



energy
[r]evolution

A SUSTAINABLE WORLD ENERGY OUTLOOK



GREENPEACE



THE ENERGY [R]EVOLUTION

- This scenario is based on the global energy scenario produced by Greenpeace International, which demonstrates how energy-related global CO₂ emissions can be reduced by 80% by 2050 based on 1990 levels.
- The South African scenario provides an exciting, ambitious and necessary blueprint for how emission reductions can be made in the energy and transport sectors and how South Africa's energy can be sustainably managed up to the middle of this century.

WHY THE NEED FOR A REVOLUTION ?

- The threat of climate change, caused by rising global temperatures, is the most significant environmental challenge facing the world at the beginning of the 21st century.
- It has major implications for the world's social and economic stability, its natural resources and in particular, the way we produce our energy.
- Nothing short of such a revolution will enable us to limit global warming to avoid impacts become devastating.
- The global Energy [R]evolution scenario has a target to reduce energy related CO2 emissions to a maximum of 10 Gigatonnes (Gt) by 2050 and phase out fossil fuels by 2085.

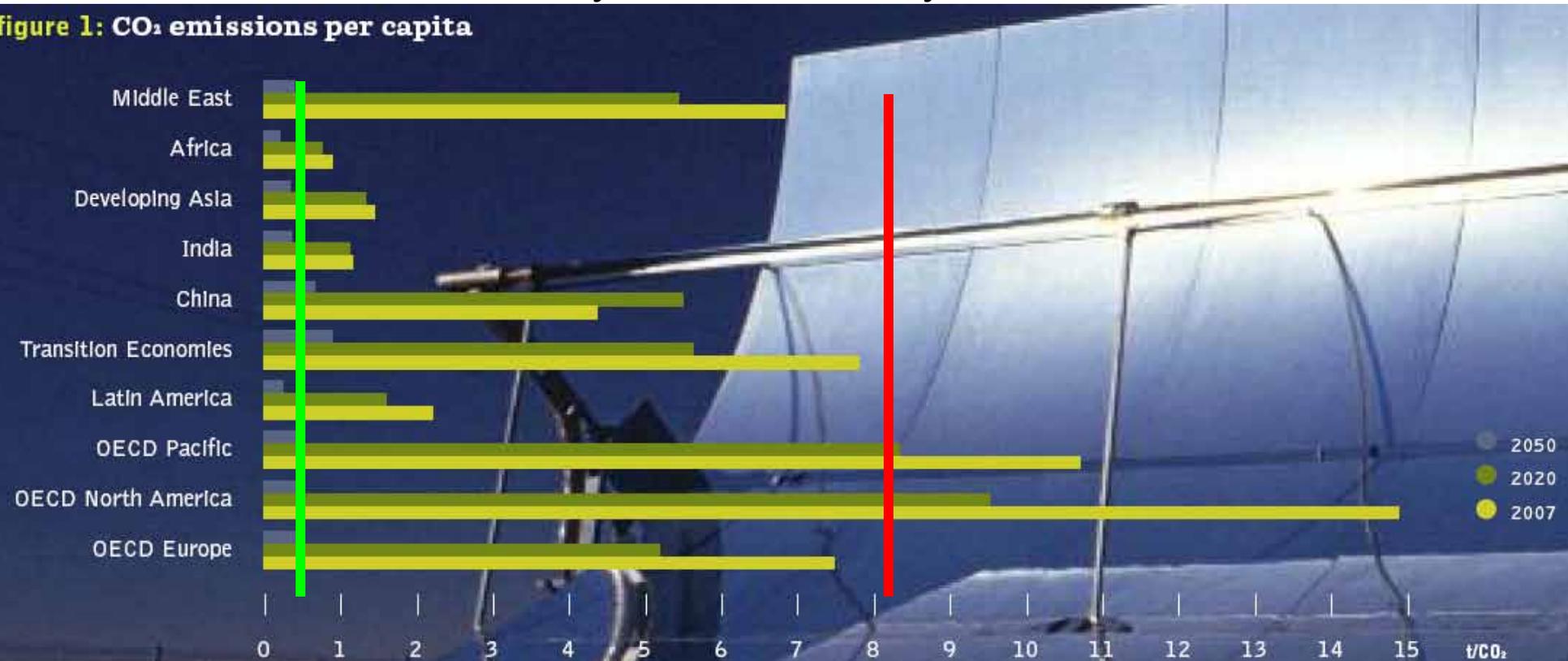
Global Climate policy targets

Stabilize global CO₂-concentration under 400 ppm

- Global CO₂ emission peak by 2015
- Reduction of Global energy related CO₂-emissions from today's 29 Gt/a to approx.
- Basic Energy [R]evolution 10 Gt CO₂/a in 2050 / Advanced Energy [R]evolution 3.5 Gt CO₂/a in 2050
- Per capita emissions by 2050: ~ 1 tCO₂/a / 0.4 tCO₂/a
- **South Africa: stabilize on 2007 by 2020 and reduce - 85% by 2050**



