Stern Review: The Economics of Climate Change

Sir Nicholas Stern, HM Treasury:
Head of Government Economic Service
Former Chief Economist – The World Bank

www.hm-treasury.gov.uk

Stern Review Methodology

- The first major contribution to the global warming debate by an economist, rather than an environmental scientist.
- The review is explicit about the treatment of risk and uncertainty in assessing the impacts of climate change. The economics of risk are placed at the heart of the economics of climate change. These probabilities, only recently available, provide the underpinnings of the analysis.
- Primary data inputs are from the Hadley Center, the Energy Modeling Forum, the USCCSP, and the IPCC Third Assessment. The PAGE model was used to estimate economic impacts. Damage estimates rise when adjusted for the possibility of amplifying feedbacks (e.g., weakened carbon sinks) and human health costs.
- CO2 is expressed as CO2e to encompass the total warming effect (radiative forcing) of all Kyoto GHGs. By this definition, the current level of GHGs is 430 ppm vs. the pre-industrial level of 280 ppm.

Conclusion is Optimistic but Urgent

"There is still time to avoid the worst impacts of climate change, if we act now and act internationally. For every $1 invested, we can save at least $5. Governments, businesses, and individuals need to work together to respond to the challenge.

Strong, deliberate policy choices by state and national governments worldwide are essential to achieve stabilization.

The task is urgent. Delaying action will take us into dangerous territory. The benefits of strong early action far outweigh the costs of not acting."

BAU Costs of Climate Change: High

- Basic elements of modern life for people around the world will be compromised – access to water, food production, and human health.
- Melting glaciers could cause water shortages for 1 in 6 of the world's population.
- Crop yields will decline, particularly in Africa.
- More extreme weather patterns will result in severe floods and drought.
- Hundreds of millions of people will suffer hunger, water shortages, and coastal flooding. All countries will be affected – poorest countries earliest and most, resulting in 200 million "climate refugees."
- *Without action, overall costs and risks are equivalent to losing 5% of global GDP each year. With wider range of risks and impacts (carbon sink breakdowns) included, costs could rise to 20% of global GDP each year.*

Mitigation Costs: Far Lower

- Cost of lowering GHG Emissions to reduce worst impacts can be limited to 1% of global GDP each year. Global GDP is currently $35 trillion, so 1% would imply $350B in cost. Costs are not trivial, but would not disrupt growth.

- Policy and investment over the next 10-20 years will have a profound impact on the climate in the second half of the century and thereafter.

- Prompt and strong action is clearly warranted. Inaction could create disruption to social and economic activity on a scale similar to those associated with the great wars and depression of the first half of the 20th Century.

Tackling Climate Change: A Pro-Growth Strategy

- Lack of action to reduce emissions will result in double the concentration of GHG's by 2035 vs. the pre-industrial level. Each ton has a damage cost of $85.
  - Average temperature rise of 2C.
  - 50% chance of temperature rise of 5C, under BAU, equivalent to average temperature change from last ice age to today.
- Emerging ETS strategies have demonstrated numerous opportunities to cut emissions for less than $25 per ton. The benefits of actions to shift the world onto a low carbon path could be on the order of $2.5 trillion.
- Tackling anthropogenic climate change is a pro-growth strategy; ignoring it will undermine economic growth. Climate change is the greatest market failure the world has ever seen. Policy change is required to mitigate risks and stabilize in the 450-550 ppm CO2e range.
- To stabilize at manageable levels, emissions would need to stabilize in the next 20 years and fall between 1% and 3% after that.

Three Critical Policy Elements

- Carbon Pricing: Taxation, Emissions Trading, or Regulation so that people are faced with full costs of their actions. Goal is a common global carbon price across countries and sectors.

- Technology Policy: To drive the development and large-scale deployment of low carbon and high efficiency products.

- Promotion of Energy Efficiency: Remove barriers to EE and inform, educate, and persuade industry and individuals about what they can do to respond to climate change.

