U.S. Department of Energy
Categorical Exclusion Determination Form

Proposed Action Title: Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- RECOVER and RECOVER SBIR/STTR (NOFO No. DE-FOA-0003510 and DE-FOA-0003511)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): CA, CO, CT, FL, ID, IL, IN, MA, MD, MN, MO, NJ, NY, OH, PA, TX, VA, WI

Proposed Action Description:

THIRD AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original, First, and Second Amended Determinations, dated January 16, 2026, February 20, 2026, and April 15, 2026, respectively). The Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- (RECOVER) program seeks to create new ways to extract critical metals and ammonia from domestic wastewater. Specifically, the projects will develop new materials to selectively bind or react to target ions and molecules in solutions with high ionic strength, natural organic matter, and/or competing cations; and create new processes to continuously recover ammonia and critical minerals without a drop in performance over time. If successful, RECOVER projects could replace 50% of domestic ammonia supplies and 100% of key critical metal supplies, ultimately reducing dependence on foreign energy and mineral sources, thereby increasing U.S. energy security.

The RECOVER Program is composed of 14 small-scale research and development projects that will be conducted by universities, small businesses, and large businesses. This Third Amended Determination adds 1 project to the original Determination (see Attachment A for all 14). All 14 projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.1 – Site characterization and environmental monitoring

B3.15 – Small-scale indoor research and development projects using nanoscale materials

For the DOE procedures regarding categorical exclusions, including the full text of each categorical exclusion, see 10 CFR 1021.102 and Appendix B to 10 CFR Part 1021, and also Section 5.4 (Applying one or more categorical exclusions to a proposal) and Appendices B and C of DOE's National Environmental Policy Act Implementing Procedures (June 30, 2025).

Requirements and guidance in 10 CFR 1021.102 and DOE's NEPA Implementing Procedures: (See full text in regulation and in Implementing Procedures)

☑ The proposal fits within a class of actions that is listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures (June 30, 2025).

To fit within the classes of actions listed in Appendix B to 10 CFR Part 1021, or Appendix B of DOE's NEPA Implementing Procedures, a proposal must satisfy the conditions that are integral elements of the classes of actions in Appendix B of both 10 CFR Part 1021 and DOE's NEPA Implementing Procedures.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the categorical exclusion would apply.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion.

[Note: For proposals that fit within the categorical exclusions listed in Appendix C of DOE's NEPA Implementing Procedures, see DOE's notice of adoption for the subject Appendix C categorical exclusion for additional considerations. DOE notices of adoption for other agency categorical exclusions may be found on DOE's Section 109 webpage.]

Based on my review of the proposed action, as NEPA Compliance Officer, I have determined that the proposed action fits within the specified class(es) of action, the other requirements and guidance set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: GEOFFREY GOODE

Digitally signed by GEOFFREY GOODE
Date: 2026.05.13 05:33:33 -04'00'

Date Determined:

This form will be locked for editing upon signature.

Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510 and DE-FOA-0003511) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
ChemFinity Technologies, Inc. (3511-1523)	**Low-Cost, Selective Iridium and Platinum Recovery from Mining and Produced Wastewaters via Porous Polymer Sorbent Processes**	**B3.6**
Roca Water, Inc. (3511-1516)	Battery-Inspired, Electrified System for Precision Resource Recovery from Wastewater	B3.6, B3.15
Carollo Engineers (3510-1660)	Selective Recovery of Critical Metals from Produced Water Using Engineered Ferritin Protein Nanocages	B3.6, B3.15
Columbia University (3510-1571)	PURE HARVES2T: Produced water Utilization for Recovery of Energy materials—High-value Advanced Resource Valorization using Emerging Switchable Solvent Technologies	B3.6
University of Missouri (3510-1580)	Development and Demonstration of a Highly Selective Rare Earth Elements Recovery System Using Novel Ion Imprinted Media	B3.6, B3.15
University of Illinois, Urbana-Champaign (3510-1532)	Robust and Regenerable Biosorbent for Selective Recovery of Rare Earth Elements from Aqueous Waste Streams	B3.6, B3.15
Johns Hopkins University (3510-1542)	Bioacid-Mediated Electrowinning for Cobalt and Nickel Recovery from Wastewater	B3.6
University of California, Davis (3510-1626)	Innovative Biocatalysts through Protein Engineering and Synthetic Biology for Efficient, Highly Selective, and Scalable Recovery of Rare Earth Elements	B3.6
Stanford University (3510-1583)	Electrochemically Driven Wastewater Refining for Ammonia, Phosphate, and Magnesium Recovery from Anaerobic Digestate	B3.6, B3.1
Phoenix Tailings (3510-1689)	SELECT: Selective Extraction via Ligand-Enhanced Complexation and Thermal separation	B3.6
University of Texas at Austin (3510-1536)	Biomimetic Membranes for Electrochemical Nutrient and Mineral Recovery from Wastewaters	B3.6; B3.15
University of Connecticut (3510-1567)	Ammonia and Phosphorus Fractionation from Anaerobic Digesters with Ceramic Membrane Distillation	B3.6, B3.15

Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510 and DE-FOA-0003511) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Princeton Critical Minerals (3510-1547)	Integrated Lithium and Magnesium from Oil and Gas Produced Water	B3.6
Northwestern University (3510-1523)	Nitrogen and Phosphorus Recovery via Intensified Microbial Extraction (N-PRIME): A Biotechnological Approach for Valorization of Municipal Wastewater	B3.6

Bold text indicates the one project included in the Third Amended CX.

U.S. Department of Energy
Categorical Exclusion Determination Form

Proposed Action Title: Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- RECOVER and RECOVER SBIR/STTR (NOFO No. DE-FOA-0003510 and DE-FOA-0003511)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): CA, CO, CT, FL, ID, IL, IN, MA, MD, MN, MO, NJ, NY, OH, PA, TX, VA, WI

Proposed Action Description:

SECOND AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original and First Amended Determinations, dated January 16, 2026 and February 20, 2026, respectively). The Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- (RECOVER) program seeks to create new ways to extract critical metals and ammonia from domestic wastewater. Specifically, the projects will develop new materials to selectively bind or react to target ions and molecules in solutions with high ionic strength, natural organic matter, and/or competing cations; and create new processes to continuously recover ammonia and critical minerals without a drop in performance over time. If successful, RECOVER projects could replace 50% of domestic ammonia supplies and 100% of key critical metal supplies, ultimately reducing dependence on foreign energy and mineral sources, thereby increasing U.S. energy security.

The RECOVER Program is composed of 14 small-scale research and development projects that will be conducted by universities, small businesses, and large businesses. This Second Amended Determination adds 2 projects to the original Determination (see Attachment A for all 13). All 13 projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.1 – Site characterization and environmental monitoring

B3.15 – Small-scale indoor research and development projects using nanoscale materials

For the DOE procedures regarding categorical exclusions, including the full text of each categorical exclusion, see 10 CFR 1021.102 and Appendix B to 10 CFR Part 1021, and also Section 5.4 (Applying one or more categorical exclusions to a proposal) and Appendices B and C of DOE's National Environmental Policy Act Implementing Procedures (June 30, 2025).

Requirements and guidance in 10 CFR 1021.102 and DOE's NEPA Implementing Procedures: (See full text in regulation and in Implementing Procedures)

☑ The proposal fits within a class of actions that is listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures (June 30, 2025).

To fit within the classes of actions listed in Appendix B to 10 CFR Part 1021, or Appendix B of DOE's NEPA Implementing Procedures, a proposal must satisfy the conditions that are integral elements of the classes of actions in Appendix B of both 10 CFR Part 1021 and DOE's NEPA Implementing Procedures.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the categorical exclusion would apply.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion.

[Note: For proposals that fit within the categorical exclusions listed in Appendix C of DOE's NEPA Implementing Procedures, see DOE's notice of adoption for the subject Appendix C categorical exclusion for additional considerations. DOE notices of adoption for other agency categorical exclusions may be found on DOE's Section 109 webpage.]

