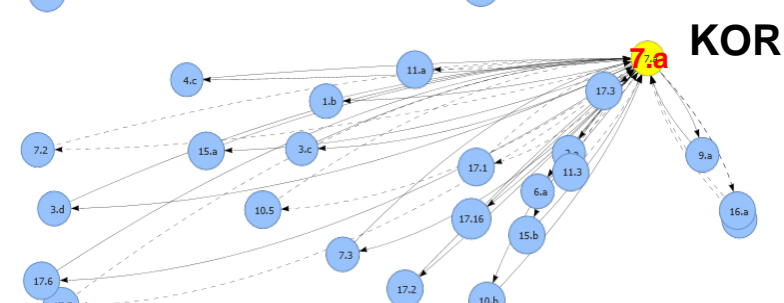
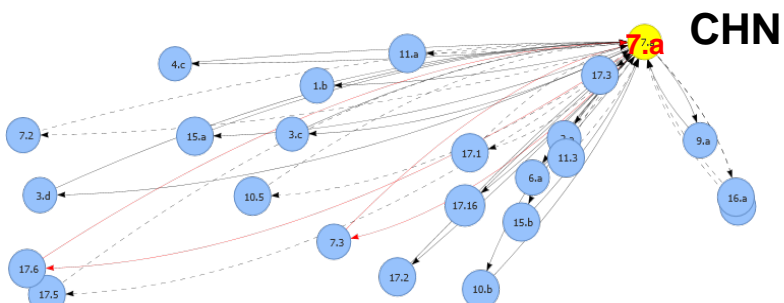
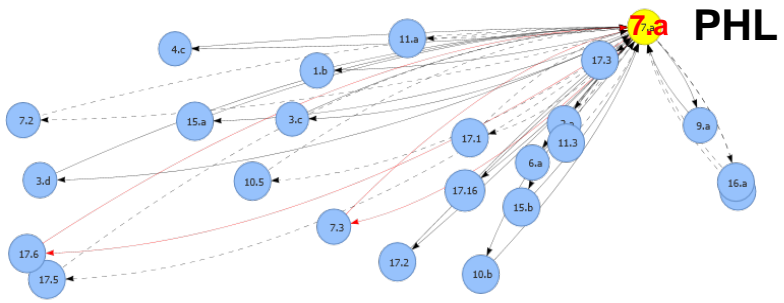
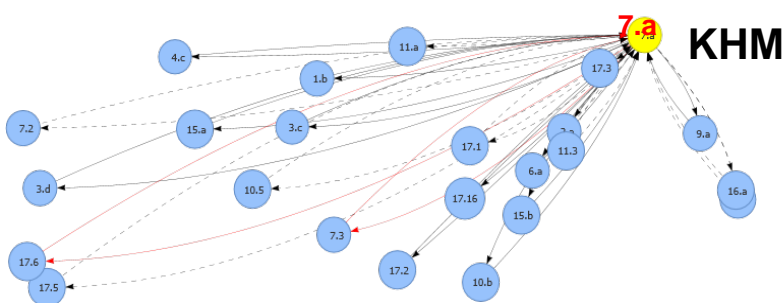


Source: Snapshots taken from IGES SDG Interlinkages and Data Visualisation Web Tool (<https://sdginterlinkages.iges.jp/>).

Target 7.a on enhancing international cooperation on clean energy R&D and cross-country comparison

- Achieving **Target 7.a** may potentially impact on achieving **13 targets** (including other targets under Goal 7).
- Again, **all synergies in KOR** but **some trade-offs in other three countries** with **Target 7.3** (double energy efficiency) and Target **17.6** (international cooperation on science and technology). The causal relationships between these targets need follow-up research.

Total links with other SDGs		13
KHM	Synergies (of 13)	85%
	Trade-offs (of 13)	15%
PHL	Synergies (ibid)	85%
	Trade-offs (ibid)	15%
CHN	Synergies (ibid)	85%
	Trade-offs (ibid)	15%
KOR	Synergies (ibid)	100%
	Trade-offs (ibid)	0%