Policy Initiatives

- Emissions Trading
- Technology Cooperation
- Action to Reduce Deforestation
- Adaptation

Policy Initiatives

- Emissions Trading
  - Develop and Link Emissions Trading Schemes around the world.
  - Strong markets in wealthy nations could drive low carbon development.
- Technology Cooperation
  - Informal and formal trade agreements will boost effectiveness of investments and innovations globally.
  - Support for energy R&D should double. Deployment of low carbon technologies should increase five-fold.
  - International cooperation on product standards will boost EE.

Policy Initiatives

- Action to Reduce Deforestation
  - Loss of natural forests worldwide contributes more to global emissions than the transportation sector. Curbing deforestation is a highly cost-effective way to reduce emissions.
- Adaptation
  - Poorest countries (developing and coastal) are most vulnerable to climate change. Climate change must be fully integrated into development policy.
  - International funding should support regional information on climate change impacts and research into new crop varieties that are more resilient to drought and floods.

Recent Policy Successes

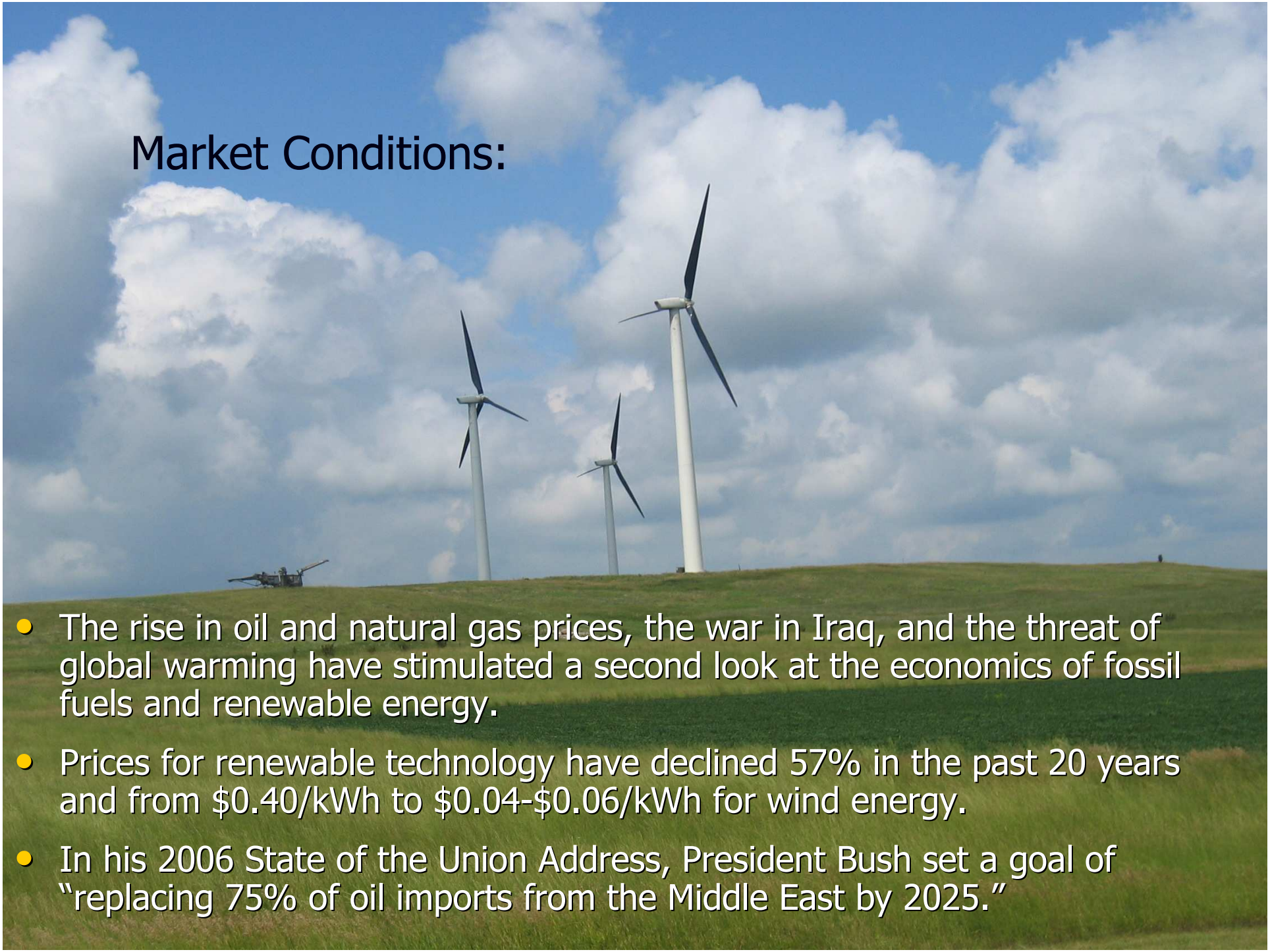
- China
  - China's 11th Five Year Plan contains a very ambitious goal to reduce the energy intensity of output by 20% from 2006-2011.
- USA
  - Investing in R&D. States are taking the lead through policy initiatives and deployment of renewable energy and through the use of emissions trading.
- India
  - Placing heavy emphasis on renewable energy and energy efficiency.