Based on my review of the proposed action, as NEPA Compliance Officer, I have determined that the proposed action fits within the specified class(es) of action, the other requirements and guidance set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: GEOFFREY GOODE

Digitally signed by GEOFFREY GOODE
Date: 2026.04.15 17:01:29 -04'00'

Date Determined:

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Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510 and DE-FOA-0003511) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Roca Water, Inc. (3511-1516)	**Battery-Inspired, Electrified System for Precision Resource Recovery from Wastewater**	**B3.6, B3.15**
Carollo Engineers (3510-1660)	**Selective Recovery of Critical Metals from Produced Water Using Engineered Ferritin Protein Nanocages**	**B3.6, B3.15**
Columbia University (3510-1571)	PURE HARVES2T: Produced water Utilization for Recovery of Energy materials—High-value Advanced Resource Valorization using Emerging Switchable Solvent Technologies	B3.6
University of Missouri (3510-1580)	Development and Demonstration of a Highly Selective Rare Earth Elements Recovery System Using Novel Ion Imprinted Media	B3.6, B3.15
University of Illinois, Urbana-Champaign (3510-1532)	Robust and Regenerable Biosorbent for Selective Recovery of Rare Earth Elements from Aqueous Waste Streams	B3.6, B3.15
Johns Hopkins University (3510-1542)	Bioacid-Mediated Electrowinning for Cobalt and Nickel Recovery from Wastewater	B3.6
University of California, Davis (3510-1626)	Innovative Biocatalysts through Protein Engineering and Synthetic Biology for Efficient, Highly Selective, and Scalable Recovery of Rare Earth Elements	B3.6
Stanford University (3510-1583)	Electrochemically Driven Wastewater Refining for Ammonia, Phosphate, and Magnesium Recovery from Anaerobic Digestate	B3.6, B3.1
Phoenix Tailings (3510-1689)	SELECT: Selective Extraction via Ligand-Enhanced Complexation and Thermal separation	B3.6
University of Texas at Austin (3510-1536)	Biomimetic Membranes for Electrochemical Nutrient and Mineral Recovery from Wastewaters	B3.6; B3.15
University of Connecticut (3510-1567)	Ammonia and Phosphorus Fractionation from Anaerobic Digesters with Ceramic Membrane Distillation	B3.6, B3.15
Princeton Critical Minerals (3510-1547)	Integrated Lithium and Magnesium from Oil and Gas Produced Water	B3.6

Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510 and DE-FOA-0003511) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Northwestern University (3510-1523)	Nitrogen and Phosphorus Recovery via Intensified Microbial Extraction (N-PRIME): A Biotechnological Approach for Valorization of Municipal Wastewater	B3.6

Bold text indicates the two projects included in the Second Amended CX.

U.S. Department of Energy
Categorical Exclusion Determination Form

Proposed Action Title: Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- RECOVER (NOFO No. DE-FOA-0003510)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): CA, CO, CT, FL, IL, MA, MD, MN, MO, NJ, NY, OH, PA, TX, VA

Proposed Action Description:

FIRST AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original Determination, dated January 16, 2026). The Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- (RECOVER) program seeks to create new ways to extract critical metals and ammonia from domestic wastewater. Specifically, the projects will develop new materials to selectively bind or react to target ions and molecules in solutions with high ionic strength, natural organic matter, and/or competing cations; and create new processes to continuously recover ammonia and critical minerals without a drop in performance over time. If successful, RECOVER projects could replace 50% of domestic ammonia supplies and 100% of key critical metal supplies, ultimately reducing dependence on foreign energy and mineral sources, thereby increasing U.S. energy security.
The RECOVER Program is composed of 12 small-scale research and development projects that will be conducted by universities and large businesses. This First Amended Determination adds 3 projects to the original Determination (see Attachment A for all 11). All 11 projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements. The University of Missouri has not identified a pilot test site location and is prohibited from commencing pilot site test work until such location is identified and provided to ARPA-E. Per the terms of the award, identification of the test site location and, if necessary, an amended NEPA Determination, are required prior to the conduct of applicable project work.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.1 – Site characterization and environmental monitoring

B3.15 – Small-scale indoor research and development projects using nanoscale materials

For the DOE procedures regarding categorical exclusions, including the full text of each categorical exclusion, see 10 CFR 1021.102 and Appendix B to 10 CFR Part 1021, and also Section 5.4 (Applying one or more categorical exclusions to a proposal) and Appendices B and C of DOE's National Environmental Policy Act Implementing Procedures (June 30, 2025).

