

HEU MINIMISATION CHALLENGES

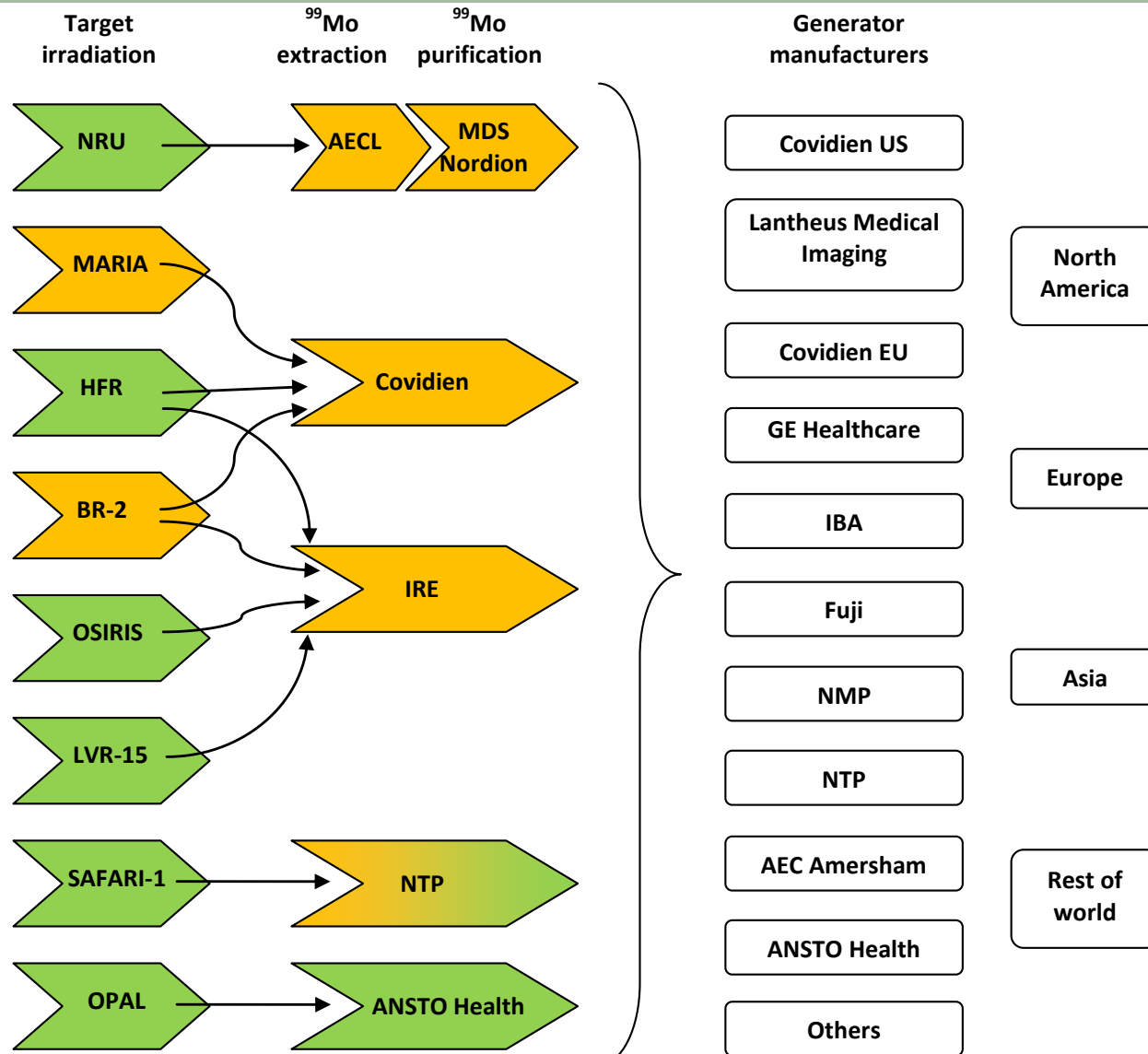
THE SUPPLY OF THE MEDICAL ISOTOPE 99-MOLYBDENUM/99m- TECHNETIUM