Prime Minister Tony Blair

The Stern Review showed that the scientific evidence of global warming was "overwhelming" and its consequences, if we fail to act, "literally disastrous."

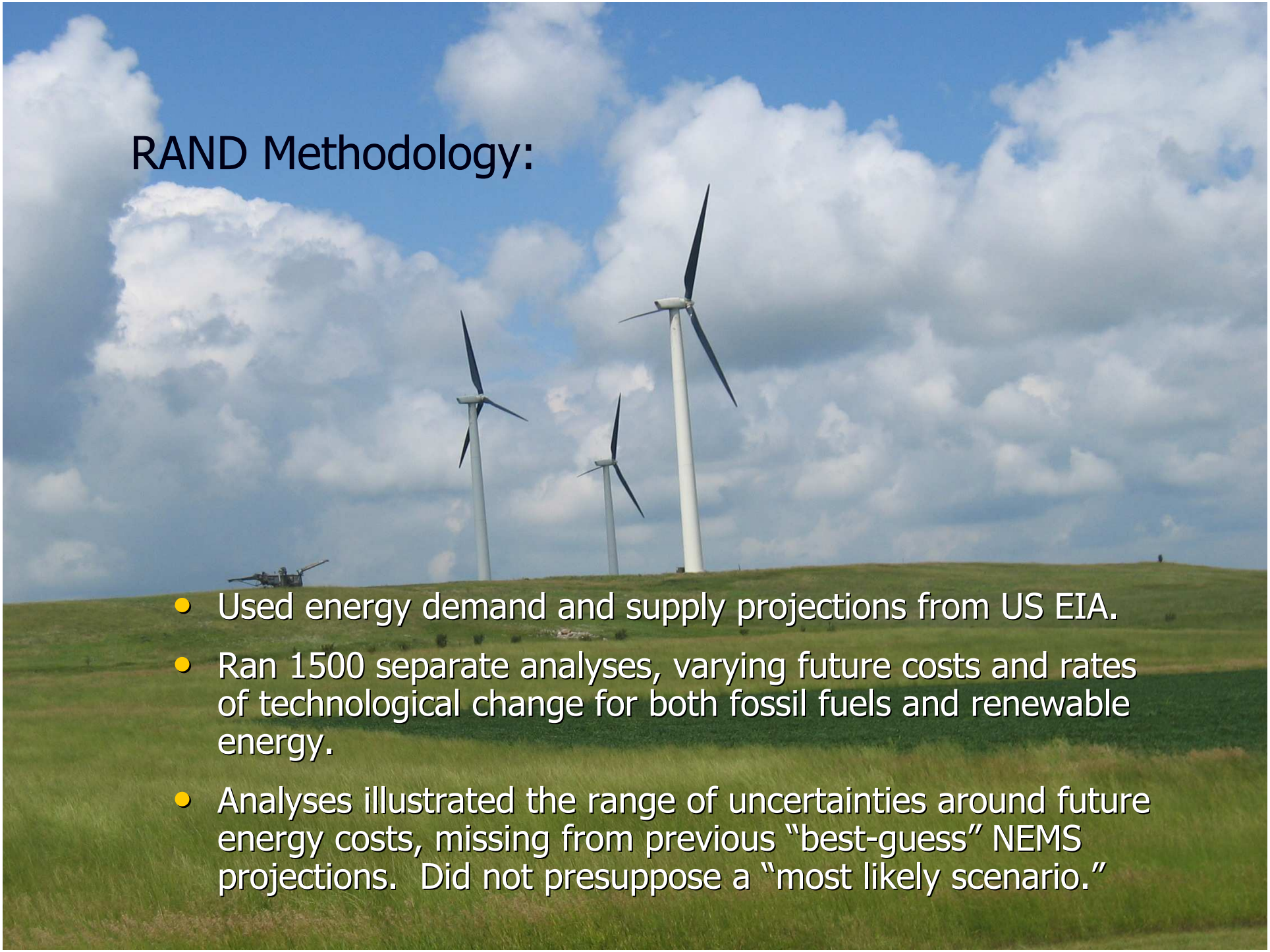
"This disaster is not set to happen in some science fiction future many years ahead, but in our lifetime."


