



SATIMGE 2020

A LINKED ENERGY-ECONOMY
MODELLING FRAMEWORK FOR ANALYSING ENERGY
AND CLIMATE POLICY IN SOUTH AFRICA

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2050



UNKNOWNNS

GLOBAL GROWTH ?
POPULATION ?
TECHNOLOGY ?
CLIMATE CHANGE IMPACTS ?

POLICY GOALS

SUSTAINABLE DEVELOPMENT

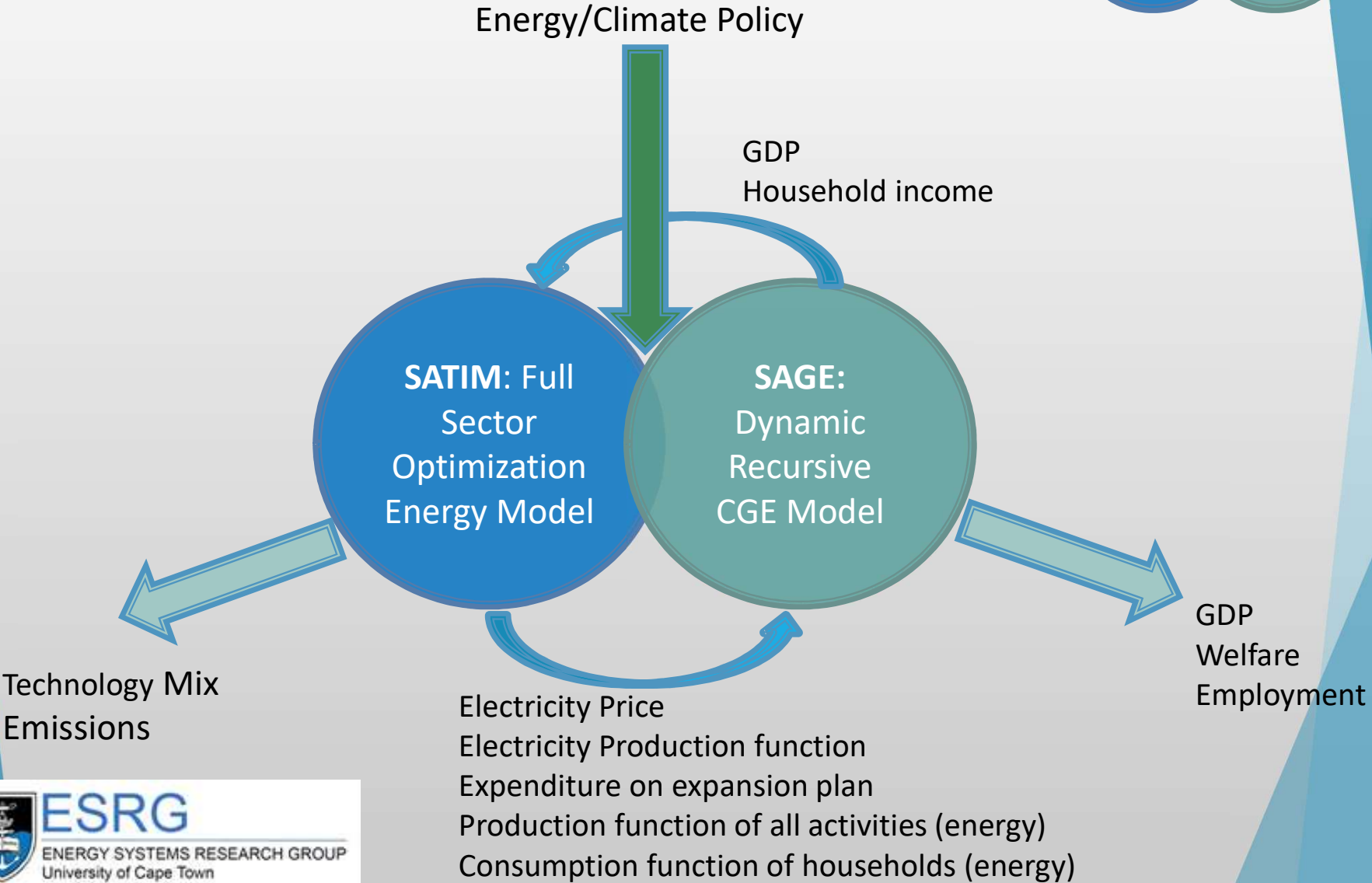
POLICY LEVERS

TAXES AND SUBSIDIES
REGULATION / MARKET DESIGN
IRP/IEP
R&D

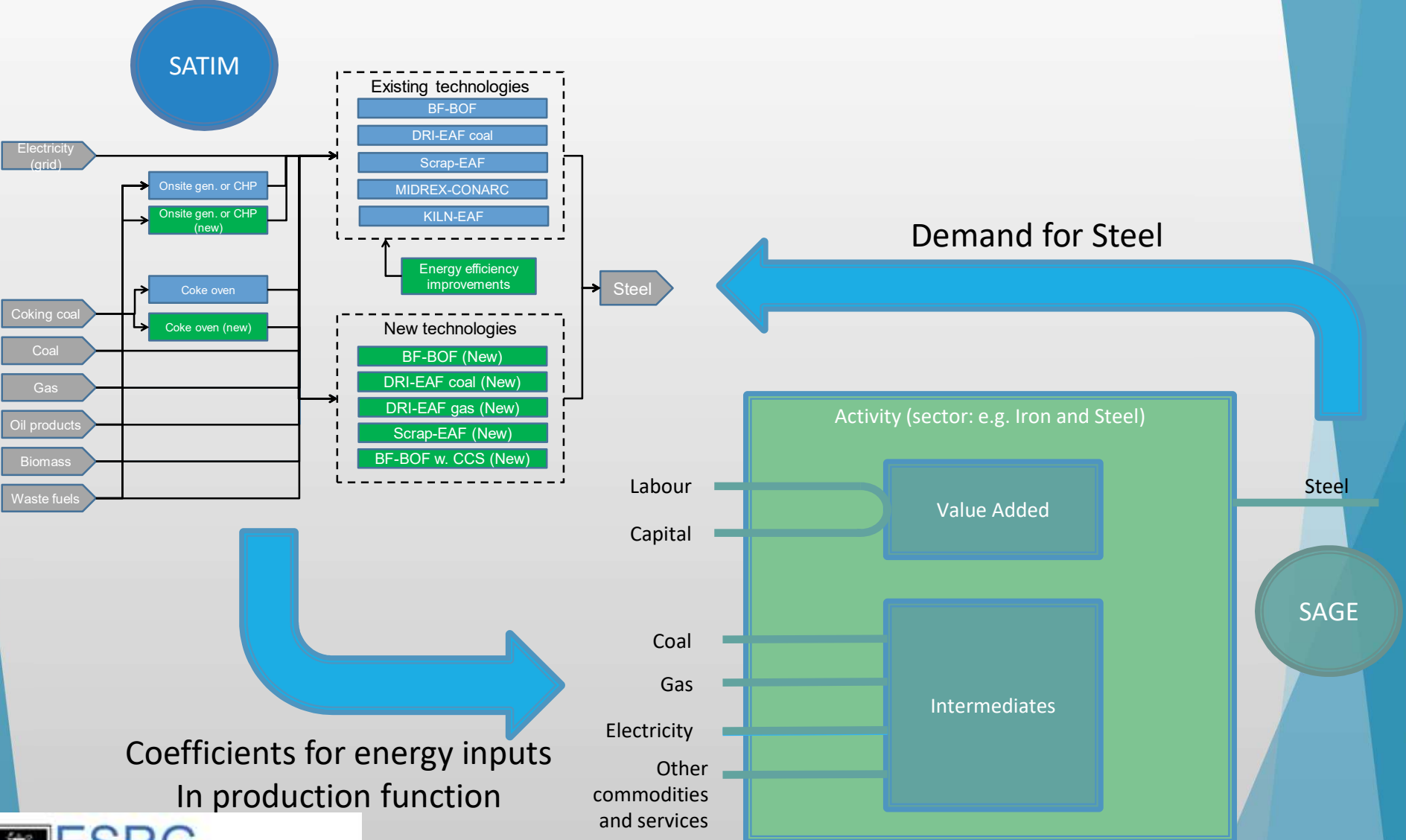
TECHNOLOGY OPTIONS

COAL / NUCLEAR
WIND / SOLAR
STORAGE
SMART GRIDS
SMART MOBILITY
ENERGY EFFICIENCY
HYDROGEN

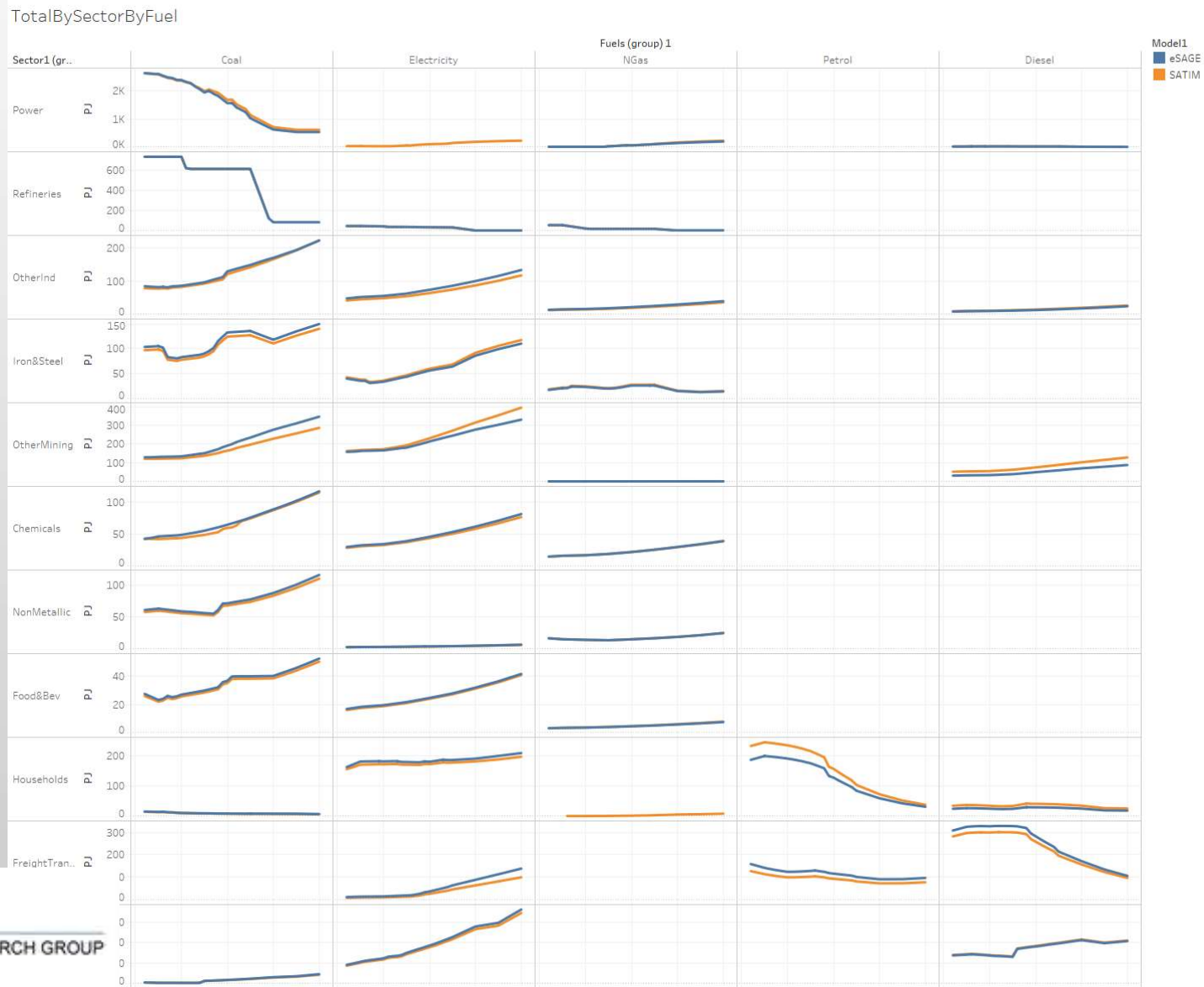
SATIMGE: Linked energy-economic model



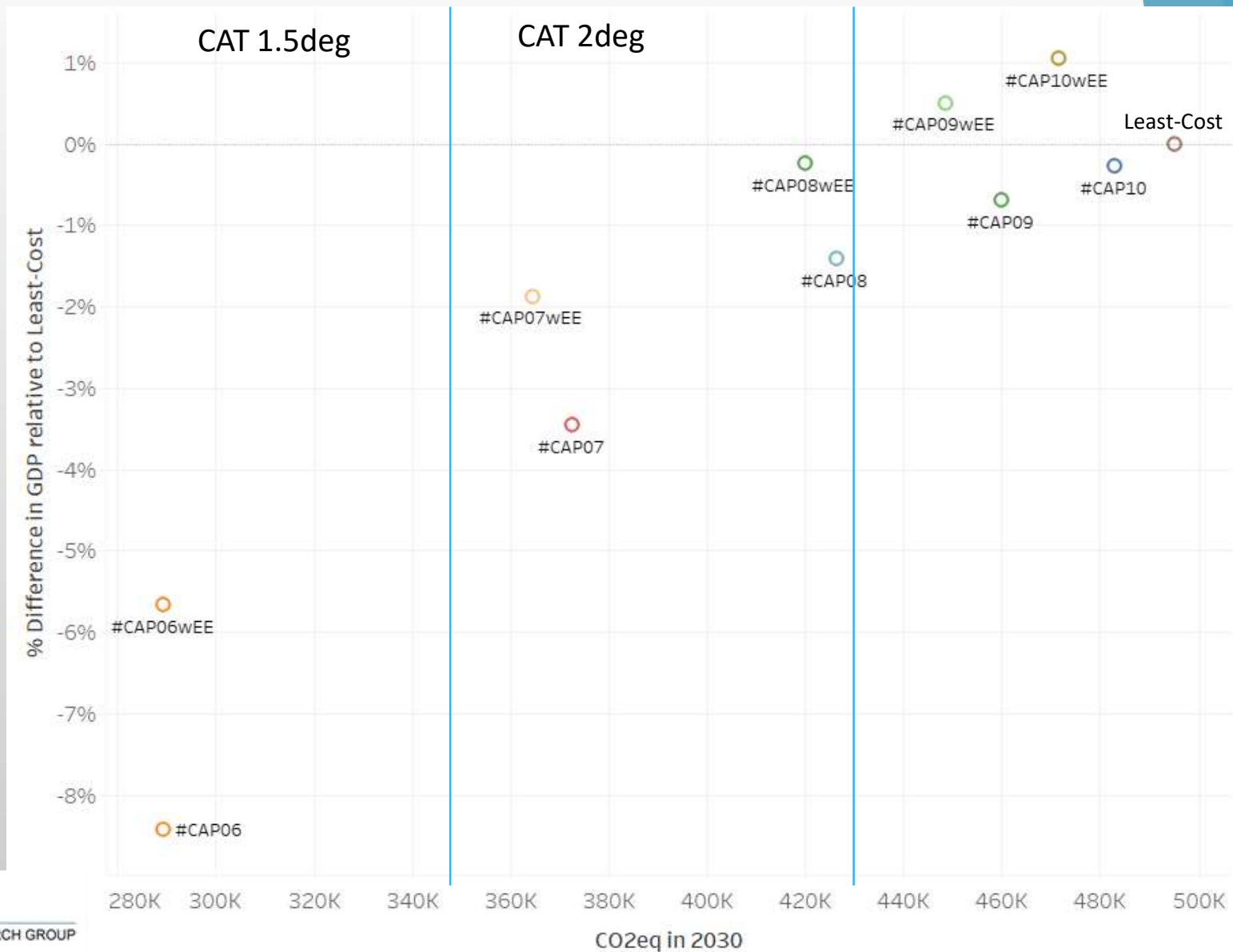
Linked model: production of steel



Linking CGE model to energy model necessary to capture technical change



Allows us to do things like the trade off between development and mitigation objectives



2003	DME IEP-1	MARKAL+LEAP
2006	EPSD-SA - IAEA	MARKAL
2007	DEA LTMS	MARKAL
2008	WWF Costing 2020 RE Target	MARKAL
2010	DME Review of RE white paper	MARKAL