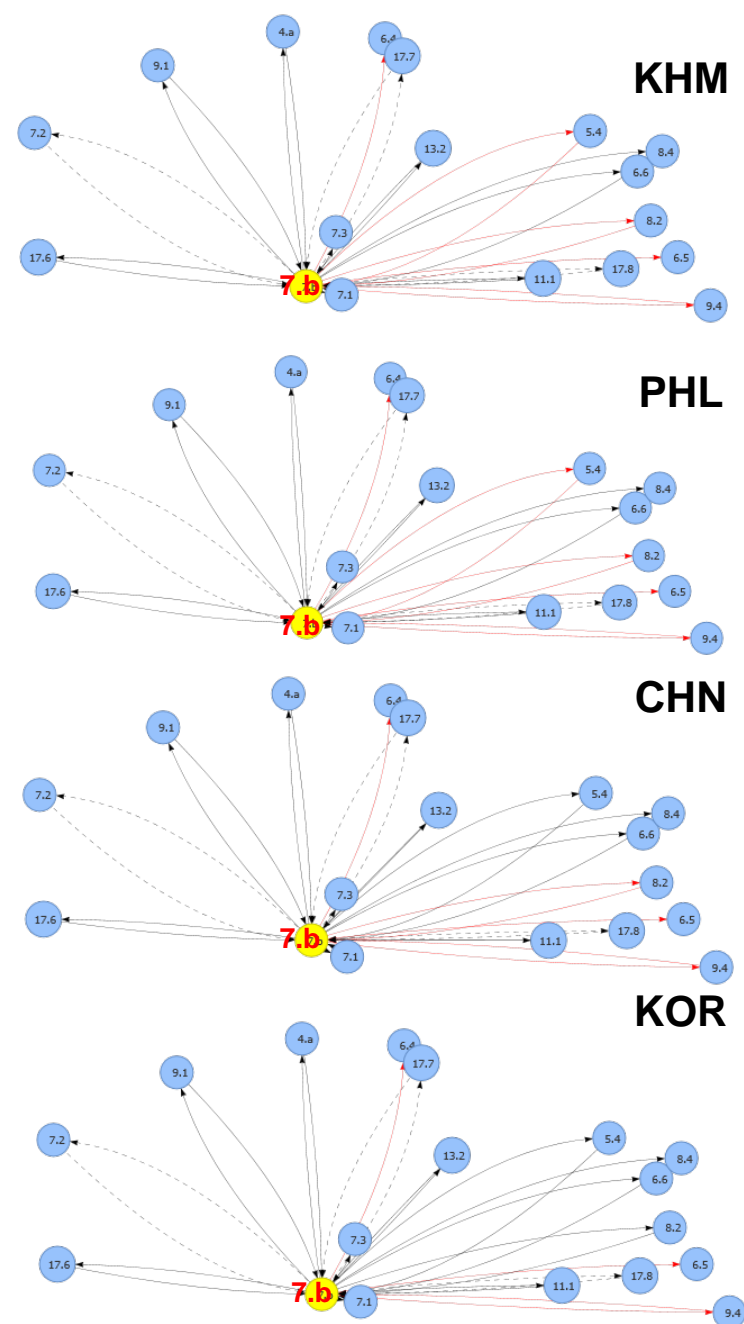
Source: Snapshots taken from IGES SDG Interlinkages and Data Visualisation Web Tool (<https://sdginterlinkages.iges.jp/>).

Target 7.b on expanding energy infrastructure and cross-country comparison

- Achieving **Target 7.b** may potentially impact on achieving **14 targets** (including other targets under Goal 7).
- More synergies in KOR** but **more trade-offs in KHM and PHL** with some targets under **Goal 5** (gender inequality), **Goal 6** (water and sanitation), **Goal 8** (decent work and economic growth) and **Goal 9** (industry, innovation and infrastructure) similarly to achieving **Target 7.1** in CHN.