Rand Corporation: Environment, Energy, and Economic Development Program (EEED)
25% Renewables by 2025 is Achievable and Affordable in the USA



Market Conditions:

- The rise in oil and natural gas prices, the war in Iraq, and the threat of global warming have stimulated a second look at the economics of fossil fuels and renewable energy.
- Prices for renewable technology have declined 57% in the past 20 years and from $0.40/kWh to $0.04-$0.06/kWh for wind energy.
- In his 2006 State of the Union Address, President Bush set a goal of "replacing 75% of oil imports from the Middle East by 2025."

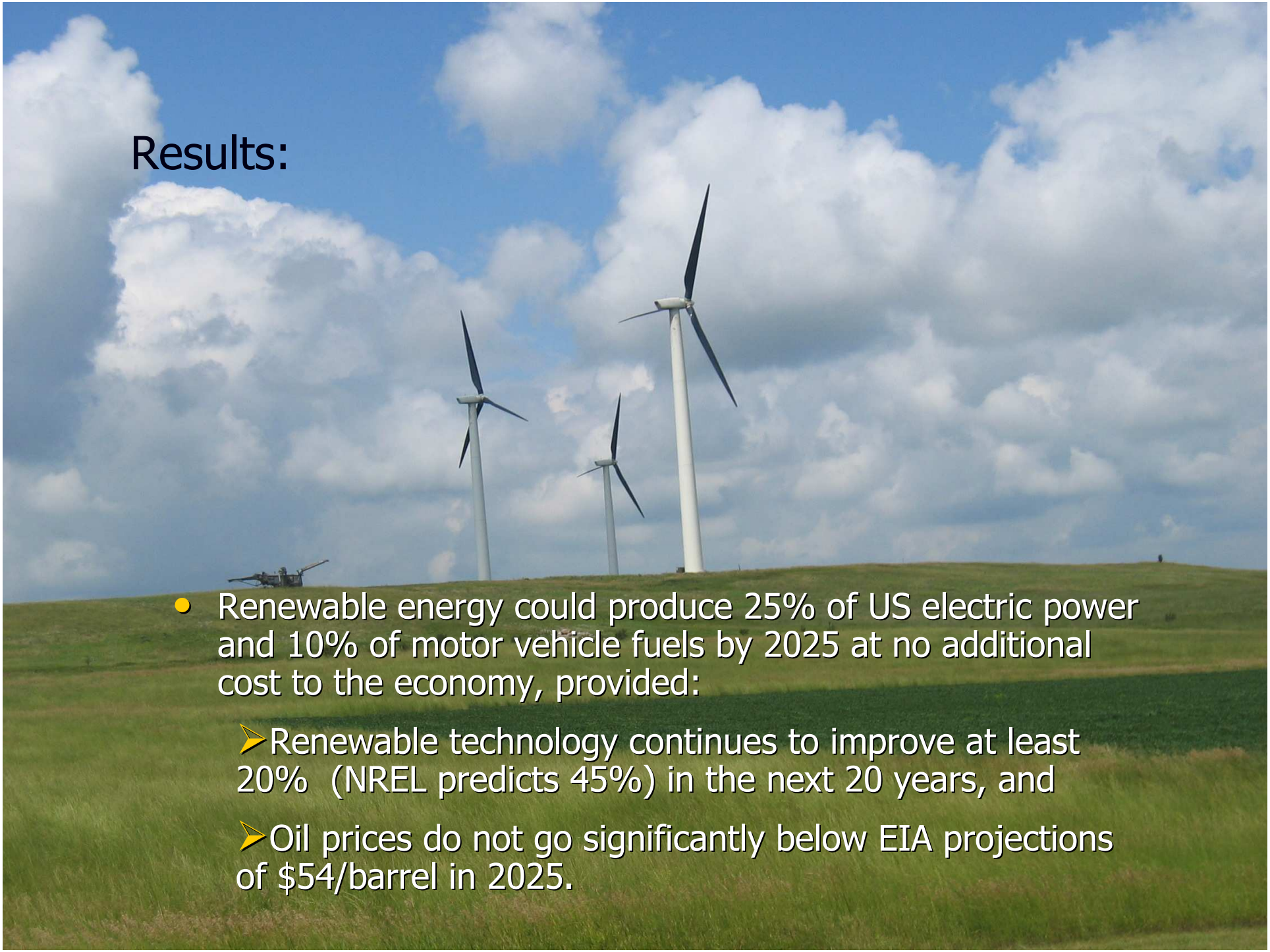


RAND Methodology:

- Used energy demand and supply projections from US EIA.
- Ran 1500 separate analyses, varying future costs and rates of technological change for both fossil fuels and renewable energy.
- Analyses illustrated the range of uncertainties around future energy costs, missing from previous "best-guess" NEMS projections. Did not presuppose a "most likely scenario."