2011	GIZ/DEA Low Emission Pathways	SATIM-2011
2012	SANEDI-Transport	SATIM-2012
2013	NPC-Power Plan	SATIM-EL-2012
2014	UNU-WIDER SATIMGE-beta1	SATIMGE-beta1
2015	UNEP Uncertainty in Baseline CO2 DDPP SA Nuclear: Risk Analysis	SATIM-MC-2015 SATIMGE-2015
2016	WB Thirsty Energy UNU-WIDER SATIMGE-beta2	SATIM-W-2016 SATIMGE-beta2
2017	FCO Gas Study SANEDI-Transport 2 DEFF PAMS	SATIM-MC-2017 SATIM-2017 SATIMGE-2017
2018	SANEDI Flexible Demand CER Coal-IPPs Alt-IRP	SATIM-FD-2018 SATIM-2018 SATIMGE-2018
2019	CoBenefits Study SA-TIED	SATIMGE-2018 SATIMGE-2019
2020	2030 NDC Update	SATIMGE-2020
2021	Net-Zero DDP-BIICS TSITICA	SATIMGE-2021 SATIMGE-2021 SATIMGE-2021

SATIMGE-2020 Highlights 1: Work done under SA-TIED project

<https://sa-tied.wider.unu.edu/climate>

<p>SA-TIED Working Paper 121</p> <p>Working papers</p> <p>Policy options in SATIMGE and the socio-economic impacts of electric vehicles in South Africa</p>	<p>SA-TIED Working Paper 102</p> <p>Modelling the costs of constraining the transition to renewable energy in South Africa</p>	<p>SA-TIED Working Paper 99</p> <p>Long term modelling of household demand and its implications for energy planning</p>
<p>SA-TIED Working Paper 84</p> <p>Improved representation of coal supply for the power sector for South Africa</p>	<p>SA-TIED Working Paper 70</p> <p>Faster than you think: Renewable energy and developing countries</p>	<p>SA-TIED Working Paper 60</p> <p>Road freight and energy in South Africa</p>
<p>SA-TIED Working Paper 29</p> <p>Least cost integrated resource planning and cost-optimal climate change mitigation policy — Alternatives for the South African electricity system</p>	<p>SA-TIED Working Paper 26</p> <p>Part 2 — Quantifying the macro and socioeconomic benefits of a transition to renewable energy in South Africa</p>	<p>SA-TIED Working Paper 19</p> <p>Quantifying the macro- and socio-economic benefits of a transition to renewable energy in South Africa</p> <p><small>BY BRUNO MERVEN, GREGORY IRELAND, FAUGA HARTLEY, CHRISTOPHER GIBSON, ALISON JONES, FABIEN ANJUM, BRUCE MCCALL, AND TARA CAETANO</small></p>