Figure 1: CO₂ emissions per capita



THE FIVE KEY PRINCIPLES BEHIND THIS SHIFT WILL BE TO:

- Create greater equity in the use of resources
- Respect the natural limits of the environment
- Decouple economic growth from the consumption of fossil fuels
- Implement renewable solutions, especially through decentralised energy systems
- Phase out dirty, unsustainable energy sources

CREATE GREATER EQUITY IN THE USE OF RESOURCES

- At one extreme, a third of the world's population has no access to electricity, whilst the most industrialized countries consume much more than their fair share.
- The Advanced Energy [R]evolution scenario has a target to achieve energy equity as soon as technically possible.
- **There is no energy shortage.** All we need to do is use existing technologies to harness energy effectively and efficiently.

Country	Penetration rate	Population without electricity (millions)
Libya	99.8%	0
South Africa	75%	12.5
Ghana	60.5%	9.4
Nigeria	50.6%	76.4
Senegal	42%	7.3
Kenya	16.1%	33.4
Congo DRC	11.1%	58.7
Uganda	9%	29.8
Malawi	9%	13.9

RESPECT THE NATURAL LIMITS OF THE ENVIRONMENT

To stop the earth's climate spinning out of control, most of the world's fossil fuel reserves – coal, oil and gas – must remain in the ground. Our goal is for humans to live within the natural limits of our small planet.

“THE STONE AGE DID NOT END FOR LACK OF STONE,
AND THE OIL AGE WILL END LONG BEFORE THE
WORLD RUNS OUT OF OIL.”

Sheikh Zaki Yamani, former Saudi Arabian oil minister

DECOUPLE GROWTH FROM FOSSIL FUEL USE.

It is commonly understood that economic development requires energy. However, this is often framed by short-term thinking where only immediate and direct economic benefit is considered. Long-term sustainability and external economic costs of energy generation are often ignored, as are the social impacts of that energy.

"WHILE OUR ECONOMY GREW 48% SINCE 1990, EMISSIONS ARE DOWN 18%. THESE FIGURES PROVE ONCE AGAIN THAT EMISSIONS CAN BE CUT WITHOUT SACRIFICING THE ECONOMY."

Connie Hedegaard, EU commissioner for climate action

IMPLEMENT CLEAN, RENEWABLE SOLUTIONS AND DECENTRALIZE ENERGY SYSTEMS

Sustainable decentralised energy systems produce less carbon emissions, are cheaper and involve less dependence on imported fuel.

They create more jobs and empower local communities. Decentralised systems are more secure and more efficient. This is what the Energy [R]evolution must aim to create.

More about smart grid later ...

PHASE OUT DIRTY, UNSUSTAINABLE AND DANGEROUS ENERGY

- We need to phase out coal and nuclear power. We cannot continue to build coal plants at a time when emissions pose a real and present danger to both ecosystems and people. **NO NEW INVESTMENTS IN COAL**
- And we cannot continue to fuel the myriad nuclear threats by pretending nuclear power can in any way help to combat climate change. There is no role for nuclear power in the Energy [R]evolution.

FROM PRINCIPLES TO PRACTICE

- About 80% of primary energy supply today still comes from fossil fuels, and 6% from nuclear power.
- A **transition phase** is required to build up the necessary infrastructure. **NO NEW INVESTMENTS IN COAL.**
- Natural gas, used in appropriately scaled cogeneration plants, is valuable as a transition fuel, and able to drive cost-effective decentralization of the energy infrastructure.

FROM PRINCIPLES TO PRACTICE

Step 1: Energy Efficiency

The Energy [R]evolution is aimed at the ambitious exploitation of the potential for energy efficiency. It focuses on current best practice and technologies that will become available in the future, assuming continuous innovation.

