



# NUCLEAR POWER: NO ANSWER TO CLIMATE CHANGE

We prepared this pamphlet among members of the Coalition Against Nuclear Energy (CANE) so that all us can take part in an informed debate about energy policy and electricity production in South Africa. CANE is **against** nuclear power and **for** an alternative mix of energy strategies and technologies. Please study this pamphlet, think about it, and discuss it in your structures. You can also follow up on the references given at the back of the pamphlet. We took all the information from respected and scientific sources.

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## The question is:

What kind of South Africa do we want to live in by 2030, and what energy technologies and strategies will get us there? We need to think about these issues:

- ✦ What is the most **effective** way to address climate change?
- ✦ What energy path is the **safest and simplest**?
- ✦ How much is it going to **cost**?
- ✦ What are the **externalized costs**<sup>1</sup> to the environment and to future generations?
- ✦ Who is going to benefit in terms of **jobs and skills**?
- ✦ If we decide to use nuclear power, how do we address **nuclear weapons proliferation** [ADD EXPLANATION IN END-NOTE]?

## Nuclear power does not help us to combat climate change at all

When **atoms** are combined together into larger chemicals, scientists call them "**molecules**". These can be found as a **solid** (like a brick), **liquid** (like water) and **gas** (like a CADAC flame). Carbon Dioxide (CO<sub>2</sub>) is a gas molecule which we find everywhere in nature. Every molecule of CO<sub>2</sub> has three atoms: one of Carbon (C) and two of Oxygen (O<sub>2</sub>). All living animals – humans included – breathe in oxygen so that we might live. All trees and plants take in CO<sub>2</sub> and give off oxygen, and use sunlight in this process. Too much CO<sub>2</sub> in the air tends to form a kind of gaseous blanket. This blanket slows down the sun's rays from bouncing back out to space, and warms the upper air – a major cause of climate change.

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<sup>1</sup> "Externalized costs" are costs that Eskom leave out when they work out the electricity price. Yet we will still have to pay those costs, or our grandchildren will have to pay them. One example of externalized costs is when we have to fix the damage to our health caused by pollution from nuclear power stations.

When scientists want to measure the amount of CO<sub>2</sub> in the air, they usually count the CO<sub>2</sub> in a volume of one million molecules of air (so many **parts per million**, or ppm). Before humans began to use coal and oil for production and transport, the amount of CO<sub>2</sub> in a volume of air was 280 parts per million (ppm)<sup>2</sup>. Every year the CO<sub>2</sub> in the air has been rising by two ppm and is now standing at 386 ppm<sup>3</sup>.

Most of this rise comes from burning oil and coal, and the rest is from cutting down trees.<sup>4</sup> At the same time, the average temperature on the Earth rose by 0.7 degrees Centigrade (deg C) [ENDNOTE: the measure on a hospital thermometer that nurses put under your tongue when you are sick] over the last two hundred years.

Scientists also predict that we will have an extra 0.6 deg C in years to come.<sup>5</sup> Since only 2 deg C is enough to cause havoc, the Copenhagen Summit of December 2009 agreed that the temperature rise must be limited to below 2 deg C. So the safest path is to choose the most cost-effective low-carbon strategies and act **now**, so that CO<sub>2</sub> levels peak not later than 2020. If we don't start now, by 2020 it may no longer be practically feasible to achieve the rate of reductions required.<sup>6</sup>

- ✦ The first step costs nothing. Users of energy can **cut back on wasteful energy use**. This is something we must do right now.
- ⊖ The second step is the best way we can spend money. We must invest in **energy efficiency**.<sup>7</sup> This means changing the way we use buildings, lights, all kinds of motors, transport, electronics and – most importantly – the production and distribution of electricity. We can pay back the cost of this investment in less than 3 years<sup>8</sup> and then get the same money back many times over.<sup>9</sup> We can also get these results at 20% of the cost of new generation plant.<sup>10</sup>
- ⊖ The South African Government's energy efficiency strategy says we can save over 4000 MW of capacity by 2025<sup>11</sup>, which is the same as a very large coal-fired power station. Our government must implement its strategy urgently by introducing financial incentives and tax breaks.

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2 Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007: Working Group 1: The Physical Science Basics. [http://www.ipcc.ch/publications\\_and\\_data/ar4/wg1/en/ch2s2-es.html](http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-es.html)

3 CO<sub>2</sub> now.org. Atmospheric CO<sub>2</sub> for November 2009. <http://co2now.org/>

4 Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007: Working Group 1: The Physical Science Basics.

