



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Scenarios for Nuclear Energy Growth

Implications for Used Fuel Management

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Purpose

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- **Provide range of possible used fuel generation scenarios**

- **Focus on 2050 time horizon**
 - 2030 too soon for effects to be seen
 - Beyond 2050 assumptions of reactor and fuel types increasingly speculative
 - Consider post-2050 impacts of pre-2050 deployments



■ Three growth scenarios

- Low: All reactors operate to end of current licenses
 - *No new renewals, no new builds*
- Medium: Maintain 20% share of electricity production
 - *All reactors in the current fleet operates for sixty years*
- High: Nuclear grows to 50% share by 2050

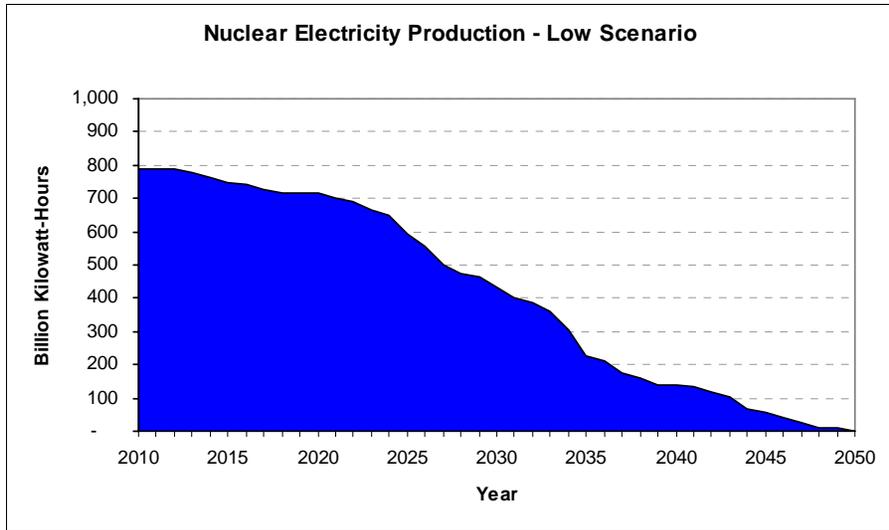
■ Assumptions

- Electricity grows 1%/year through 2050
- All new reactors resemble Gen III+ concepts
 - *Generic 1400 MWe capacity*
 - *New builds constrained to ramp up production*
- Average burnup of 50 GWd/MTiHM (~20 MT/GWe-yr)



Low Growth Scenario

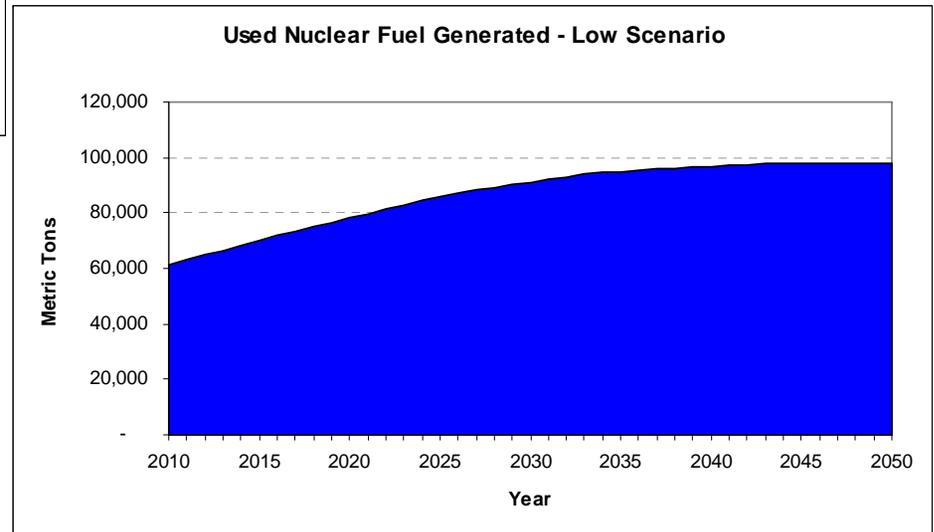
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Nuclear electricity phased out by 2049