Policy briefs

- Least-cost power pathway for South Africa
- A just transition to cleaner energy in South Africa

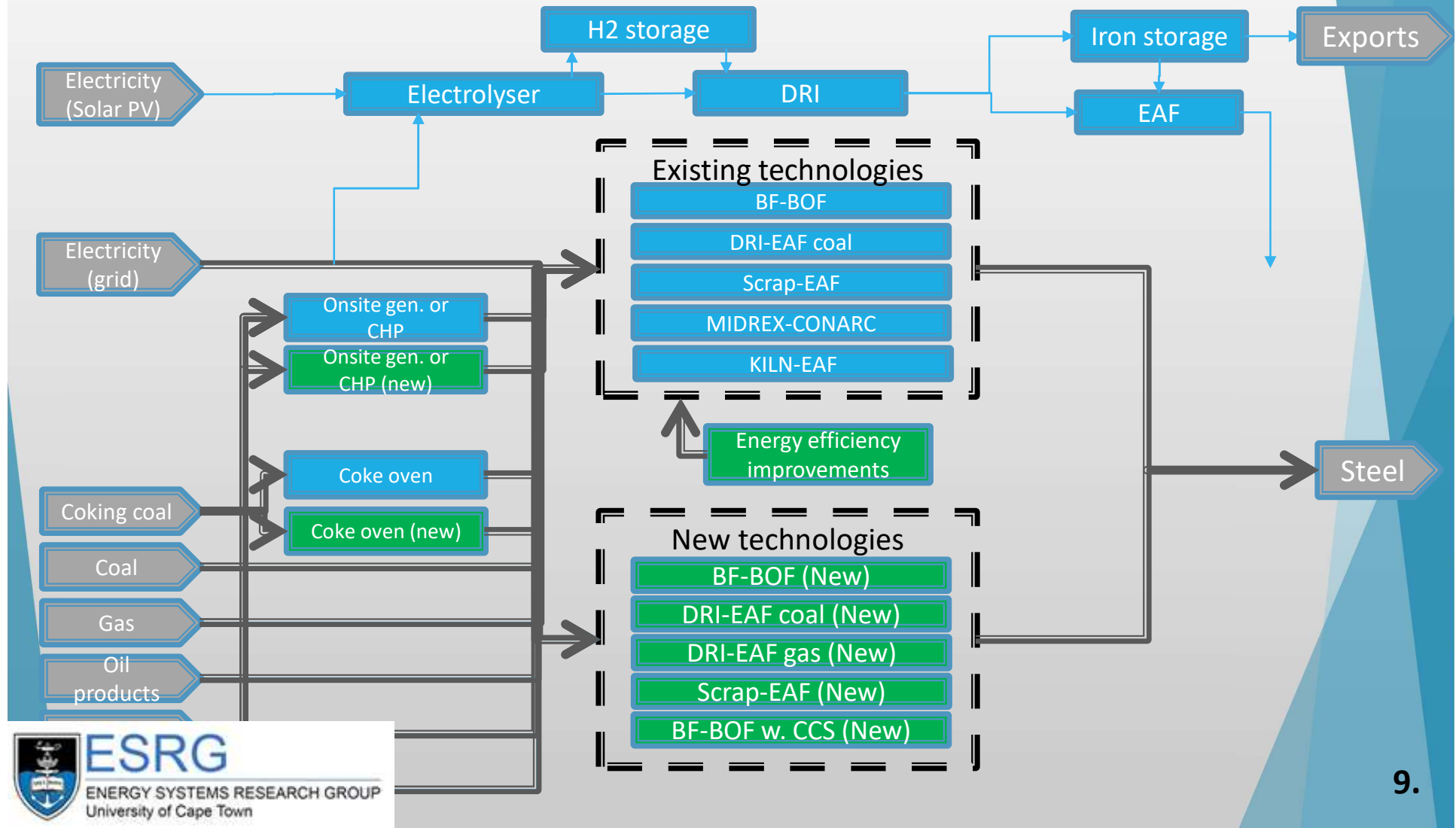
Key findings

- There no longer exists a trade-off between economic development and power sector decarbonization in South Africa.
- Shifting away from coal to RE does not negatively affect economic development → Protecting the coal-mining sector does not save jobs.
- Investment in renewable power is the least-cost option for South Africa.
- Artificially constraining the inclusion of solar PV and wind in the long term increases the electricity price and negatively affects economic development.
- Removing constraints on renewable energy deployment leads to higher real GDP and increased net employment
- A just transition plan is needed to protect workers and dependent communities