5 Intergovernmental Panel on Climate Change (IPCC). Climate Change 2007. Synthesis Report. Table 3.1 Pg 45. [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf)

6 Twenty six Questions and Answers in regard to the study "Greenhouse gas emission targets for limiting global warming to 2 deg C". Meinshausen et al. 2009 in 30th April issue of Nature. Q8 Pg 6 and Q12 Pg 8. [http://www.pik-potsdam.de/news/press-releases/files/qanda\\_meinshausen\\_et\\_al\\_2009\\_ghgtargets-2c\\_pik-press.pdf](http://www.pik-potsdam.de/news/press-releases/files/qanda_meinshausen_et_al_2009_ghgtargets-2c_pik-press.pdf)

7 McKinsey Global Energy + Materials. Unlocking Energy Efficiency in the US Economy. July 2009. [http://www.mckinsey.com/client-service/electricpower/naturalgas/downloads/US\\_energy\\_efficiency\\_exc\\_summary.pdf](http://www.mckinsey.com/client-service/electricpower/naturalgas/downloads/US_energy_efficiency_exc_summary.pdf)

8 Dept of Minerals and Energy. Energy Efficiency Strategy of the Republic of South Africa. March 2005. Pg 11. [http://www.dme.gov.za/pdfs/energy/efficiency/ee\\_strategy\\_05.pdf](http://www.dme.gov.za/pdfs/energy/efficiency/ee_strategy_05.pdf)

9 McKinsey Global Institute. The carbon productivity challenge: Curbing climate change and sustaining economic growth. June 2008. Exhibit 5 Pg 15. [http://www.mckinsey.com/mgi/publications/Carbon\\_Productivity/index.asp](http://www.mckinsey.com/mgi/publications/Carbon_Productivity/index.asp)

10 McKinsey Global Institute. The Case for Investing in Energy Productivity. Feb 2008. Pg 12. [http://www.mckinsey.com/mgi/reports/pdfs/Investing\\_Energy\\_Productivity/Investing\\_Energy\\_Productivity.pdf](http://www.mckinsey.com/mgi/reports/pdfs/Investing_Energy_Productivity/Investing_Energy_Productivity.pdf)

11 Dept of Minerals and Energy. Energy Efficiency Strategy of the Republic of South Africa. March 2005. Pg 5. [http://www.dme.gov.za/pdfs/energy/efficiency/ee\\_strategy\\_05.pdf](http://www.dme.gov.za/pdfs/energy/efficiency/ee_strategy_05.pdf)

- ✦ **Renewable energy** is energy that comes from natural sources of power, such as the sun and the wind (but NOT uranium or coal!), and they are nearly free of CO<sub>2</sub>. South Africa could have as much as 15% renewable energy by 2020 at a reasonable cost.<sup>12</sup>
- ✦ Using the sun's rays to heat water directly (**solar water heating**) is much more efficient than using electricity to heat a geyser. When it is running properly, solar water heating is free of CO<sub>2</sub>. If the Government were to subsidise one million solar water heaters with timers from now until 2020, we would save another 3000 MW of power for electricity production<sup>13</sup> – the same as another, large, coal-fired power station.
- ✦ Engineers can build **wind farms** in two years, and we know well the building and running costs. Wind turbines also do not consume any water. South Africa could have up to 12% of carbon-free wind-generated electricity by 2020 and 20% by 2030.<sup>14</sup> Once again, this is the same as another large, coal-fired power station.
  - Some pro-nuclear lobbyists say that the wind is not always available. Yet, if the wind turbines were built all over the country and fed into the grid, the wind would always blow somewhere, so we have built this fact into our calculation.



- ✦ **Concentrated Solar** thermal Plants (CSP) are like giant magnifying glasses that concentrate the sun's rays on one spot, which becomes very hot and can then be used to make electricity. Engineers can build these plants in 3-4 years, while CSP could generate 13% of our electricity by 2020, and 27% by 2030<sup>15</sup>. Solar thermal plants are expensive but are coming down in price as fast as the price for nuclear power plants is going up.
  - South Africa has the best locations for sunshine in the world. By 2030 researchers are sure that solar thermal power will be the most cost-effective source of carbon-free bulk electricity and usable heat. With hot-salt storage, and possibly with gas back-up from the Kudu gas fields, this power supply would be available 24 hours a day.