Almost 100,000 MT of used fuel generated

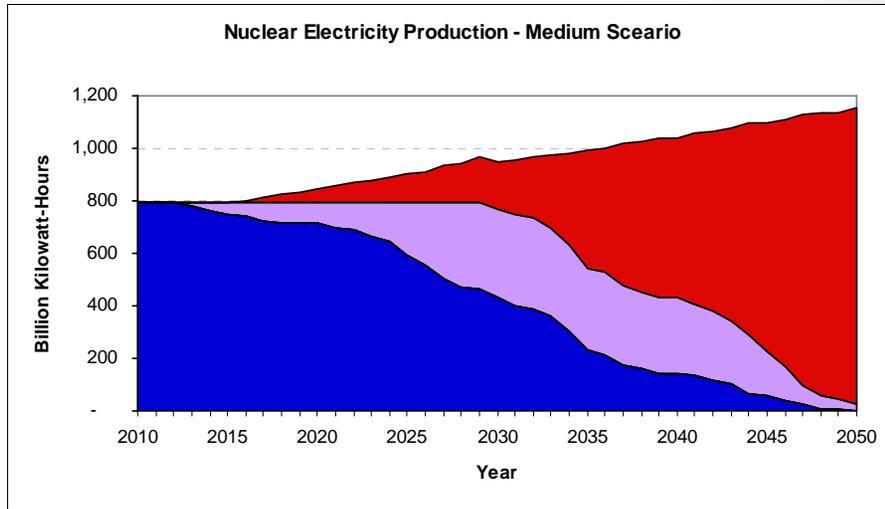
 Current LWRs





Medium Growth Scenario

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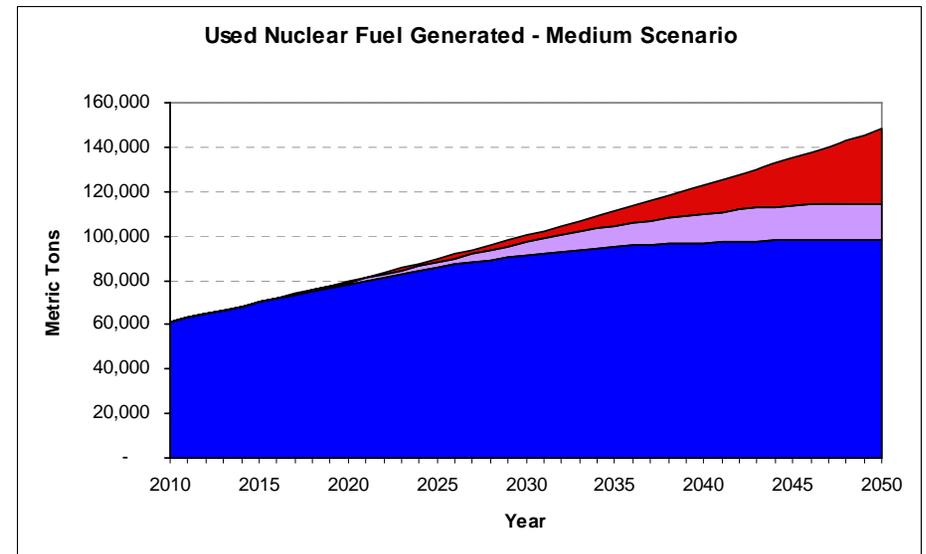


-  Gen III+ Adv. LWRs
-  Assumed License Renewals
-  Current LWRs

Maintain 20% market share through 2050

- 146 GWe capacity - 105 (larger) reactors
- Average build rate about three reactors per year