Exploitation of existing large energy efficiency potentials will ensure that primary energy demand decreases - from the current 5,500 PJ/a (2007) to 4,095 PJ/a in 2050, compared to 8,246 PJ/a in the Reference scenario.

FROM PRINCIPLES TO PRACTICE

Step 2: Decentralized energy and large scale renewables

This is energy generated at or near the point of use, and this kind of system would be ideal for the delivery of electricity to rural communities in South Africa that are not located near to the grid. Moving away from Energy Security to both Energy Security and Energy Access.

We need a roof top revolution! With RE getting grid priority.

Decentralised renewable energy production and energy management of demand are both fluctuating but can be balanced on a smart grid

FROM PRINCIPLES TO PRACTICE

Step 2 Continued: Renewable electricity

The electricity sector will be the pioneer of renewable energy utilization. Many renewable electricity technologies have been experiencing steady growth over the past 20 to 30 years of up to 35% annually and are expected to consolidate at a high level between 2030 and 2050.

By 2050, under the Advanced Energy [R]evolution scenario, the majority of electricity will be produced from renewable energy sources. Growth of electricity use in transport will further promote the effective use of renewable power generation technologies.

PRINCIPLES TO PRACTICE

Step 2 Continued

The Advanced Energy [R]evolution scenario will also result in

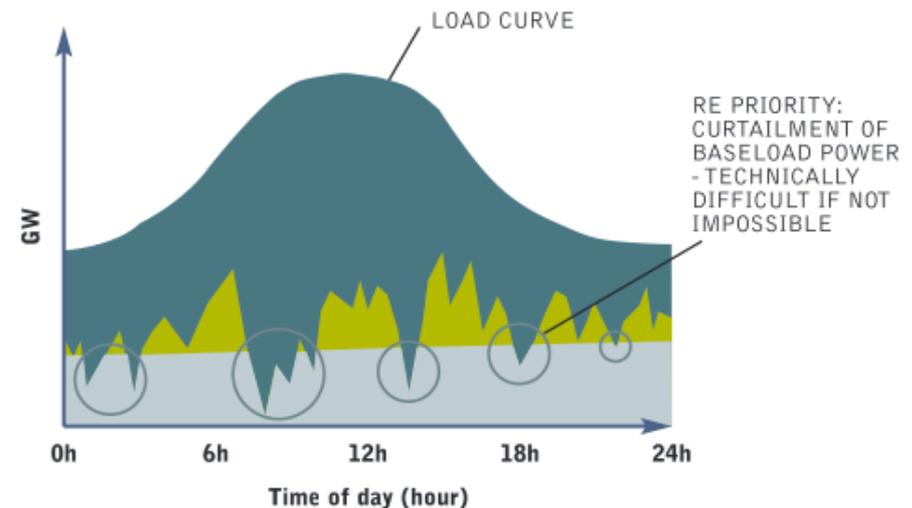
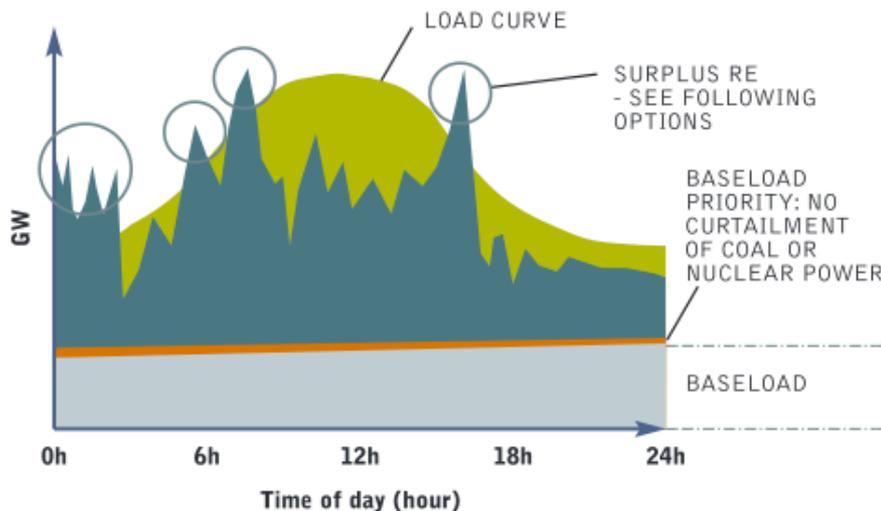
- Dramatic change in the business model of energy companies, utilities, fuel suppliers and the manufacturers of energy technologies.
- Decentralised energy generation and large solar or offshore wind arrays which operate in remote areas, without the need for any fuel, will have a profound impact on the way utilities operate in 2020 and beyond.
- **Ownership will therefore shift towards more private investors and away from centralized utilities.** In turn, the value chain for power companies will shift towards project development, equipment manufacturing and operation and maintenance.