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- $^{99\text{m}}\text{Tc}$ is the decay product of ^{99}Mo
- Used in 80% of all nuclear medicine procedures
- Key tool for nuclear diagnostic imaging
 - Powerful and non-invasive
 - Identification of common diseases at early stages
 - Cardiac ailments, cancers
 - Track disease progression and provide predictive information about success of therapy options
- Used by about 30 million patients a year globally
- However, supply is no longer reliable
 - Shortages over the past few years
 - Current infrastructure not sufficient
- However most (but not all) of the world's ^{99}Mo comes from the irradiation of highly enriched uranium targets

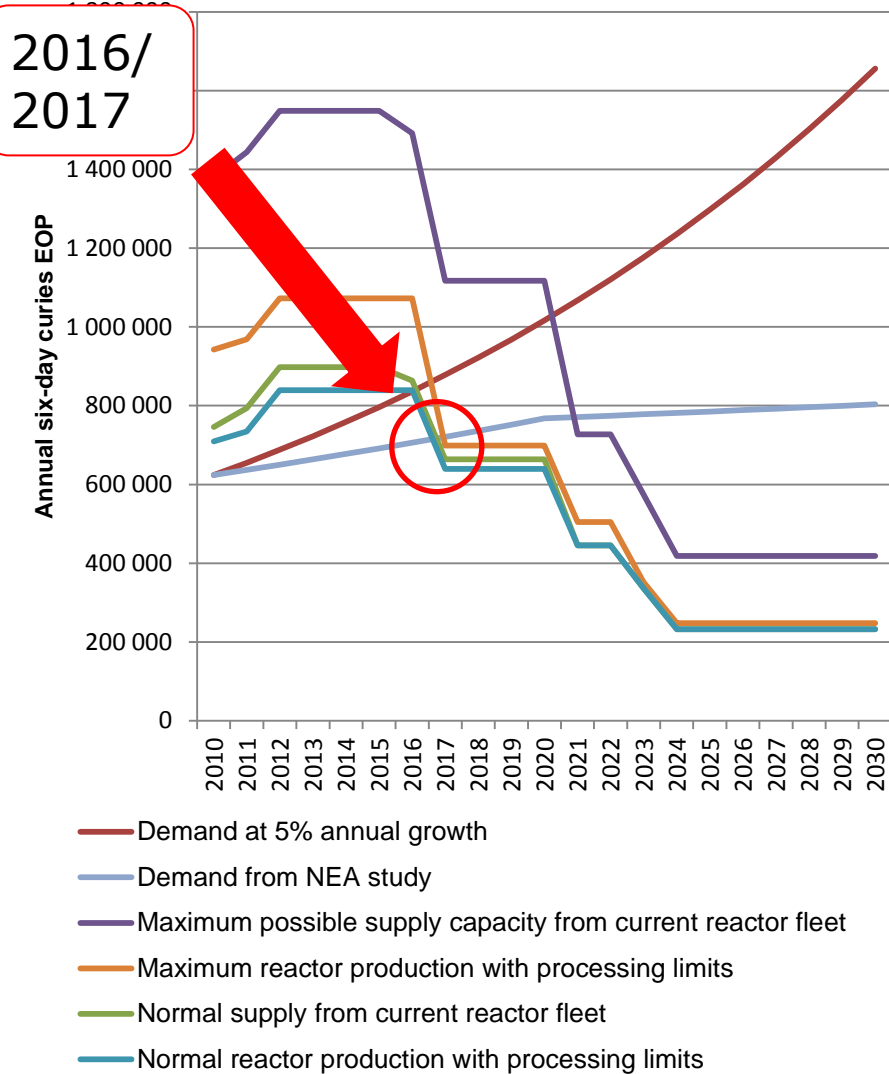


Target irradiation in research reactors: Green – LEU fuel; Orange – HEU fuel

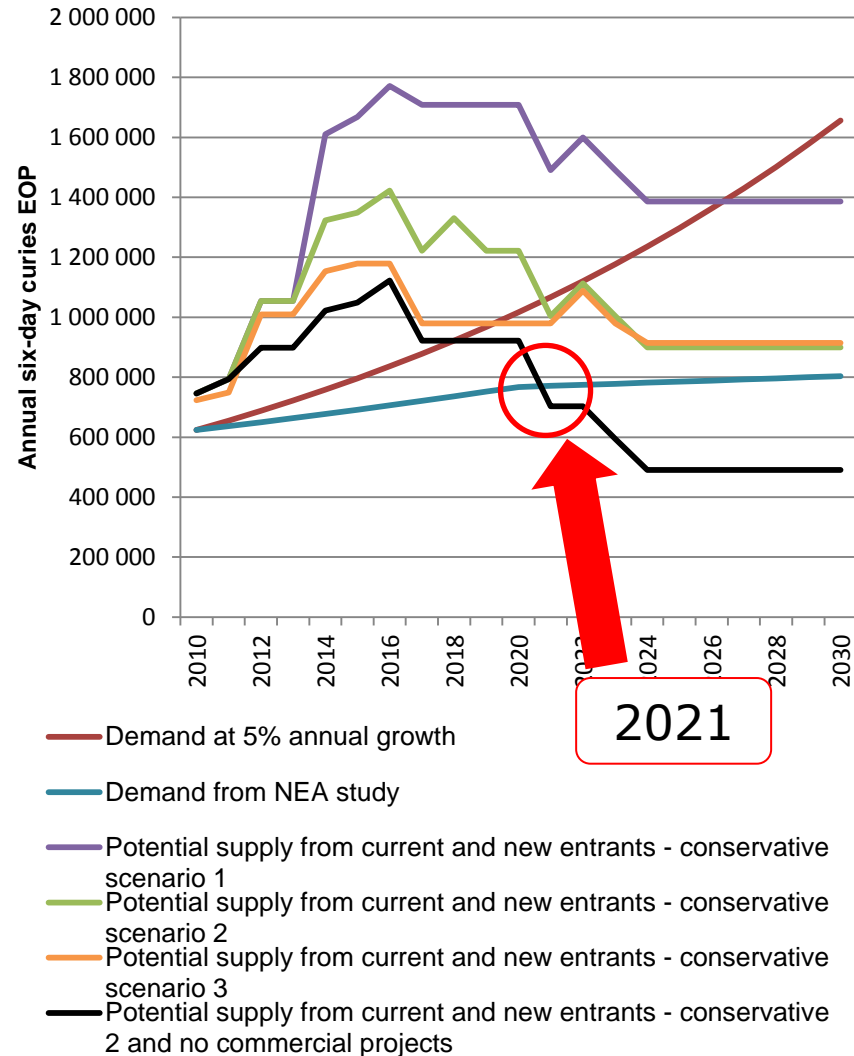
⁹⁹Mo extraction and purification: Green – LEU targets; Orange – HEU targets

- LEU Conversion agreed to by all major ^{99}Mo producing nations
 - For important non-proliferation reasons
 - No direct market justification – externality
- Will have impact on producers and users of $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ – less ^{235}U
 - Affect the available capacity to produce: global markets
 - Increase costs of developing product: cost/price impacts
- Coming during period of significant transition to provide reliable supply
 - Ageing fleet faces unexpected and prolonged shutdowns; permanent shutdowns
 - Regional limitations on processing capacity can limit full use of reactors in outage situations
- OECD issued policy approach to encourage reliable supply
 - 6 principles mainly directed to economic sustainability, calling for full-cost recovery and paying for outage reserve capacity
 - Also calls for conversion to LEU targets – security of supply

Current Supply vs. Demand



Conservative Potential Supply vs. Demand



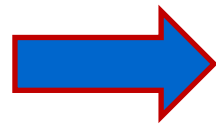
- Past and on-going work to study the technical side of conversion (IAEA): challenges and opportunities
- Very few publicly-available studies on the market impact
- NEA studying the affect on supply security
 - Would enough $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$ be available and at what cost?
- Develop policy options and recommendations to encourage smoothest market transition to LEU possible

From preliminary findings

- Expect to find that costs will be important but not prohibitive
- Government support will be necessary, as noted in policy
- Capacity impacts will occur from less ^{99}Mo produced, but no conversion related shutdowns expected