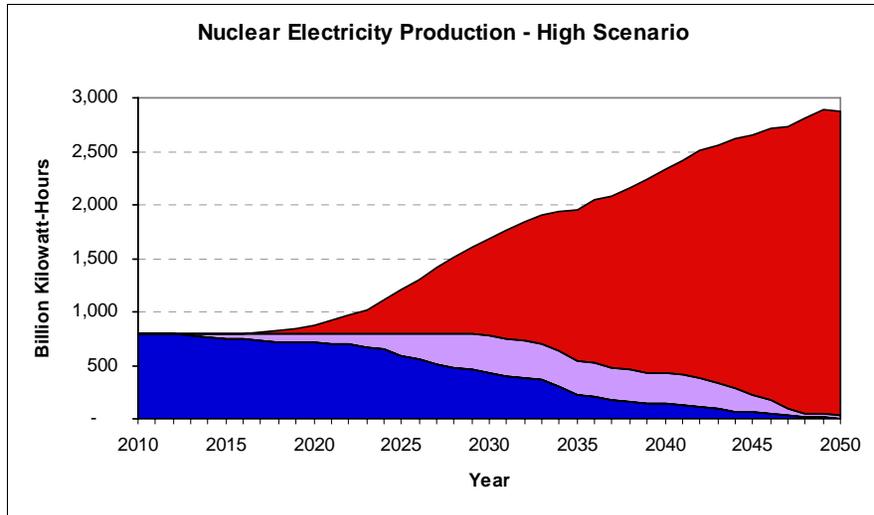
Most used fuel from current reactors by 2050





High Growth Scenario

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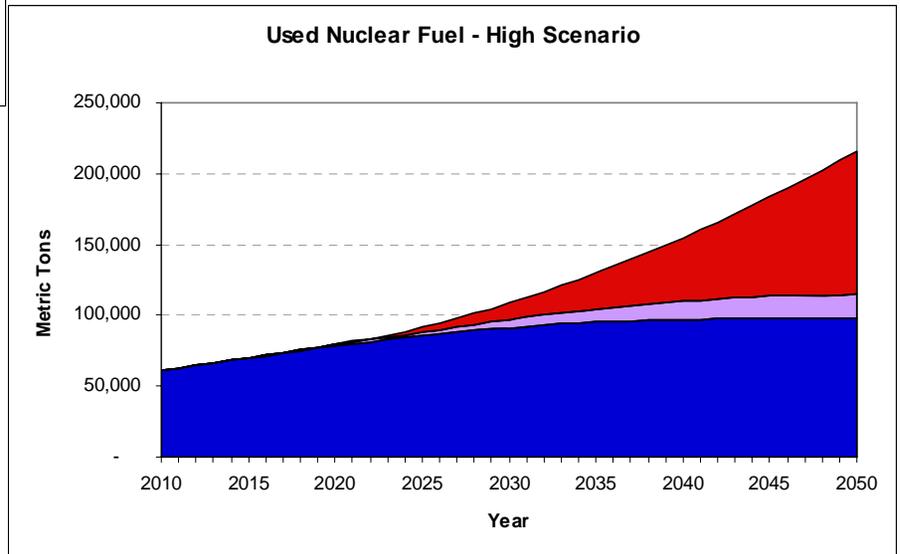


50% share by 2050

- *365 GWe capacity (~260 reactors)*
- *Sustained build rate ~9 per year*

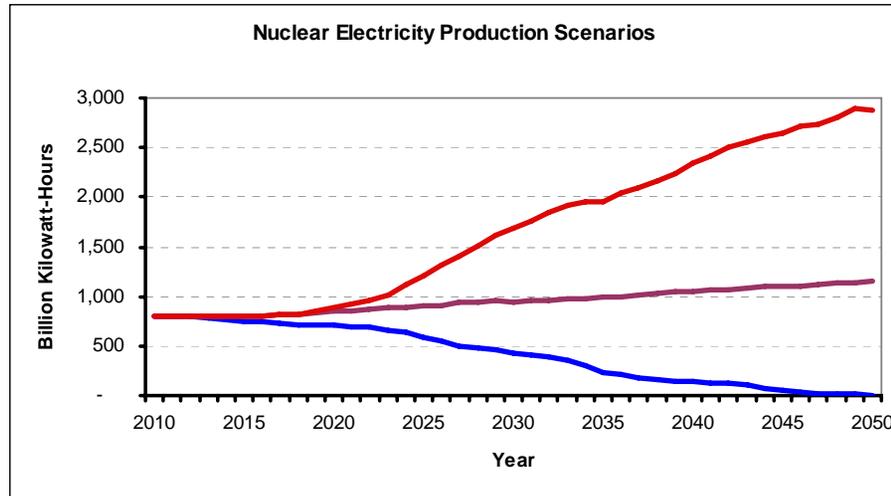
About as much used fuel from new builds as legacy reactors by 2050