A FEW MORE WORDS ABOUT THE CHANGING BUSINESS MODEL

- Simply selling electricity to customers will play a smaller role, as the power companies of the future will deliver a total power plant to the customer, not just electricity. They will therefore move towards becoming service suppliers for the customer.
- Those traditional energy supply companies which do not move towards renewable project development will either lose market share or drop out of the market completely.
- Eskom to build the new power themselves (presumably about ZAR 1,38/kWh) and compared that with what it costs to buy from IPP's (ZAR 0,89 for wind) Ref REIPPPP 2012

STEP 3: OPTIMIZED INTEGRATION – RENEWABLES 24/7

It is often argued that renewable energy technology cannot provide base load capacity to the electricity network and thus a power system based on coal and nuclear is assumed to be essential. However, uninterrupted power supply is possible without new coal or nuclear build.



STEP 3: OPTIMIZED INTEGRATION – RENEWABLES 24/7

- Clever technologies can track and manage energy use patterns, provide flexible power that follows demand through the day, use better storage options and group customers together to form 'virtual batteries'.
- With all these solutions we can secure the renewable energy future needed to avert catastrophic climate change. Renewable energy 24/7 is technically and economically possible, it just needs the right policy and the commercial investment to get things moving and 'keep the lights on'24.

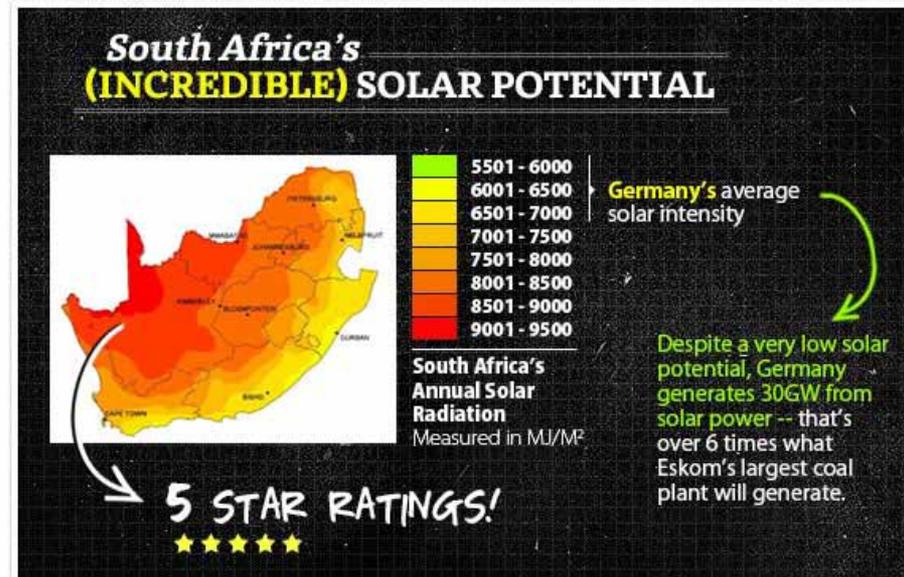
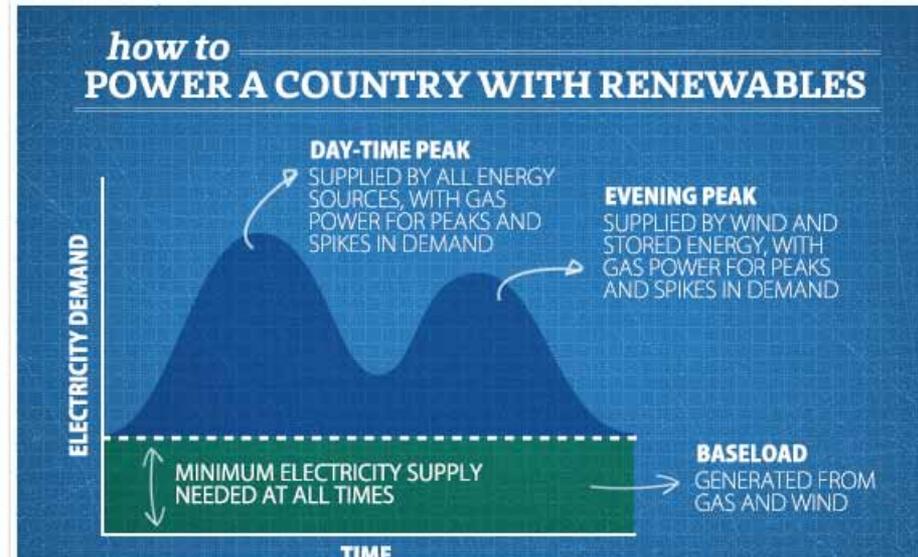
STEP 3: OPTIMIZED INTEGRATION – RENEWABLES 24/7