Requirements and guidance in 10 CFR 1021.102 and DOE's NEPA Implementing Procedures: (See full text in regulation and in Implementing Procedures)

☑ The proposal fits within a class of actions that is listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures (June 30, 2025).

To fit within the classes of actions listed in Appendix B to 10 CFR Part 1021, or Appendix B of DOE's NEPA Implementing Procedures, a proposal must satisfy the conditions that are integral elements of the classes of actions in Appendix B of both 10 CFR Part 1021 and DOE's NEPA Implementing Procedures.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the categorical exclusion would apply.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion.

[Note: For proposals that fit within the categorical exclusions listed in Appendix C of DOE's NEPA Implementing Procedures, see DOE's notice of adoption for the subject Appendix C categorical exclusion for additional considerations. DOE notices of adoption for other agency categorical exclusions may be found on DOE's Section 109 webpage.]

Based on my review of the proposed action, as NEPA Compliance Officer, I have determined that the proposed action fits within the specified class(es) of action, the other requirements and guidance set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: GEOFFREY GOODE

Digitally signed by GEOFFREY GOODE
Date: 2026.02.20 16:29:59 -05'00'

Date Determined:

This form will be locked for editing upon signature.

Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Columbia University (3510-1571)	**PURE HARVES2T: Produced water Utilization for Recovery of Energy materials—High-value Advanced Resource Valorization using Emerging Switchable Solvent Technologies**	**B3.6**
University of Missouri (3510-1580)	**Development and Demonstration of a Highly Selective Rare Earth Elements Recovery System Using Novel Ion Imprinted Media**	**B3.6, B3.15**
University of Illinois, Urbana-Champaign (3510-1532)	**Robust and Regenerable Biosorbent for Selective Recovery of Rare Earth Elements from Aqueous Waste Streams**	**B3.6, B3.15**
Johns Hopkins University (3510-1542)	Bioacid-Mediated Electrowinning for Cobalt and Nickel Recovery from Wastewater	B3.6
University of California, Davis (3510-1626)	Innovative Biocatalysts through Protein Engineering and Synthetic Biology for Efficient, Highly Selective, and Scalable Recovery of Rare Earth Elements	B3.6
Stanford University (3510-1583)	Electrochemically Driven Wastewater Refining for Ammonia, Phosphate, and Magnesium Recovery from Anaerobic Digestate	B3.6, B3.1
Phoenix Tailings (3510-1689)	SELECT: Selective Extraction via Ligand-Enhanced Complexation and Thermal separation	B3.6
University of Texas at Austin (3510-1536)	Biomimetic Membranes for Electrochemical Nutrient and Mineral Recovery from Wastewaters	B3.6; B3.15
University of Connecticut (3510-1567)	Ammonia and Phosphorus Fractionation from Anaerobic Digesters with Ceramic Membrane Distillation	B3.6, B3.15
Princeton Critical Minerals (3510-1547)	Integrated Lithium and Magnesium from Oil and Gas Produced Water	B3.6
Northwestern University (3510-1523)	Nitrogen and Phosphorus Recovery via Intensified Microbial Extraction (N-PRIME): A Biotechnological Approach for Valorization of Municipal Wastewater	B3.6

Bold text indicates the three projects included in the First Amended CX.

U.S. Department of Energy
Categorical Exclusion Determination Form

Proposed Action Title: Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- RECOVER (NOFO No. DE-FOA-0003510)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): CA, CT, FL, IL, MA, MD, MN, NJ, NY, PA, TX, VA

Proposed Action Description:

The Realize Energy-rich Compound Opportunities Valorizing Extraction from Refuse waters -- (RECOVER) program seeks to create new ways to extract critical metals and ammonia from domestic wastewater. Specifically, the projects will develop new materials to selectively bind or react to target ions and molecules in solutions with high ionic strength, natural organic matter, and/or competing cations; and create new processes to continuously recover ammonia and critical minerals without a drop in performance over time. If successful, RECOVER projects could replace 50% of domestic ammonia supplies and 100% of key critical metal supplies, ultimately reducing dependence on foreign energy and mineral sources, thereby increasing U.S. energy security.