- Gen III+ Adv. LWRs
- Assumed License Renewals
- Current LWRs





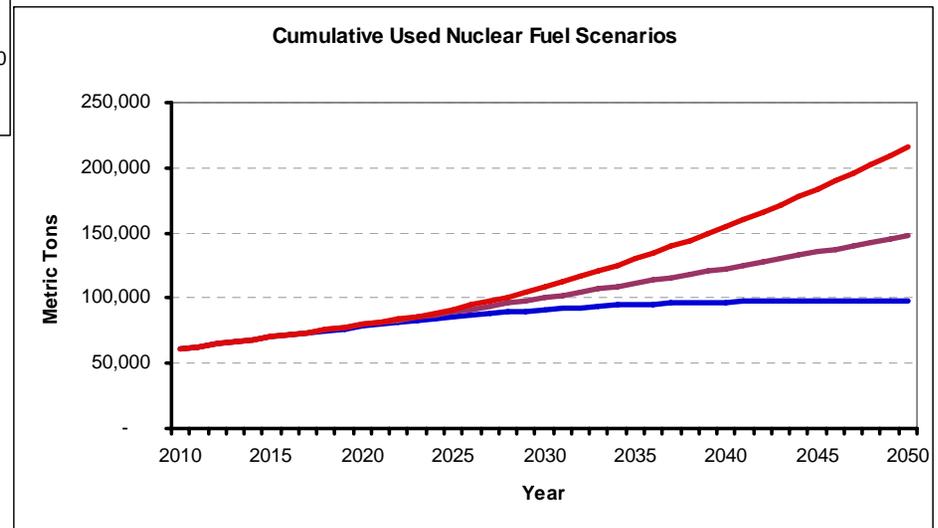
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Range in electricity production much more dramatic than used fuel generation

Changes in cumulative impact take much longer for effects to be seen

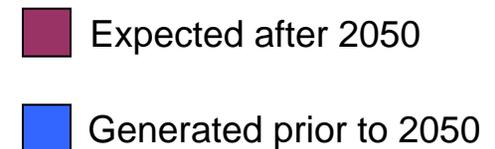
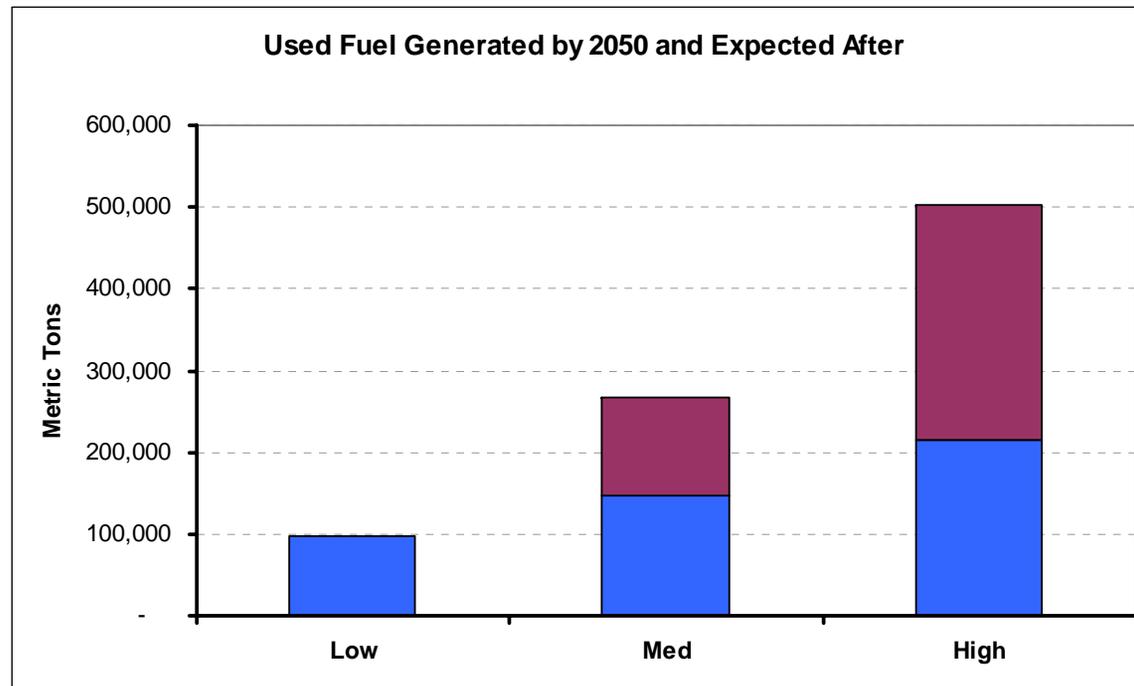
- High Growth Scenario
- Medium Growth Scenario
- Low Growth Scenario





