

Evaluating Megatons to Megawatts

Methodological Notes

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Preamble

Megatons to Megawatts (M2M) was a program through which highly enriched uranium (HEU) from dismantled Soviet nuclear weapons was converted into fuel for civilian energy production in the United States. It remains one of the most successful examples of nuclear disarmament and peaceful scientific cooperation between former adversaries, with significant security, economic, and environmental implications.

Given the program's scale, complexity, and lasting impact, evaluating M2M has required a multidisciplinary, multigenerational, and long-term effort. No single field can fully capture its significance. Security studies, diplomacy, technical innovation, economics, and environmental science have all been brought together to provide a comprehensive understanding of the program.

The evaluation has been intentionally designed as a multigenerational effort, integrating firsthand experience with new perspectives and emerging methodologies. It has also unfolded over multiple years rather than being compressed into a short period of time. Understanding a project of this magnitude requires sustained reflection, collaborative learning, and cumulative research.

Why Evaluate M2M?

- M2M is an important and unusually rich case of international cooperation.
- Historical cases deserve careful investigation and evaluation.
- Lessons learned may inform future policy choices and cooperative initiatives.
- Some dimensions of the program, particularly its environmental implications, remain insufficiently studied.
- Despite its significance, M2M is not widely known outside specialized communities.

- The case may provide a foundation for comparative research on nuclear disarmament and international cooperation.

How Has M2M Been Evaluated?

The evaluation has been guided by the following principles and activities:

- Acknowledgement and review of the extensive literature and documentation produced on M2M, especially the comprehensive monograph of Jeffrey Hughes ([here](#))
- Direct engagement with a broad network of individuals who participated in, managed, or influenced the program, especially through the Oral History project ([here](#))
- Direct engagement with researchers who have studied and written about M2M.
- An explicitly interdisciplinary approach.
- Three annual working seminars:
 - **Setting the Conditions** — June 16, 2025
 - **Managing Cooperation** — June 15, 2026
 - **Outcomes** — June 14, 2027
- Construction of detailed timelines and systematic testing of rival explanations.
- Assessment of the strength and reliability of available evidence.
- Iterative refinement of the CNDSI Matrix, the project's overarching interpretive framework.

The CNDSI Matrix: Domains of Analysis

The evaluation considers multiple dimensions of the M2M experience. The CNDSI Matrix organizes evidence and analysis into four interconnected domains: Security, Technical, Economic, and Environmental. These domains are analytically distinct but deeply interconnected, and together they provide a framework for understanding the conditions, processes, outcomes, and broader significance of the program. Of particular interest is the emergence and the effectiveness of cooperation ([here.](#))

Security Domain

This domain examines the security and governance dimensions of M2M, including its contributions to nuclear risk reduction, strategic stability, and international security. It considers defense and military implications, intelligence activities, public policy decisions, diplomatic negotiations, institutional arrangements, and the operational mechanisms that enabled cooperation between former adversaries.

Technical Domain

This domain focuses on the knowledge, expertise, and technological systems that made M2M possible. It includes scientific and theoretical foundations, historical precedents, technical solutions for the conversion of highly enriched uranium, implementation and maintenance processes, verification and monitoring mechanisms, and the roles and interactions of the individuals and institutions responsible for carrying out the program.

Economic Domain

This domain evaluates the economic dimensions of M2M at multiple levels. It examines the financial flows generated by the program, including revenues, costs, gains, and losses, as well as its effects on energy markets, industrial sectors, participating organizations, and the broader economic systems within which the program operated.

Environmental Domain

This domain assesses the environmental significance of M2M. It considers whether environmental factors were incorporated into the design and implementation of the program, establishes the environmental baseline against which outcomes can be assessed, and evaluates the direct and indirect environmental impacts associated with the conversion of weapons material into civilian nuclear fuel.

Comparative Analysis

The project includes preliminary comparisons with other cases of nuclear disarmament and cooperative threat reduction. These comparisons contribute to the development of a broader Nuclear Disarmament Cases Matrix and help situate M2M within a larger body of historical experience.

Relational Responsibility

CNDSI seeks to acknowledge the contributions of interlocutors, collaborators, and participating institutions. The project maintains and regularly updates a record of individuals and organizations that have been contacted and engaged throughout the evaluation process.

Cumulative Specificity

The HEU Deal/M2M program was highly innovative and complex. It involved multiple actors, institutions, technical systems, and fields of expertise. CNDSI seeks to describe, explain,

verify, and evaluate these processes, moving from broad hypotheses to increasingly specific understandings. The project relies on diverse, verified, and verifiable sources while seeking explanations that are both rigorous and persuasive.

Communication and Public Relevance

A deep and articulate understanding of the HEU Deal/M2M program is relevant to multiple communities, including academia, the private sector, government, international organizations, and civil society. The project therefore seeks not only to generate knowledge but also to communicate it effectively to diverse audiences.

Interview Protocol

Interviews have been conducted according to a standardized protocol to ensure consistency, transparency, and respect for participants. All interlocutors have been invited through formal outreach and provided with clear information regarding the aims of the project, as well as their right to anonymity or attribution.

Each interview follows a semi-structured format that balances open-ended questions with prompts linked to the categories of the CNDSI Matrix. With participants' consent, interviews are recorded, transcribed, and thematically coded to facilitate comparative analysis.

Particular attention is given to identifying alternative perspectives, examining competing explanations, and documenting areas of agreement and disagreement across accounts. The protocol is designed to generate evidence that is both rigorous and sensitive to the complexity of lived experience.

About CNDSI

CNDSI is an informal network of practitioners, scholars, and policy actors committed to understanding, verifying, and applying knowledge at the intersection of nuclear disarmament, clean energy production, and sustainability.

Participation is by invitation and is often free of charge.

For additional information, please contact **ac4cndsi@columbia.edu**.