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12 Energy Research Centre, UCT. Costing a 2020 Target of 15% Renewable Electricity for South Africa. October 2008.

[http://www.erc.uct.ac.za/Research/publications/08-Marquardetal-costing\\_a\\_2020\\_target.pdf](http://www.erc.uct.ac.za/Research/publications/08-Marquardetal-costing_a_2020_target.pdf)

13 Eskom: Solar water heating FAQ's. [http://www.eskomdsm.co.za/?q=Solar\\_water\\_heating\\_FAQs#crisis](http://www.eskomdsm.co.za/?q=Solar_water_heating_FAQs#crisis)

14 Energy Research Centre, UCT. Costing a 2020 Target of 15% Renewable Electricity for South Africa. October 2008.

15 Energy Research Centre, UCT. Large-scale roll out of concentrating solar power in South Africa. Edkins, Winkler, Marquard. August 2009. Table 2 Pg 6.

[http://www.erc.uct.ac.za/Research/publications/09Edkins-etal-Rollout\\_of\\_CSP.pdf](http://www.erc.uct.ac.za/Research/publications/09Edkins-etal-Rollout_of_CSP.pdf)

# We do not have time for nuclear power to make a difference

Although nuclear power does not release much CO<sub>2</sub> compared to coal, it is still too expensive, too slow and takes money away from cheaper and quicker options. If we ordered one today, it would not be ready before 2020<sup>16</sup> which is far too late. Looking at the planet as a whole, we would need 50 years to have enough nuclear power plants to really reduce carbon emissions and slow down global warming.

## Nuclear power costs too much

No private investors anywhere in the world will take on the capital costs of nuclear power without government loan guarantees or similar public underwriting. The capital costs of nuclear power are so high and so uncertain that one commentator said: "...it is completely impossible to produce definitive estimates for new nuclear costs at this time".<sup>17</sup> Another analyst said that the cost of building a nuclear power plant in the USA has gone up by 15% a year since 2003<sup>18</sup>. With inflation running at 3% a year, the real rate is 12%, which means that the actual costs for nuclear power are doubling every five years.

No nuclear plant operators anywhere in the world today carry full liability in case of accident. In SA the operator is granted limited liability and regulation is subsidized by the tax payer. Without this, there would no nuclear power.<sup>19</sup>

When we talk about the long-term management of highly radioactive nuclear fuel that has been taken out of a nuclear reactor, we are talking about tens of thousands of years. No private investor can pay for long-term waste management, because the long-term cost is uncertain. We cannot work out the cost because we have no reliable management system for long-term waste management anywhere in the world "There is no plan for high level wastes...the progress on high level waste disposal has not been positive"<sup>20</sup> Any cost not budgeted for will fall on future generations.



**"Just Keep Driving around - We may come up with a solution yet!"**

16. The planning, design and construction of a nuclear power plant takes at least 10 years from inception.

17 Steve Kidd, Director of Strategy and Research at the World Nuclear Association. Escalating costs of new build: what does it mean? Nuclear Engineering International. Aug 22 2008.

<http://www.neimagazine.com/story.asp?storyCode=2050690>

18 Centre for Energy and Environmental Policy Research. Update on the cost of nuclear power. May 2009.

Pg17. <http://web.mit.edu/ceepr/www/publications/workingpapers/2009-004.pdf>

19 International Institute for Sustainable Development: Global Subsidies Initiative. Gambling on nuclear power: how public money fuels the industry.

<http://www.globalsubsidies.org/en/subsidy-watch/commentary/gambling-nuclear-power-how-public-money-fuels-industry>