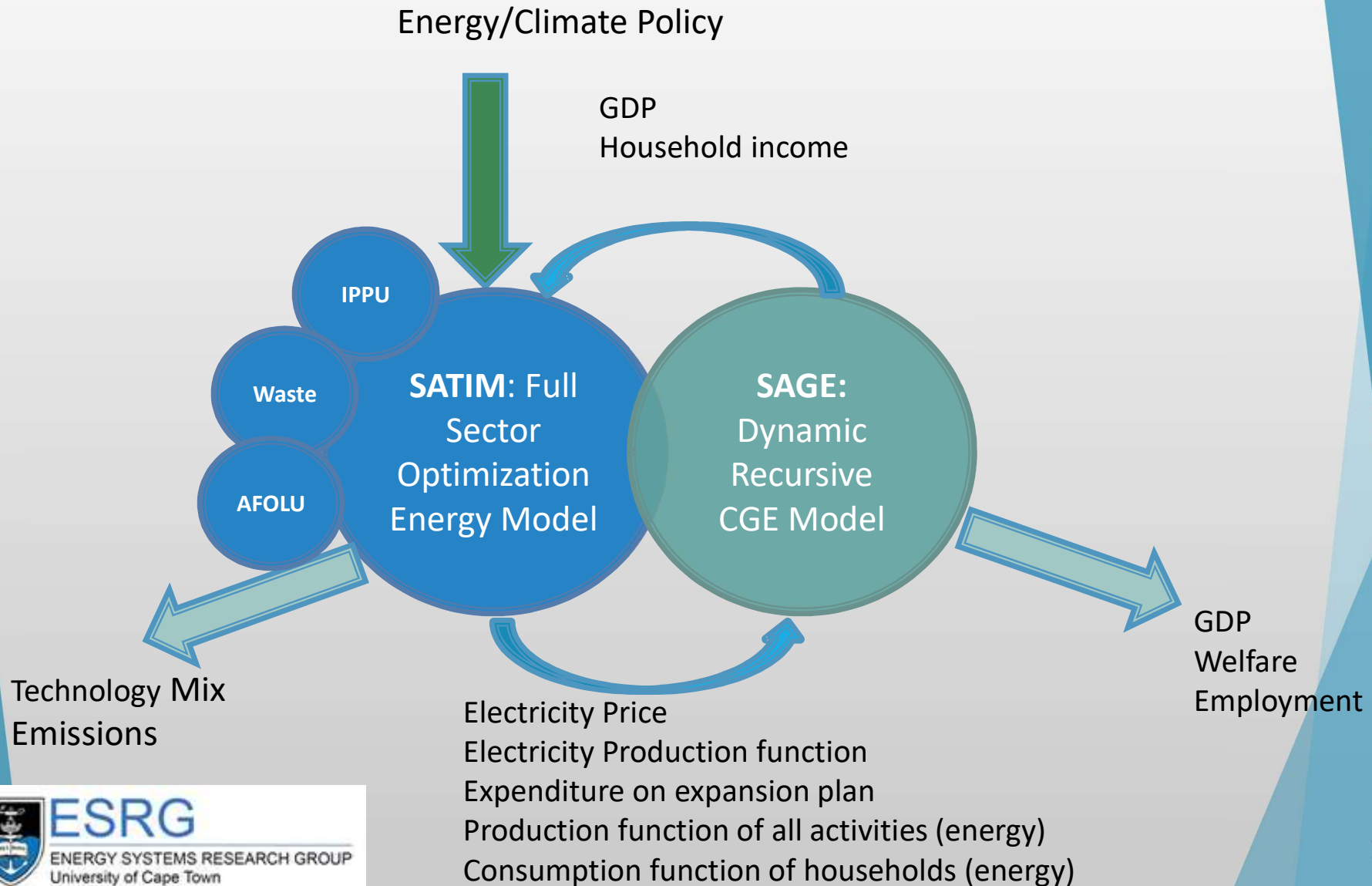


SATIMGE-Highlight 2:

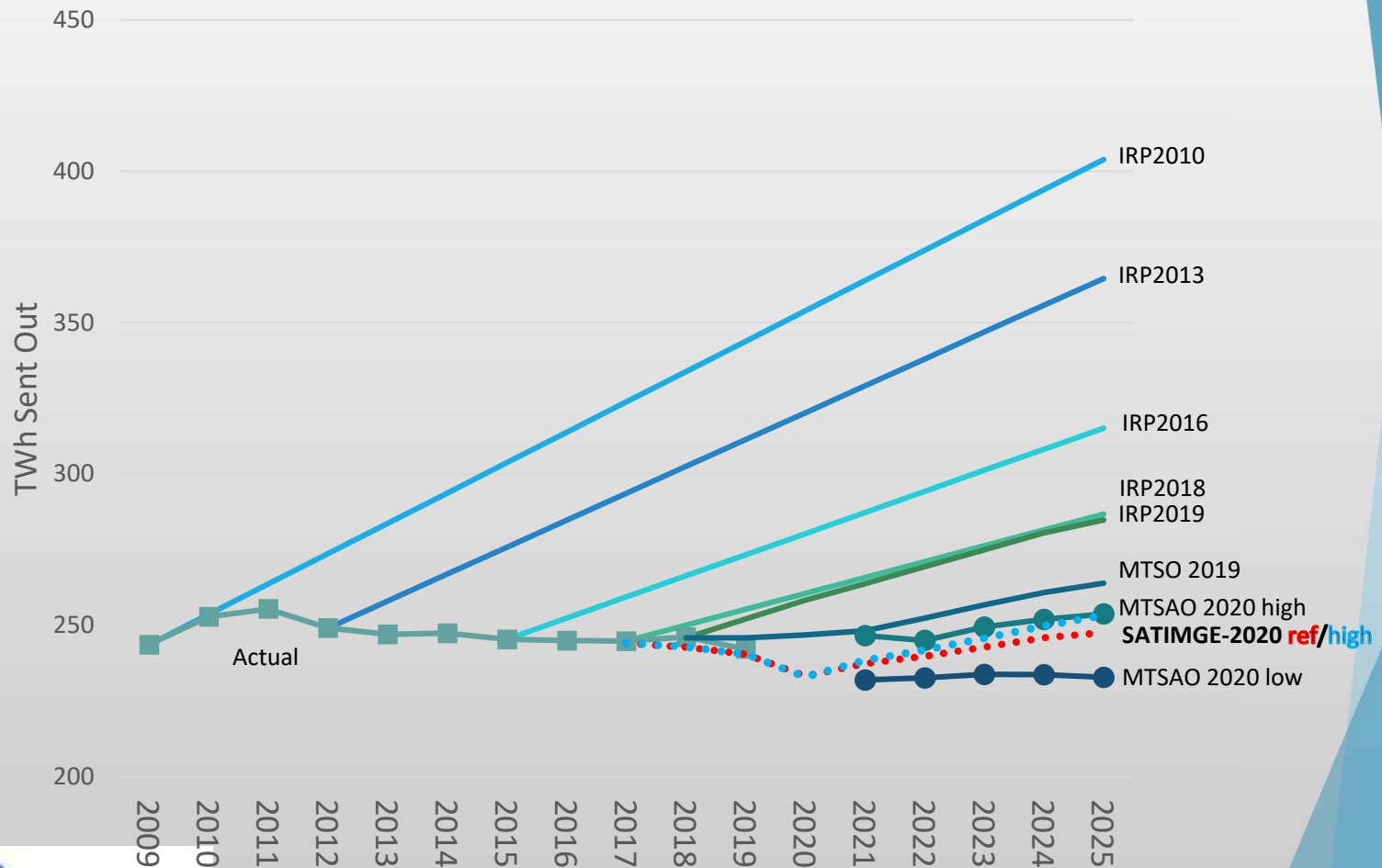
Updates made under Deep Dives in DDP BIICS (Bryce to elaborate)