The key elements of this new power system architecture are

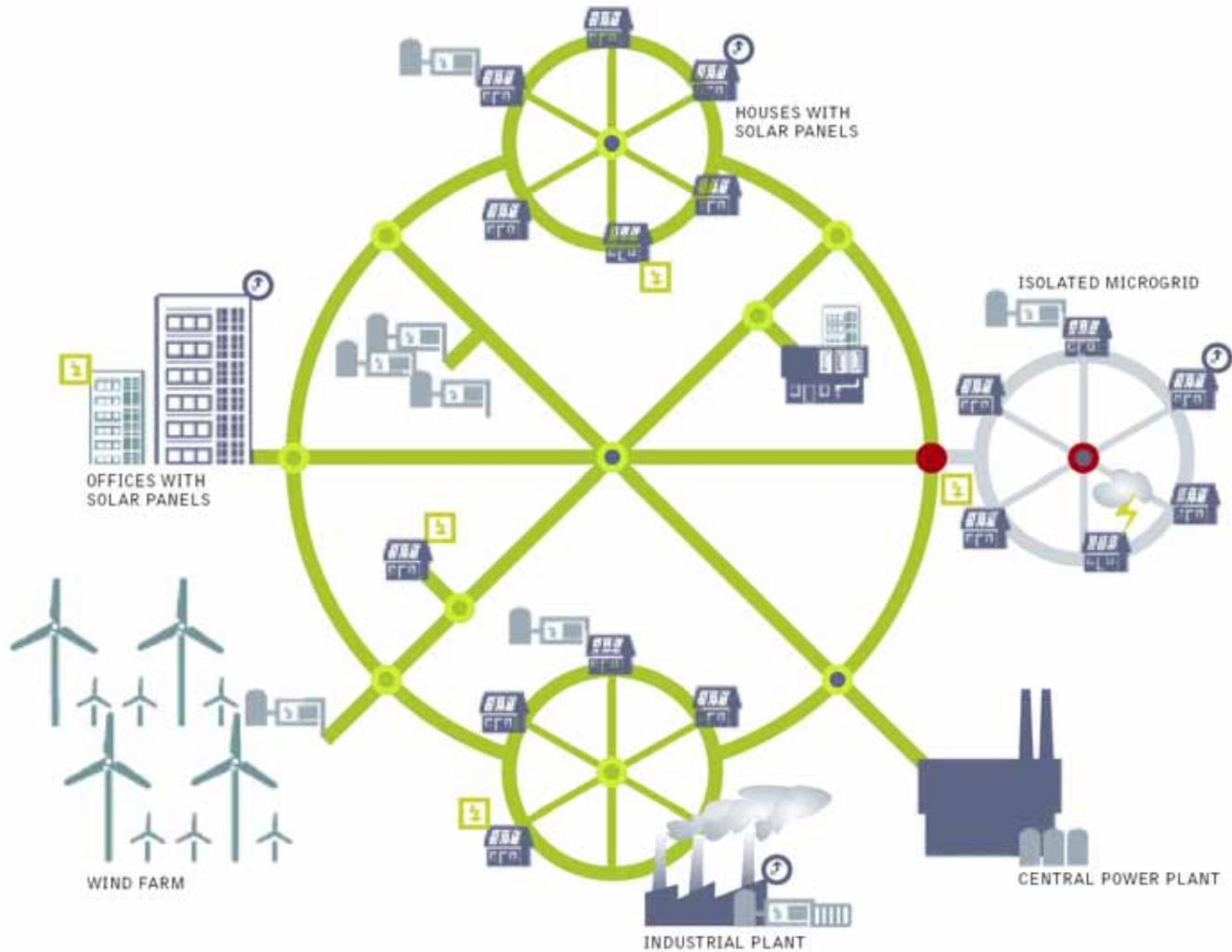
- Hybrid systems
- Micro grids,
- Smart grids and an
- Efficient large scale super grid.