20 Massachusetts Institute of Technology. Update of the MIT 2003 Future of Nuclear Power Study. 2009. Pg.

11. While this was written for the USA, it applies even more to SA.

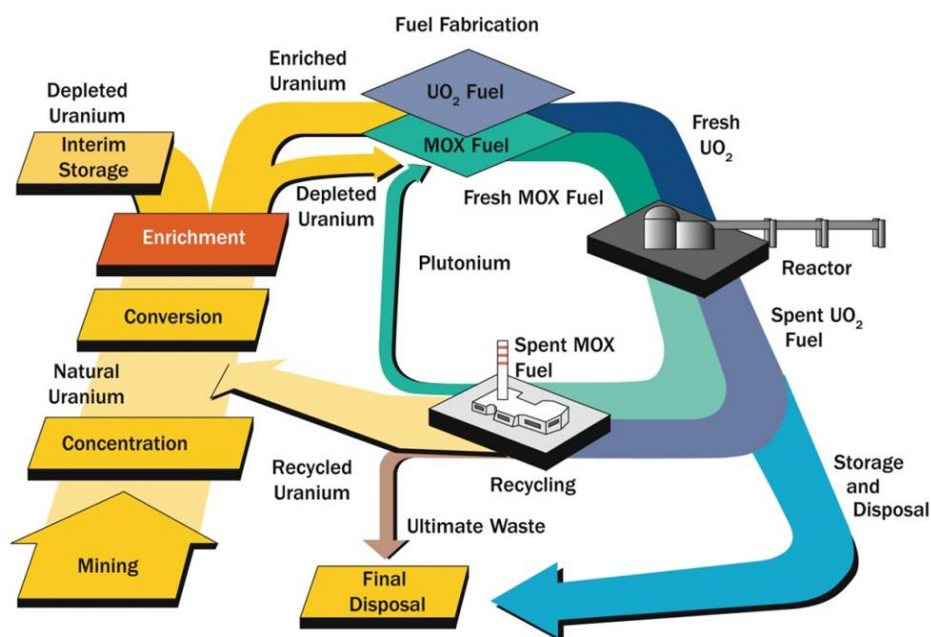
# Nuclear power: least jobs for money

South Africa needs the type of skills that workers can learn quickly, so that they can start working as soon as possible, and lift themselves and their families out of poverty and inequality. We also need skills that teach workers to become their own bosses and for them to survive in tough times.

Renewable energy technology and energy efficiency installations, such as solar-water heaters will create many more jobs, much more quickly, and more suited to the job market than nuclear power.<sup>21</sup> These jobs will also be more spread out around the country and not only to be found in one or two places.<sup>22</sup>

We do not have enough highly-trained engineers to design and safely monitor nuclear power plants through their working life so if we chose nuclear power we would have to train them at university level and we would have to pay them huge salaries to keep them here.

# Nuclear power: not safe, not simple



Source: U.S. Nuclear Regulatory Commission

The nuclear industry starts with the mining of uranium ore. Then the ore is processed into uranium oxide before being enriched for nuclear fuel. After the fuel is used up it has to be stored and transported, and there has to be an evacuation plan in case of emergency and general security against the theft of nuclear material for use in terrorism or secret nuclear weapons. All of these activities pose a serious, hazardous risk, some more than others.

21 AGAMA Energy. Employment Potential of Renewable Energy in South Africa. Nov 2003. Fig 5 Pg ix. <http://www.eskom.co.za/content/Employment%20Potential%20of%20renewable%20resources%20in%20SA.pdf>

22 Renewable Energy Briefing Paper. Potential of Renewable Energy to contribute to National Electricity Emergency Response and Sustainable Development. Holm, Banks, Schaffler, Worthington, Afrane-Okese. March 2008. Table 6 pg 22.



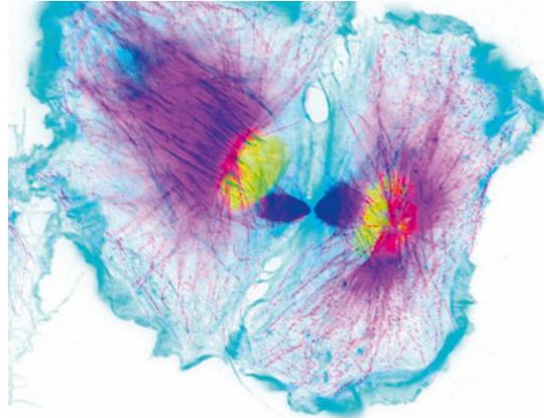
- ✦ **Uranium mining** brings up huge masses of radioactive rocks from underground, to be crushed and carried to local people by the wind. It also takes masses of fresh water and leaks radio-active and acidic waste-water into the local water supply, both above and below ground. Acid mine drainage has been described as "second only to global warming in terms of ecological risk".<sup>23</sup>
- ✦ **Uranium enrichment and fuel fabrication plants** release significant quantities of radioactivity and toxic chemicals into the environment.



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23 Dept of Environment and Tourism. Emerging Issues Paper: Mine Water Pollution. March 2008. Pg. 1.  
[http://soer.deat.gov.za/dm\\_documents/Mine\\_Water\\_Pollution\\_fPA1A.pdf](http://soer.deat.gov.za/dm_documents/Mine_Water_Pollution_fPA1A.pdf)

- ⊖ **Nuclear power plants** are licensed to release radioactive fission products such as cesium and strontium in the normal course of their operation. These waste products are radioactive and chemically similar to elements essential for life. They build up inside plants and animals which we eat.