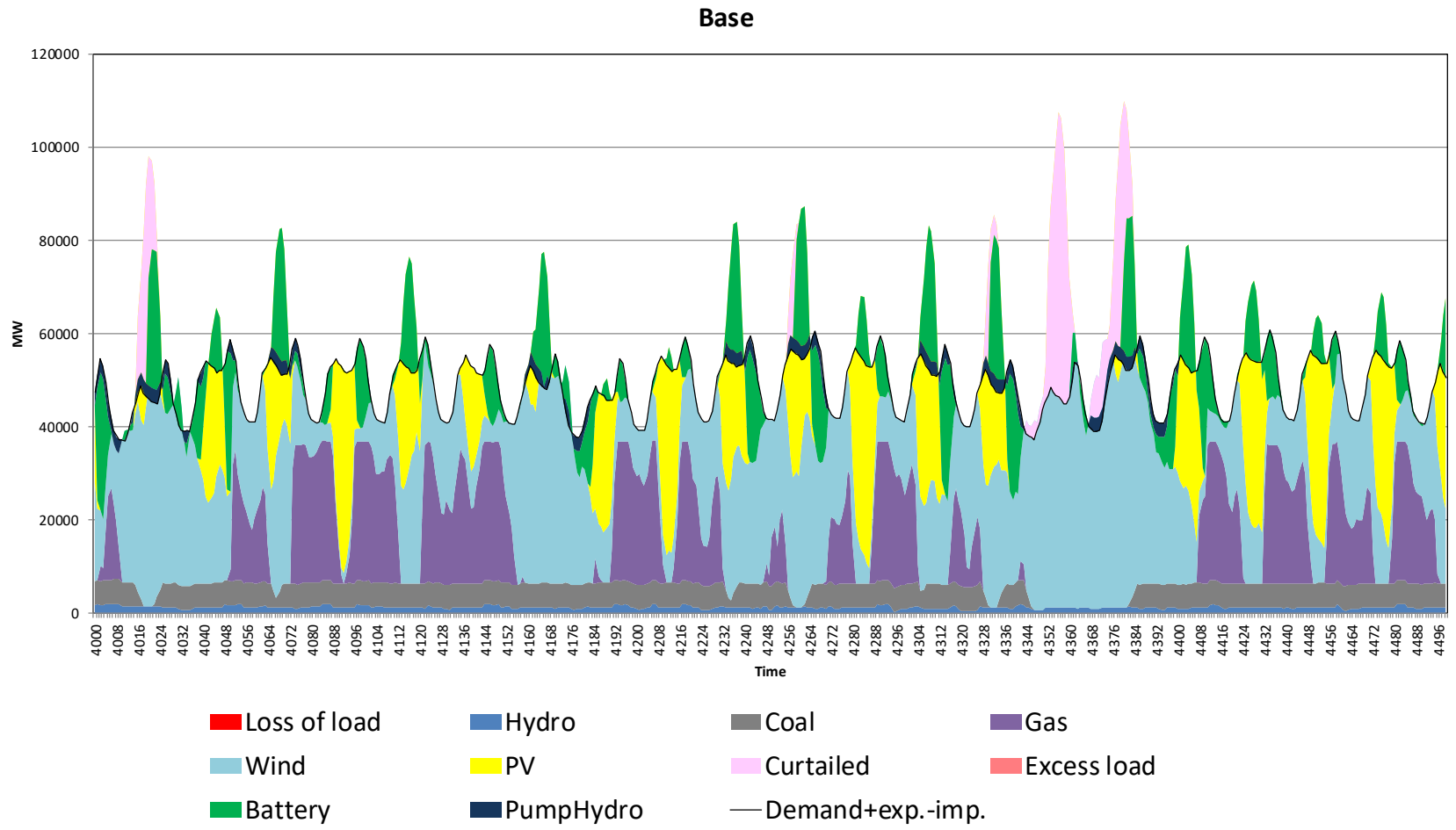
SATIMGE-Highlight 3: Inclusion of IPPU + Link to Waste and AFOLU models



SATIMGE-Highlight 4: Update of GDP and demand taking into account COVID



SATIMGE-Highlight 6: Prelim Link to IRENA Flextool for high- temporal checks on power sector



SATIMGE-Highlight 7: Git-based version control for model

The image displays the GitKraken interface, showing a commit history on the left and a diff view of a file named `tch_pwr.imp` in the center. The commit history includes messages such as "Small change in TCH_PWR, KLEM indicators added, Price indicators" and "Fixes made to DMD_PROJ(hh,tra),TCH_PWR:ramp rates, NCAP_AF-LO on OCGTs". The diff view shows changes to various data points, including `ACT_COST_ERBND-I` and `ACT_COST_ERBND-E`.

