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Sustainable nuclear energy; large scale production with proliferation safety?

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In addition to renewable sources such as solar and wind, nuclear fission is receiving new attention as a developed source of carbon-[MC-V1] free energy. This can be seen in the recent reports by IAEA and by changing attitudes towards nuclear energy in EU. There are some recent proposals by IEA and NEA for considerable intensification of nuclear energy development to 1200 GW by 2050. However, increased nuclear nuclear fission deployment is also a cause for legitimate concern. A much larger number of nuclear reactors would be needed for a major impact on carbon emission. The crucial question is whether it can be done without increasing the risk of nuclear proliferation. Specifically, can a larger nuclear share in world energy production, well above the present 6%, be achieved in next few decades without adding the proliferation-sensitive technologies of reprocessing spent fuel and recycling plutonium to the problems of the unavoidable use of enrichment technology? The answer depends on the available uranium resources and on the assumed period of uranium resources consumption. Selected consumption period would be a compromise between climate control requests and the technical and industrial realities. We determined the maximum possible nuclear build-up for the 2025-2065 period under the constraints of the estimated uranium resources and the use of once-through nuclear fuel technology. Results show that nuclear energy without reprocessing could reduce carbon emission by substantial fraction of the total reduction needed to bring the WEO 2009 Reference Scenario prediction of total GHG emissions in 2065 to the level of the WEO 450 Scenario limiting global temperature increase to 2 °C. This would ease the task for other carbon free energy sources and give them the time for development. What is even more important, a period up to 2065 without reprocessing and plutonium use would offer a good chance to develop conditions for the safe large scale use of plutonium. Should that be achieved in these available 50 years, nuclear energy could be considered a long term sustainable energy source in the energy mix required for the climate acceptable energy strategy.

Summary

In addition to renewable sources such as solar and wind, nuclear fission is receiving new attention as a developed source of carbon-[MC-V1] free energy. This can be seen in the recent reports by IAEA and by changing attitudes towards nuclear energy in EU. There are some recent proposals by IEA and NEA for considerable intensification of nuclear energy development to 1200 GW by 2050. However, increased nuclear nuclear fission deployment is also a cause for legitimate concern. A much larger number of nuclear reactors would be needed for a major impact on carbon emission. The crucial question is whether it can be done without increasing the risk of nuclear proliferation. Specifically, can a larger nuclear share in world energy production, well above the present 6%, be achieved in next few decades without adding the proliferation-sensitive technologies of reprocessing spent fuel and recycling plutonium to the problems of the unavoidable use of enrichment technology? The answer depends on the available uranium resources and on the assumed period of uranium resources consumption. Selected consumption period would be a compromise between climate control requests and the technical and industrial realities. We determined the maximum possible nuclear build-up for the 2025-2065 period under the constraints of the estimated uranium resources and the use of once-through nuclear fuel technology. Results show that nuclear energy without reprocessing could reduce carbon emission by substantial fraction of the total reduction needed to bring the WEO 2009 Reference Scenario prediction of total GHG emissions in 2065 to the level of the WEO 450 Scenario limiting global temperature increase to 2 °C. This would ease the task for other carbon free energy sources and give them the time for development.

What is even more important, a period up to 2065 without reprocessing and plutonium use would offer a good chance to develop conditions for the safe large scale use of plutonium. Should that be achieved in these available 50 years, nuclear energy could be considered a long term sustainable energy source in the energy mix required for the climate acceptable energy strategy.

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