- When the National Nuclear Regulator (NNR) allows Eskom to send out these highly dangerous fission products, they only work out the effect on people from exposure outside the body. Yet the real threat comes from fission particles inside the body. This is much more harmful than outside and can cause premature cancers. Women, unborn infants and young children are especially at risk.<sup>24</sup>
- If nuclear plants were inherently safe they would not need any evacuation zone or evacuation plan. In the event of a very bad accident, you would not be insured. Also, all home-owners have radiation damage excluded from their insurance policies. If nuclear power was safe, insurance companies (who understand risk) would insure you.
- ⊖ If investors in nuclear power want to get back their original money, the reactors have to be run for a very long time. Yet, as the plants get older, they become more fragile and are more likely to break down, losing money by way of electricity sales.<sup>25</sup>
- ⊖ The transportation of nuclear fuel and radioactive waste carries a grave risk of accident and is susceptible to terrorist attack. Even ships have to travel with an armed escort.
- ⊖ The Pebble Bed Modular Reactor (PBMR) is a new, experimental reactor planned for the existing Koeberg site, near Cape Town. This technology is inherently unsafe because it does not have a bomb-proof containment structure.<sup>26</sup> Some scientists and engineers have also questioned called the design safety features.
- ⊕ The nuclear industry can't be left to manage itself but requires a complex, centralized state with a militarized, security establishment all of its own. This poses a threat not only to democracy, but also the practice of human rights, because the industry thrives on secrecy, lies, espionage, and intimidation.

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24 International Journal of Environmental Research and Public Health. 2009. Article: Very low dose fetal exposure to Chernobyl contamination resulted in increases in infant leukemia in Europe and raises questions about current radiation risk models. Christopher Busby.

<http://www.mdpi.com/1660-4601/6/12/3105/pdf>

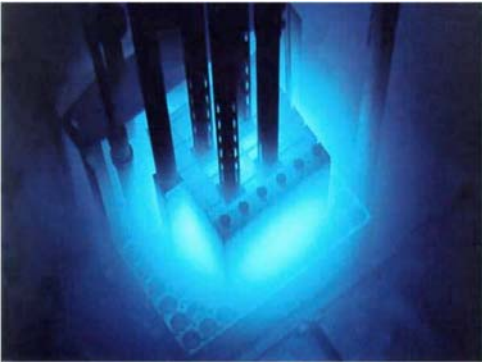
25 Union of Concerned Scientists. Safety of old and new nuclear reactors. David Lochbaum. May 2001.

[http://www.ucsusa.org/nuclear\\_power/nuclear\\_power\\_risk/safety/safety-of-old-and-new-nuclear.html](http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safety-of-old-and-new-nuclear.html)

26 PBMR. Safety Q & A's.: "total containment of radioactivity was deemed unnecessary"

<http://www.pbmr.co.za/index.asp?Content=237>

# Nuclear power: no global security



Nuclear bombs need the elements tritium and plutonium, or uranium. Tritium and plutonium come only from nuclear reactors, so countries that want to make nuclear bombs have to have nuclear reactors and nuclear enrichment or fuel reprocessing plants. Nuclear power plants provide reactors that can be used to extract the raw materials of nuclear weapons or they can be used as a cover to hide a nuclear-weapons programme.

- ✦ These countries have both civil nuclear plants and nuclear weapons: USA, Russia, the UK, France, China, India, Pakistan, and Israel.
- ✦ South Africa produced nuclear weapons at the same time that Koeberg was being built, but has since dismantled them.
- ✦ North Korea started to build two civilian nuclear power plants in 1994, but the construction was stopped in 2002 due to international sanctions. They nevertheless went on to build and explode 2 nuclear bombs. The transfer of technology began with the civil nuclear reactors.
- ✦ Iran has civilian nuclear plants and is suspected of trying to build nuclear weapons.



Further reading: Nuclear Power: Climate Fix or Folly? Amory Lovins. Dec 2008.  
[http://www.rmi.org/rmi/Library/E09-01\\_NuclearPowerClimateFixOrFolly](http://www.rmi.org/rmi/Library/E09-01_NuclearPowerClimateFixOrFolly)

*CANE is South Africa's coalition against nuclear energy. Member organizations and individuals include: [please fill in ...]*