Commit History:

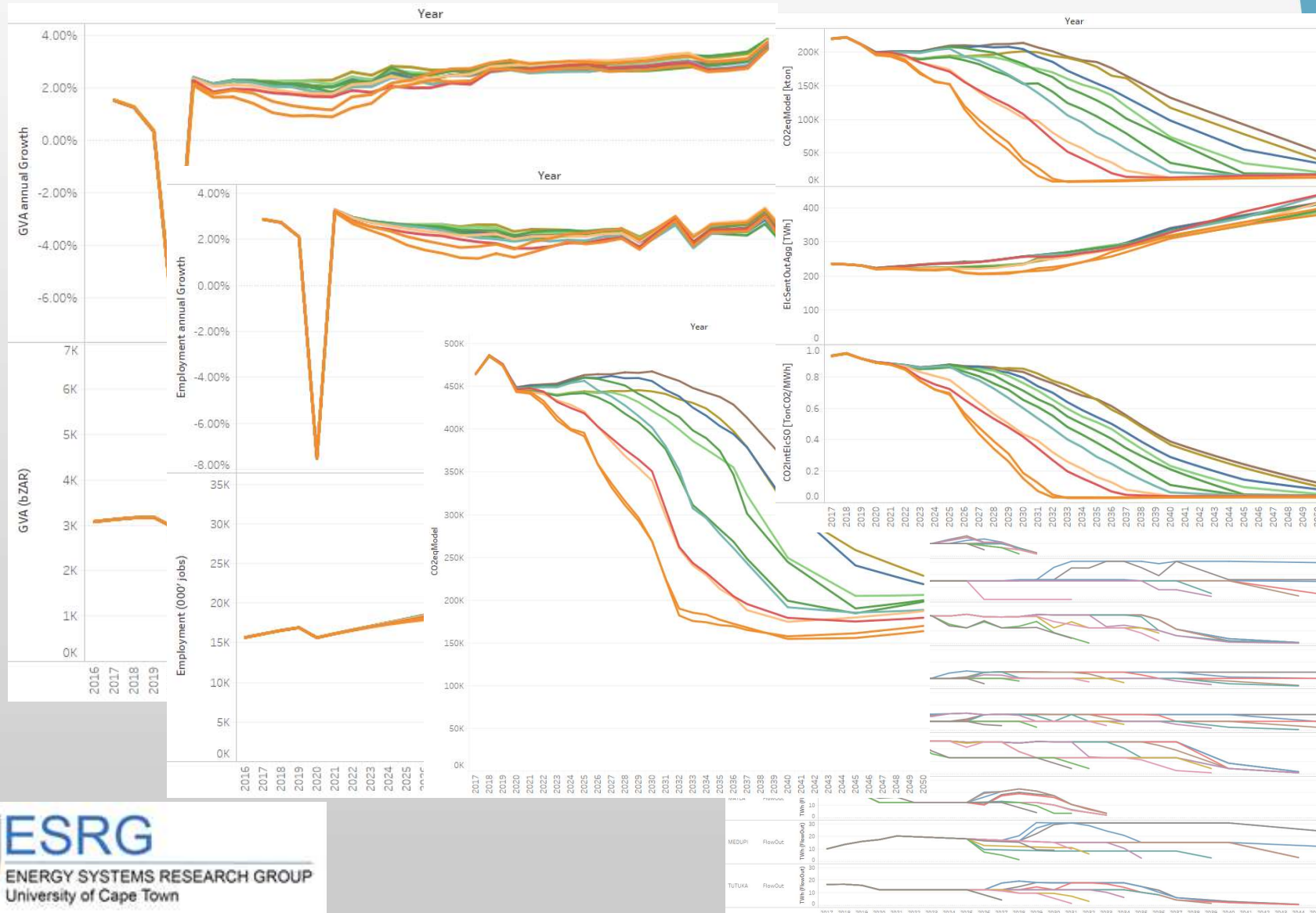
- 12 hours ago: Small change in TCH_PWR, KLEM indicators added, Price indicators
- 2 weeks ago: Fixes made to DMD_PROJ(hh,tra),TCH_PWR:ramp rates, NCAP_AF-LO on OCGTs
- 3 weeks ago: Endog.Retirement.Fixes:fugitive on gas.Fix to residential,iron&steel.
- Aramco Refinery Added to Base,sub-annual reporting,NCAP_AF-lo in pwr2018
- Tmp Fix on Gas use in power sector.
- Link to IEA-WEO oil prices,capital.inc fix,CO2Cap,other minor fixes
- with Latest AFOLU and Waste models
- Final final runs (LEAF+GVA decoupling+NDP runs)incl.GDXs,+mdb.

Diff View (Selected File: tch_pwr.imp):

Line	File	Change
124	T XCOPEL Commercial Electricity PJ,GW	PRC,ELE,DAVNITE
125	T XICPEL Industrial CP-Electricity PJ,GW	PRC,ELE,DAVNITE
126	T XIPEL Industrial FA-Electricity PJ,GW	PRC,ELE,DAVNITE
127	T XIPEL Industrial FB-Electricity PJ,GW	PRC,ELE,DAVNITE
128	T XIPEL Industrial IS-Electricity PJ,GW	PRC,ELE,DAVNITE
129	T XIPEL Industrial MI-Electricity PJ,GW	PRC,ELE,DAVNITE
130	T XIPEL Industrial NF-Electricity PJ,GW	PRC,ELE,DAVNITE
131	T XIPEL Industrial NF-Electricity PJ,GW	PRC,ELE,DAVNITE
132	T XIPEL Industrial NF-Electricity PJ,GW	PRC,ELE,DAVNITE
133	T XIPEL Industrial OF-Electricity PJ,GW	PRC,ELE,DAVNITE
134	T XIPEL Industrial PP-Electricity PJ,GW	PRC,ELE,DAVNITE
135	T XRESEL Residential Electricity PJ,GW	PRC,ELE,DAVNITE
136	T XTRAEEL Transport Electricity PJ,GW	PRC,ELE,DAVNITE
137	T XUPSEL Supply Sector Electricity PJ,GW	PRC,ELE,DAVNITE
138		
139	TS DATA REGION1	
140	ACT_BND MINSOUHVRS	- - - ANNUAL UP 3 2.16112 null null null 146
141	ACT_BND MINSKENDVRS	- - - ANNUAL UP 3 73.79864 null null nu 147
142	ACT_BND MINSKRIESES	- - - ANNUAL UP 3 95.75862 null null null 148
143	ACT_BND MINSKUSTILG	- - - ANNUAL UP 3 156 null null null nu 149
144	ACT_BND MINSKUSTIVRS	- - - ANNUAL UP 3 79.88778 null null nu 150
145	ACT_BND MINSKUSTIVRS	- - - ANNUAL UP 3 116.23595 null null nu 151
146	ACT_BND PEXEEL	- - - ANNUAL FX 3 54.126 null null null null 152
147	ACT_COST EPTSTO-E	- - - 0 0 null null null null 153
148	ACT_COST ERBID-N	- - - 0 62.2613488055821 null null nu 154
149	ACT_COST ERBID-N	- - - 0 115.143296383203 null null nu 155
150	ACT_COST ERHYD-E	- - - 0 null null null null null 156
151	ACT_COST ERHYD-E	- - - 0 null null null null null 157
152	ACT_COST ERHYD-N	- - - 0 null null null null null 158
153	ACT_COST ERHYD-N	- - - 0 null null null null null 159
154	ACT_COST ERHYD-N	- - - 0 null null null null null 160
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161	ACT_COST ETCLPEB-N	- - - 0 7.42821569799135 null null 167
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163	ACT_COST ETCLPEB-N	- - - 0 7.42821569799135 null null 169
164	ACT_COST ETCLPEB-N	- - - 0 7.42821569799135 null null 170