The RECOVER Program is composed of 12 small-scale research and development projects that will be conducted by universities and large businesses. This Determination covers 8 of the 12 projects (listed in Attachment A). The projects fit within the class of actions identified under the DOE Categorical Exclusions identified below. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements. University of Connecticut has not identified a pilot test site location and is prohibited from commencing pilot site test work until such location is identified. Per the terms of the award, identification of the test site location and if necessary, an amended NEPA Determination, are required prior to the conduct of applicable project work.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.1 – Site characterization and environmental monitoring

B3.15 – Small-scale indoor research and development projects using nanoscale materials

For the DOE procedures regarding categorical exclusions, including the full text of each categorical exclusion, see 10 CFR 1021.102 and Appendix B to 10 CFR Part 1021, and also Section 5.4 (Applying one or more categorical exclusions to a proposal) and Appendices B and C of DOE's National Environmental Policy Act Implementing Procedures (June 30, 2025).

Requirements and guidance in 10 CFR 1021.102 and DOE's NEPA Implementing Procedures: (See full text in regulation and in Implementing Procedures)

☑ The proposal fits within a class of actions that is listed in Appendix B to 10 CFR Part 1021 or Appendix B and C of DOE's NEPA Implementing Procedures (June 30, 2025).

To fit within the classes of actions listed in Appendix B to 10 CFR Part 1021, or Appendix B of DOE's NEPA Implementing Procedures, a proposal must satisfy the conditions that are integral elements of the classes of actions in Appendix B of both 10 CFR Part 1021 and DOE's NEPA Implementing Procedures.

☑ There are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal. DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the categorical exclusion would apply.

☑ The proposal has not been segmented to meet the definition of a categorical exclusion.

[Note: For proposals that fit within the categorical exclusions listed in Appendix C of DOE's NEPA Implementing Procedures, see DOE's notice of adoption for the subject Appendix C categorical exclusion for additional considerations. DOE notices of adoption for other agency categorical exclusions may be found on DOE's Section 109 webpage.]

Based on my review of the proposed action, as NEPA Compliance Officer, I have determined that the proposed action fits within the specified class(es) of action, the other requirements and guidance set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: GEOFFREY GOODE Digitally signed by GEOFFREY GOODE Date: 2026.01.16 11:46:28 -05'00'

Date Determined:

This form will be locked for editing upon signature.

Attachment A: Projects in the RECOVER (NOFO No. DE-FOA-0003510) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Johns Hopkins University (3510-1542)	Bioacid-Mediated Electrowinning for Cobalt and Nickel Recovery from Wastewater	B3.6
University of California, Davis (3510-1626)	Innovative Biocatalysts through Protein Engineering and Synthetic Biology for Efficient, Highly Selective, and Scalable Recovery of Rare Earth Elements	B3.6
Stanford University (3510-1583)	Electrochemically Driven Wastewater Refining for Ammonia, Phosphate, and Magnesium Recovery from Anaerobic Digestate	B3.6, B3.1
Phoenix Tailings (3510-1689)	SELECT: Selective Extraction via Ligand-Enhanced Complexation and Thermal separation	B3.6
University of Texas at Austin (3510-1536)	Biomimetic Membranes for Electrochemical Nutrient and Mineral Recovery from Wastewaters	B3.6; B3.15
University of Connecticut (3510-1567)	Ammonia and Phosphorus Fractionation from Anaerobic Digesters with Ceramic Membrane Distillation	B3.6, B3.15
Princeton Critical Minerals (3510-1547)	Integrated Lithium and Magnesium from Oil and Gas Produced Water	B3.6
Northwestern University (3510-1523)	Nitrogen and Phosphorus Recovery via Intensified Microbial Extraction (N-PRIME): A Biotechnological Approach for Valorization of Municipal Wastewater	B3.6