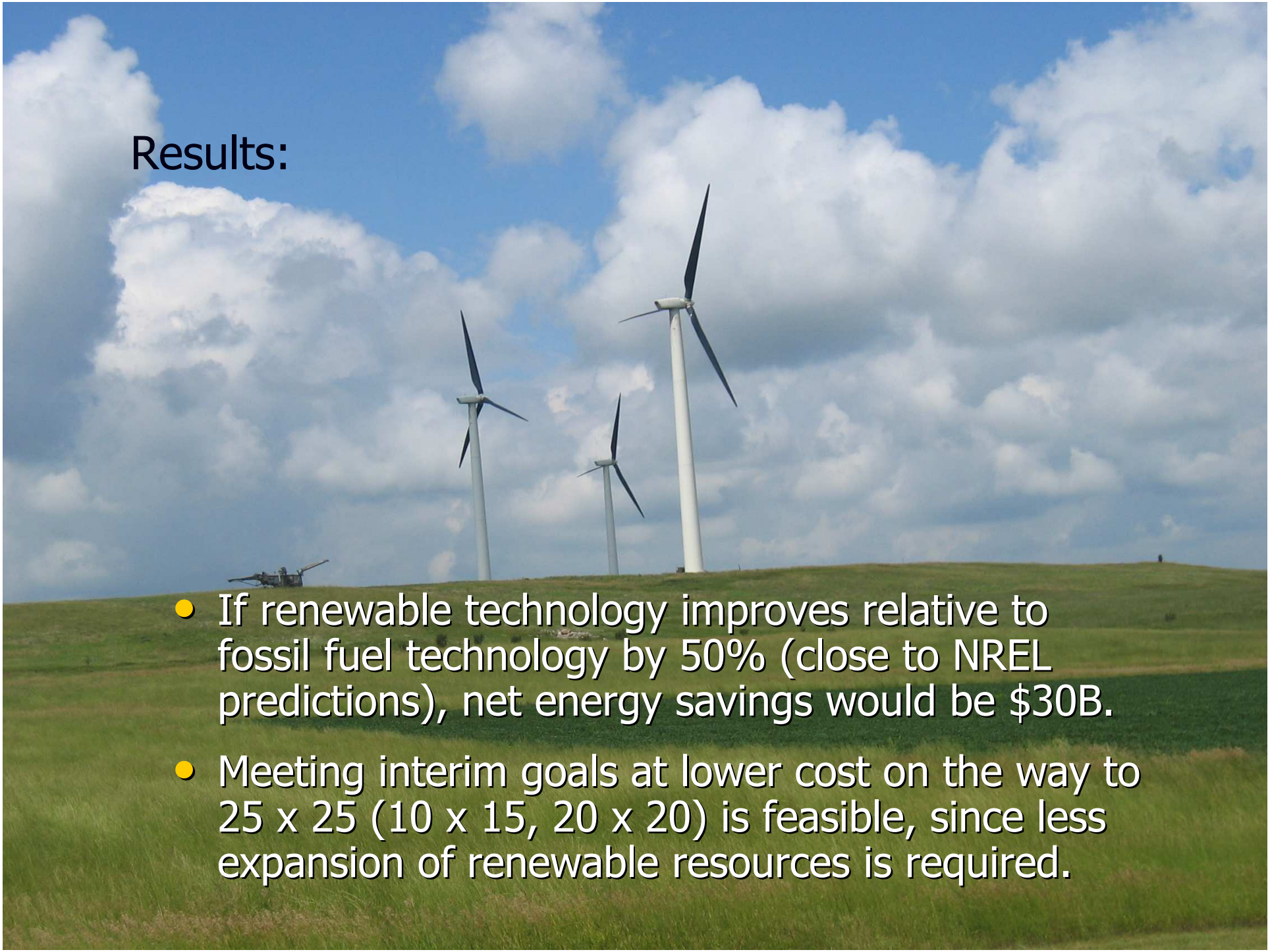
Results:

Renewable energy at this level lowered total energy expenditures in virtually all cases in which current energy price and cost trends continue.



Results:

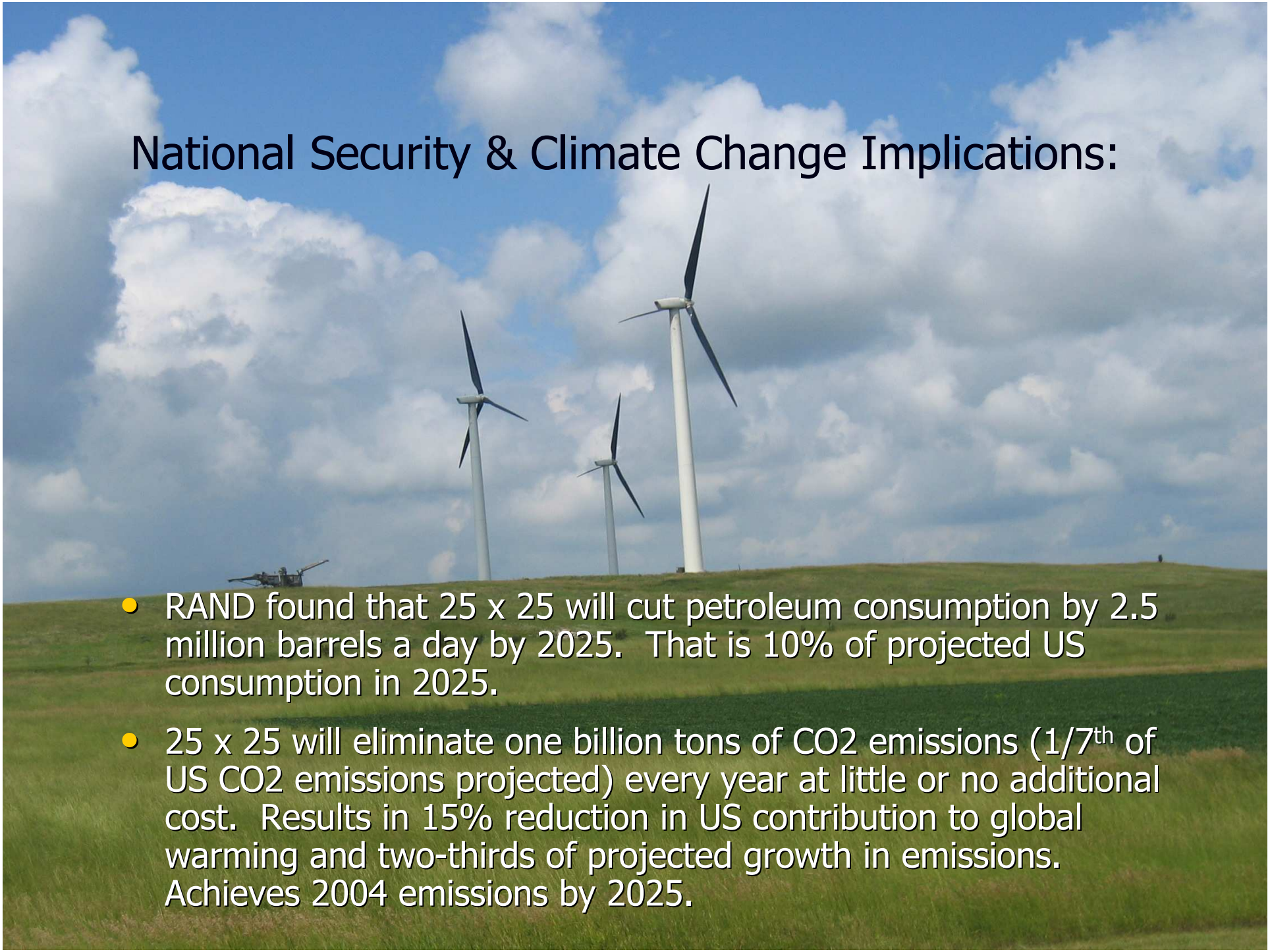
- Renewable energy could produce 25% of US electric power and 10% of motor vehicle fuels by 2025 at no additional cost to the economy, provided:
  - Renewable technology continues to improve at least 20% (NREL predicts 45%) in the next 20 years, and
  - Oil prices do not go significantly below EIA projections of $54/barrel in 2025.



Results:

- If renewable technology improves relative to fossil fuel technology by 50% (close to NREL predictions), net energy savings would be $30B.
- Meeting interim goals at lower cost on the way to 25 x 25 (10 x 15, 20 x 20) is feasible, since less expansion of renewable resources is required.

National Security & Climate Change Implications:



- RAND found that 25 x 25 will cut petroleum consumption by 2.5 million barrels a day by 2025. That is 10% of projected US consumption in 2025.
- 25 x 25 will eliminate one billion tons of CO2 emissions (1/7th of US CO2 emissions projected) every year at little or no additional cost. Results in 15% reduction in US contribution to global warming and two-thirds of projected growth in emissions. Achieves 2004 emissions by 2025.