SMART GRIDS

- In Denmark, for example, the average supplied by wind power is about 20%, with peaks of more than 100% of demand. On those occasions surplus electricity is exported to neighboring countries.
- In Spain, a much larger country with a higher demand, the average supplied by wind power is 14%, with peaks of more than 50%.



smart-grid vision for the energy [r]evolution



BARRIERS TO RENEWABLE ENERGY

There are no real technical or economic barriers to implementing the Energy [R]evolution. It is the lack of political will that is to blame for the slow progress to date

6 RENEWABLE ENERGY MYTHS



~~renewable energy is too expensive~~
~~renewable energy doesn't work~~
~~It can't supply electricity 24/7~~
~~renewables have a huge CO₂ footprint~~

[CLICK HERE](#)

WHAT DOES THE FUTURE LOOK LIKE

- The electricity sector will be the pioneer of renewable energy utilization. By 2030, 49% of electricity will be produced from renewable sources, increasing to 94% by 2050.
- After 2020, the final energy share of electric vehicles on the road increases to 14% by 2030 and 2050 to 53%.
- More public transport systems also use electricity, as well as there being a greater shift in transporting freight from road to rail.



table 6.3: fuel cost savings and investment costs under three scenarios

INVESTMENT COST	DOLLAR	2007-2010	201-2020	2021-2030	2031-2040	2041-2050	2007-2050	2007-2050 AVERAGE PER YEAR
SOUTH AFRICA (2011) DIFFERENCE E[R] VERSUS REF								
Conventional (fossil & nuclear)	billion \$	0	-8	-32	-11	-10	-61	-1.4
Renewables (Incl. CHP)	billion \$	0	22	44	50	78	194	4.5
Total	billion \$		13	13	38	69	133	3.1
SOUTH AFRICA (2011) DIFFERENCE ADV E[R] VERSUS REF								
Conventional (fossil & nuclear)	billion \$	0	-13	-34	-13	-10	-70	-1.6
Renewables (Incl. CHP)	billion \$	0	52	60	92	90	293	6.8
Total	billion \$		39	26	78	80	223	5.2
CUMULATED FUEL COST SAVINGS								
SAVINGS E[R] CUMULATED IN €								
Fuel oil	billion \$/a		1.1	16.9	41.4	64.0	123	2.9
Gas	billion \$/a		-4.0	-20.2	-30.3	-31.5	-86	-2.0
Hard coal	billion \$/a		4.7	15.6	34.6	63.1	118	2.7
Total	billion \$/a		1.9	12.3	45.8	95.6	156	3.6
SAVINGS ADV E[R] CUMULATED IN €								
Fuel oil	billion \$/a		1.1	16.9	42.9	65.9	127	3.0
Gas	billion \$/a		-4.0	-11.0	-0.9	15.9	0	0.0
Hard coal	billion \$/a		7.0	23.9	47.5	77.6	156	3.6
Total			4.2	29.7	89.6	159.4	283	6.6

Greenpeace Africa's new green jobs briefing 'More jobs and progress for South Africa: The Advanced Energy [R]evolution scenario