SATIMGE-Highlight 8: Tableau Dashboard for viewing indicators

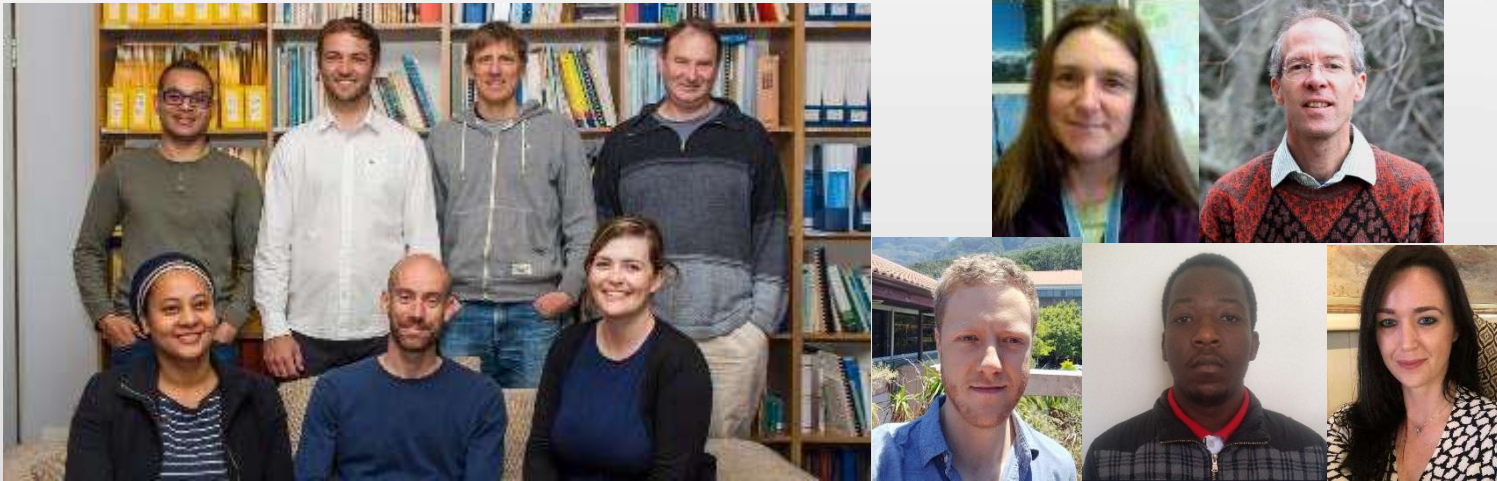


SATIMGE-2021?

- ▶ Pathways to Net-Zero for South Africa by 2050-2060
- ▶ Impacts of Climate Actions on households (TSITICA-ARUA)
- ▶ Further Deep dives under DDP-BIICS

Thank you!

We are open for collaboration and contributions for future work...



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email – brunomerven@gmail.com

References: Past SATIM and SATIMGE projects

Year	Project	Link
2003	IEP-1	
2006	EPSD-SA - IAEA	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2006/Papers-2005/05Winkler-Alfstad-Howells-Energy_Policies_Phase2.pdf
2007	LTMS	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2007/07Scenario_team-LTMS_Scenarios.pdf
2008	Costing 2020 RE Target	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2008/08-Marquardetal-costing_a_2020_target.pdf
2010	Review of RE white paper	report not published
2011	Low Emission Pathways	report not published
2012	SANEDI-Transport	https://open.uct.ac.za/handle/11427/16905
2013	NPC-Power Plan	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2013/13ERC-Towards_new_power_plan.pdf
2014	UNU-WIDER SATIMGE beta 1	https://www.wider.unu.edu/sites/default/files/wp2014-135.pdf
2015	UNEP Uncertainty in Baselines	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2016/16-Merven-et-al-Longterm_GHG_forecasts.pdf
	SDSN DDP	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2015/15-Altieri-et-al-Pathways_to_deep_carbonisation.pdf
	SA Nuclear: Risk Analysis	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2015/15-ERC-Nuclear_build_plan_Technical_report.pdf
2016	WB Thirsty Energy	https://openknowledge.worldbank.org/bitstream/handle/10986/26255/113464-WP-P144930-PUBLIC-W16014-eBook.pdf?sequence=5&isAllowed=y
	UNU-WIDER SATIMGE beta 2	https://www.wider.unu.edu/publication/development-linked-modelling-framework-analysing-socioeconomic-impacts-energy-and
2017	Gas Study	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2017/17-Merven-et-al-Uptake_natural_gas_SA.pdf
	SANEDI-Transport 2	https://journals.assaf.org.za/index.php/jesa/article/view/4176
	PAMS	Final report not published - need to put draft released to stakeholders on our website
2018	SANEDI Flexible Demand	https://www.ee.co.za/wp-content/uploads/2018/10/Gregory-Ireland-University-of-Cape-Town-presentation.pdf (need to put report on our website)
	CER Coal-IPPs	https://cer.org.za/wp-content/uploads/2018/05/ERC-Coal-IPP-Study-Report-Finalv2-290518.pdf
	SA-TIED Alt-IRP	http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2019/Alt%20IRP%20final%2007022019_2.pdf
2019	CoBenefits Study	https://www.cobenefits.info/wp-content/uploads/2019/03/COBENEFITS-Study-South-Africa-Employment.pdf
	SA-TIED	https://sa-tied.wider.unu.edu/climate
2020	DEFF-SSN 2030 NDC Update	Report Due early 2021
2021	DEFF-SSN Net-Zero	
	GCRF STITICA	
	IKI DDP-BIICS	

2021

17.
2021