■ Expected Used Nuclear Fuel from reactors operating in 2050

- Assume they run for their full lifetime (taken to be 60 years)
- Do not consider any additional new builds after 2050





- **Potentially wide range of used fuel projections that will need to be considered**
- **Even a low growth scenario implies ~100,000 metric tons**
- **Building new reactors in the coming decades will create expectations of used fuel generation beyond 2050**
- **New reactor concepts and fuel cycle management approaches could be notably different than the current system**
- **The amount of used fuel only one of the relevant attributes**



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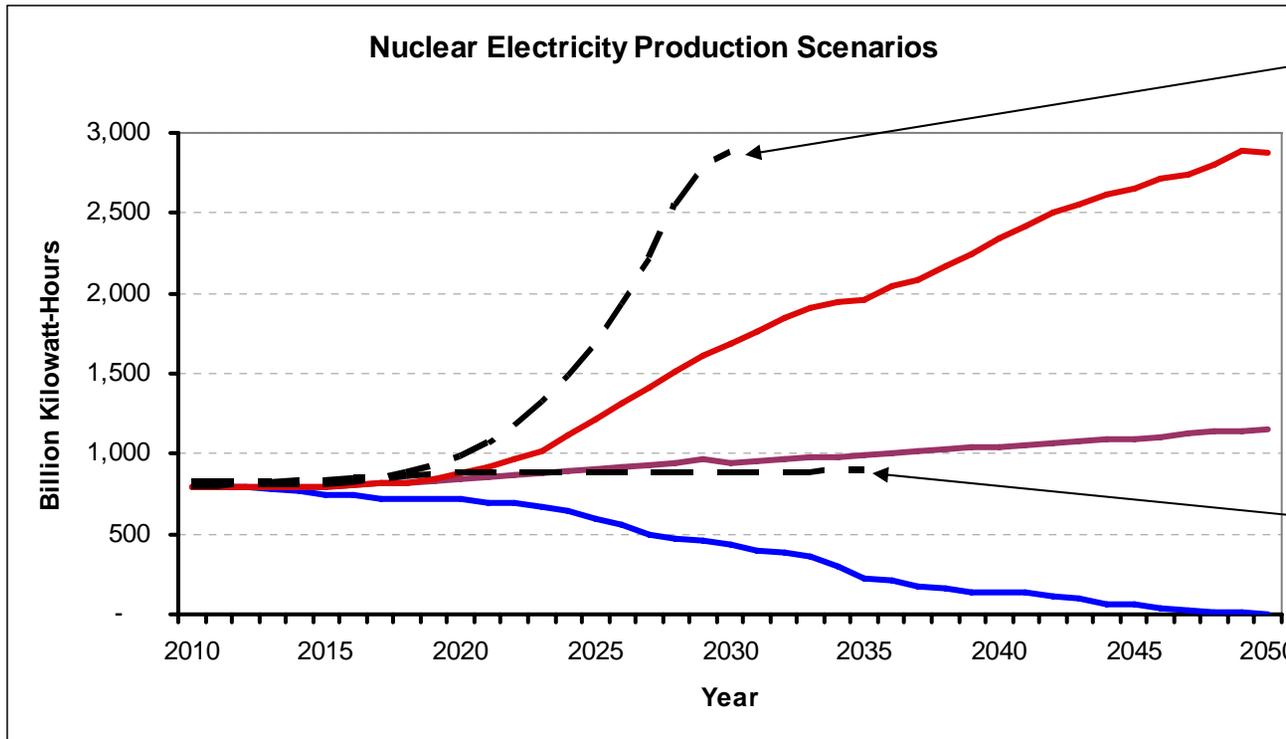
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Backup