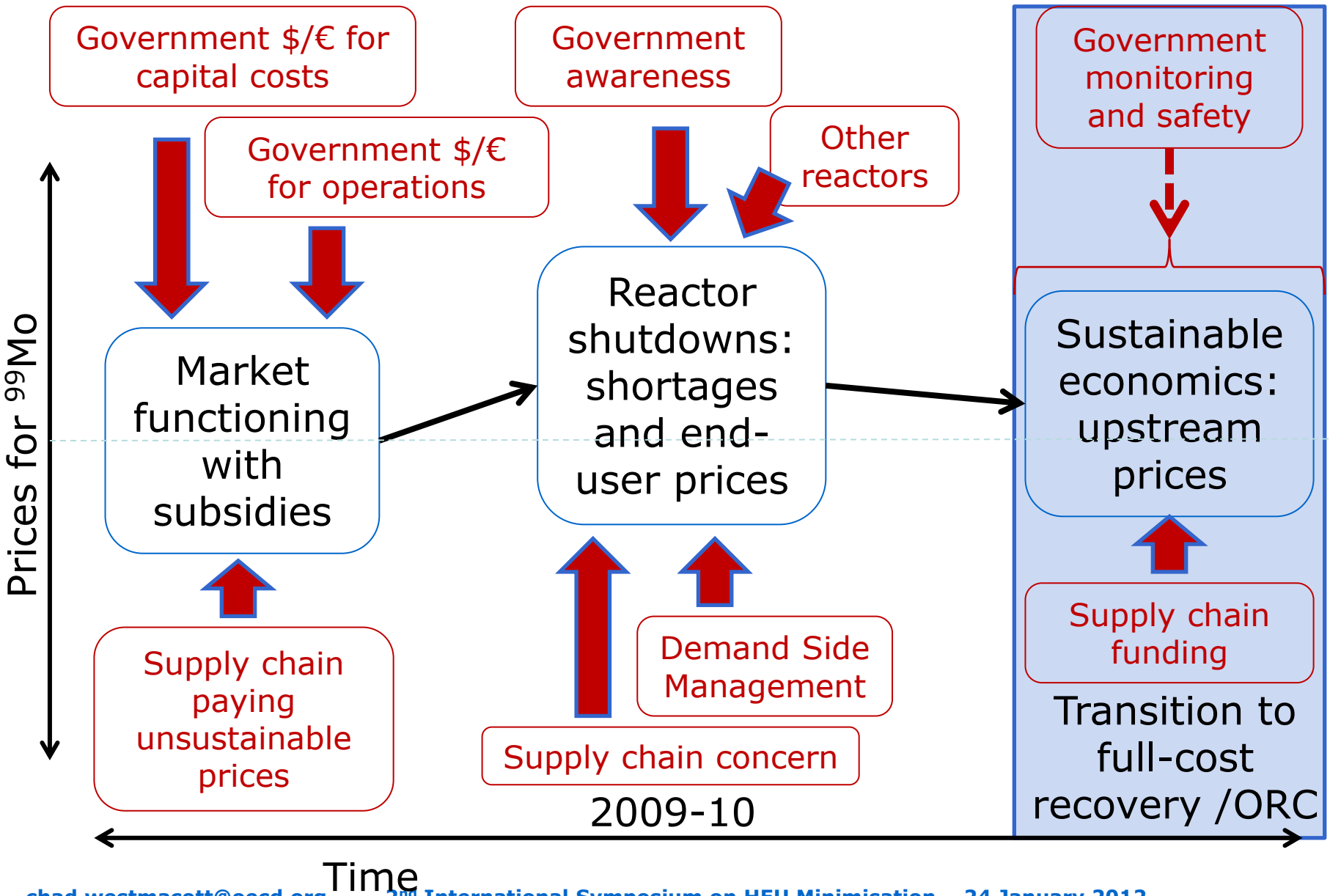
- Need to recognise difficult
 - Many actions needed by many stakeholders: governments, reactor operators, processors, generator manufacturers, regulatory bodies (nuclear and health)
 - Time is needed to allow transition while ensuring security of supply: infrastructure changes, regulatory approvals
 - Market forces: LEU-based ^{99}Mo will likely be more expensive and cheaper is better for end-user ($^{99\text{m}}\text{Tc}$ is the same)

P.4: Governments should support conversion to use LEU targets



- R&D
- Examine options for market justification to using LEU targets
- Meantime, consider financial support of price differential
- Encourage development of alternatives

- NEA continuing to study issue, leading to recommended options to encourage conversion smoothly
- Committed actions/timelines to conversion by most producers



The transition to an economically sustainable future