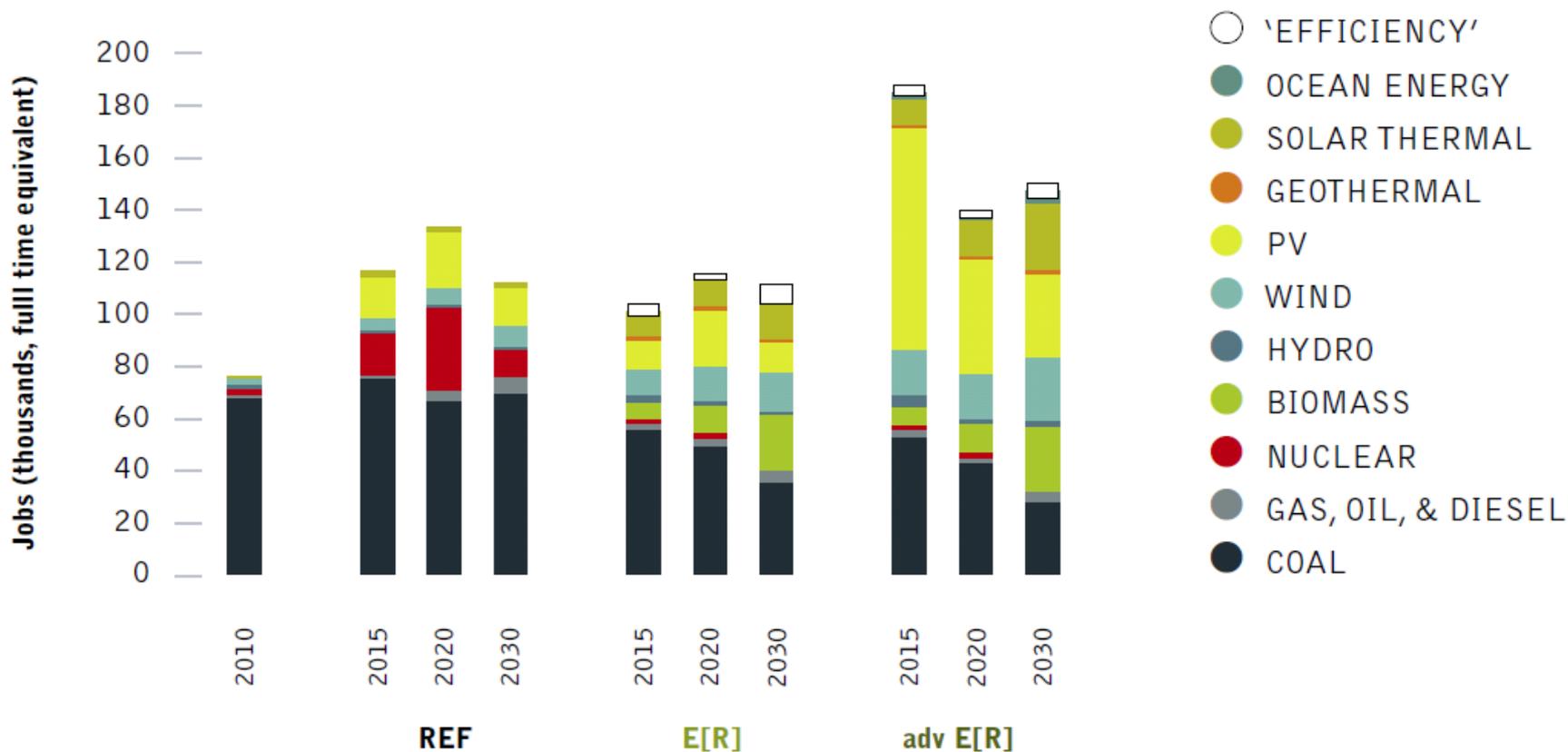
We specifically look at the job creation potential of the government's current pathway (based on the Integrated Resource Plan for electricity (IRP), published in 2011), to the [Advanced Energy \[R\]evolution](#). The IRP will result in 111 000 direct jobs by 2030, compared to 149 000 direct jobs in the Advanced Energy [R]evolution scenario.



table 7.1: electricity sector jobs in the three scenarios

Thousand Jobs	2010	2015	REFERENCE		ENERGY [R]EVOLUTION			ADVANCED ENERGY [R]EVOLUTION		
			2020	2030	2015	2020	2030	2015	2020	2030
Coal	67.8	75.1	66.9	69.7	55.4	49.6	35.9	53.0	42.7	28.6
Gas, oil and diesel	1.8	1.8	4.1	6.4	3.0	3.2	3.8	3.0	2.7	3.5
Nuclear	1.3	16.5	31.7	9.9	1.3	1.3	0.0	1.3	1.3	0.0
Renewables	4.8	22.6	30.3	25.3	38.5	58.9	64.4	123.9	85.8	97.4
Manufacturing (export)	-	-	-	-	-	-	-	2.7	5.1	14.5
Energy efficiency	-	-	-	-	4.6	2.8	7.6	4.6	2.4	5.5
Total Jobs	75.7	116.0	133.0	111.3	102.8	115.8	111.6	188.4	140.0	149.5

figure 7.1: jobs by technology under three scenarios



RENEWABLE ENERGY?
I'M A HUGE FAN!



TELL GOVT TO USE
THE WIND MORE! ▶

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