Scenario Comparison

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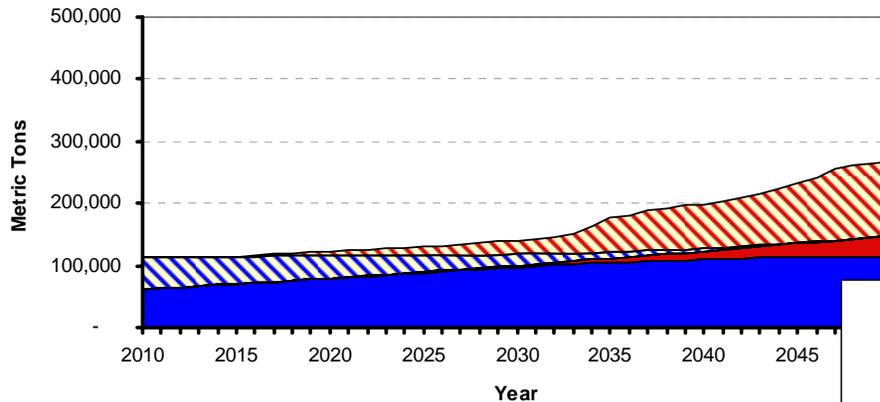
EIA Climate Analysis 2008

EIA Ref. 2010



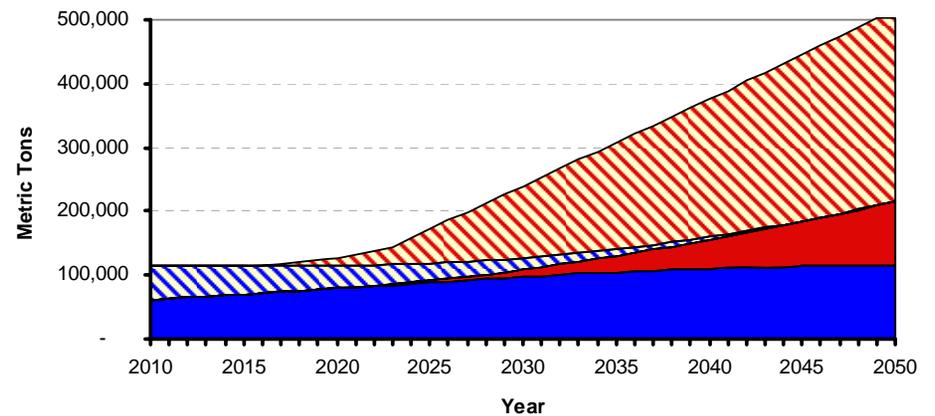
Generated and Expected Used Fuel – Medium and High Scenarios

Expected and Generated Used Nuclear Fuel - Medium Scenario



Impact of new builds on used fuel generation really seen after 2050

Expected and Generated Used Nuclear Fuel - High Scenario



-  Used Fuel Still Expected from ALWRs
-  Used Fuel Generated by ALWRs
-  Used Fuel Still Expected from Current Fleet
-  Used Fuel Generated by Current Fleet