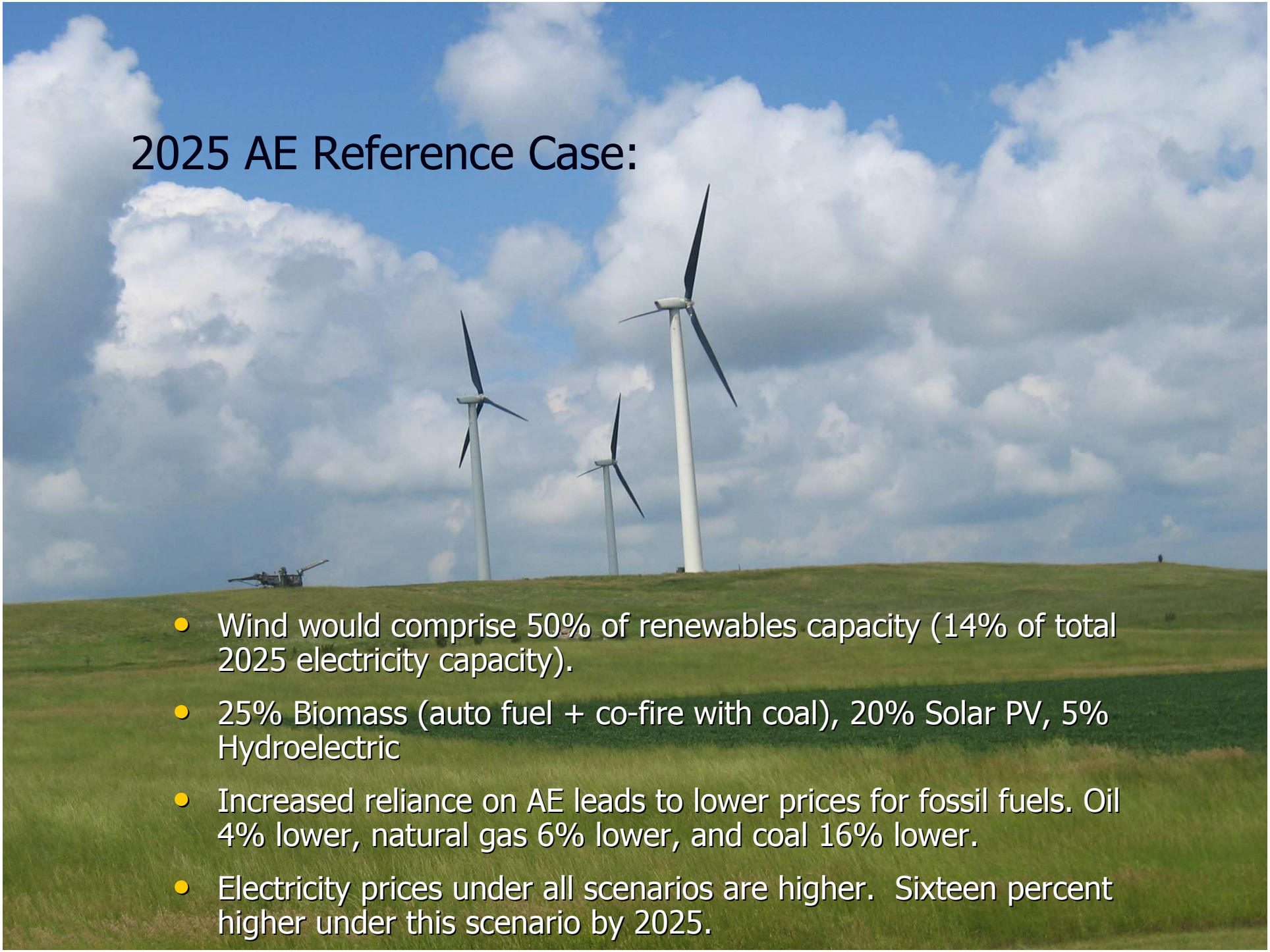
Renewables Challenges:

- Intermittency Issues
- Transmission
- Interconnection Issues
- Supply
- Environmental Concerns

Renewables Benefits:

- Reduction in GHGs
- Jobs/Economic Growth in Rural Communities
- Reduction in Local Air Pollution
- Downward pressure on fossil fuel prices
- More diverse energy portfolio could reduce energy price volatility (wind is hedge against natural gas)

2025 AE Reference Case:



- Wind would comprise 50% of renewables capacity (14% of total 2025 electricity capacity).
- 25% Biomass (auto fuel + co-fire with coal), 20% Solar PV, 5% Hydroelectric
- Increased reliance on AE leads to lower prices for fossil fuels. Oil 4% lower, natural gas 6% lower, and coal 16% lower.
- Electricity prices under all scenarios are higher. Sixteen percent higher under this scenario by 2025.