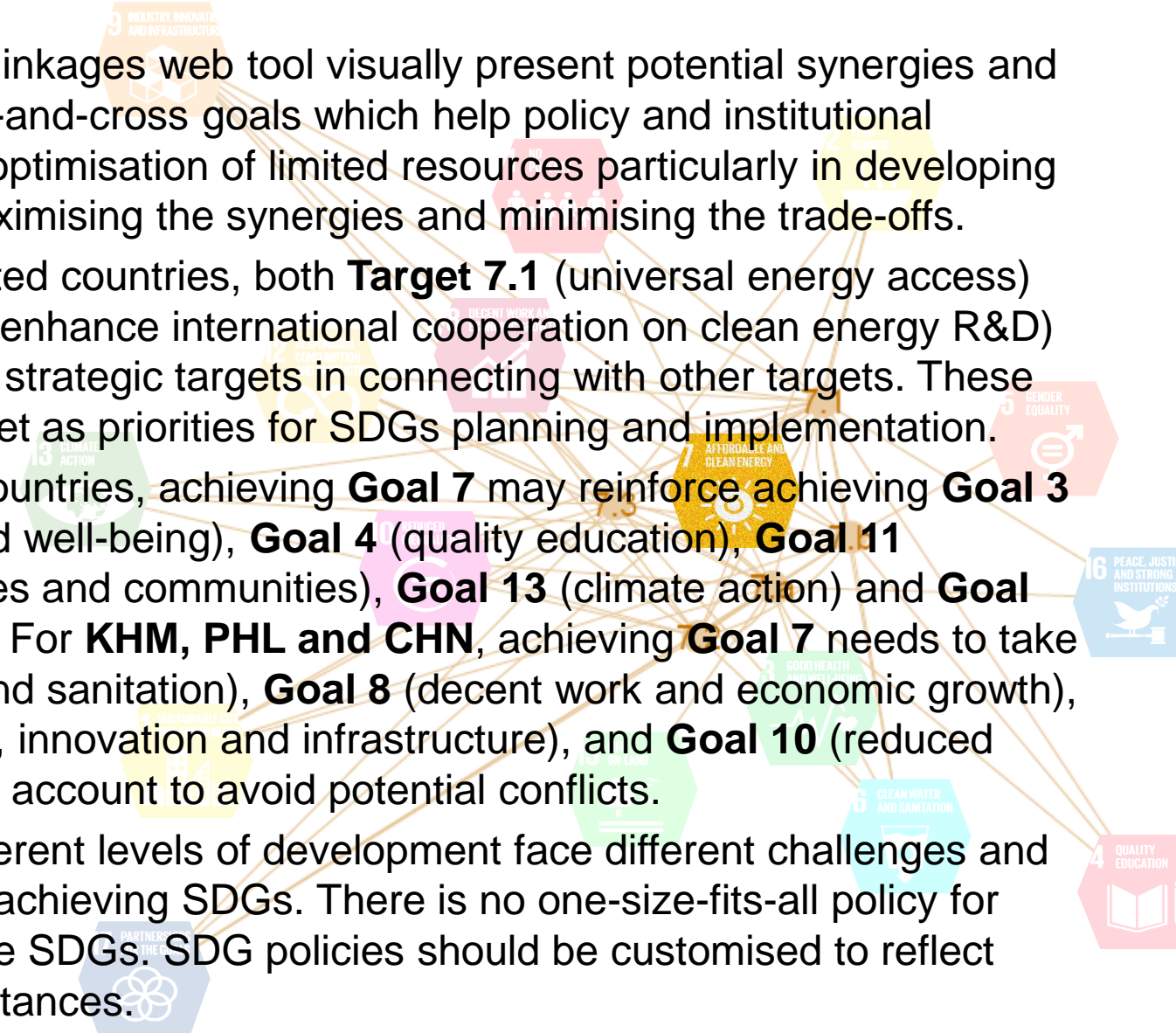
Total links with other SDGs **14**

KHM	Synergies (of 14)	64%
	Trade-offs (of 14)	36%
PHL	Synergies (ibid)	64%
	Trade-offs (ibid)	36%
CHN	Synergies (ibid)	71%
	Trade-offs (ibid)	29%
KOR	Synergies (ibid)	79%
	Trade-offs (ibid)	21%



Source: Snapshots taken from IGES SDG Interlinkages and Data Visualisation Web Tool (<https://sdginterlinkages.iges.jp/>).

Key messages

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- IGES SDG interlinkages web tool visually present potential synergies and trade-offs within-and-cross goals which help policy and institutional integration and optimisation of limited resources particularly in developing countries by maximising the synergies and minimising the trade-offs.
 - In most of selected countries, both **Target 7.1** (universal energy access) and **Target 7.a** (enhance international cooperation on clean energy R&D) are identified as strategic targets in connecting with other targets. These targets can be set as priorities for SDGs planning and implementation.
 - In all selected countries, achieving **Goal 7** may reinforce achieving **Goal 3** (good health and well-being), **Goal 4** (quality education), **Goal 11** (sustainable cities and communities), **Goal 13** (climate action) and **Goal 15** (life on land). For **KHM, PHL and CHN**, achieving **Goal 7** needs to take **Goal 6** (water and sanitation), **Goal 8** (decent work and economic growth), **Goal 9** (industry, innovation and infrastructure), and **Goal 10** (reduced inequalities) into account to avoid potential conflicts.
 - Countries at different levels of development face different challenges and opportunities in achieving SDGs. There is no one-size-fits-all policy for implementing the SDGs. SDG policies should be customised to reflect national circumstances.



Thank you!

Contact: zhou@iges.or.jp