INFORMATION SHEET

PRESIDING: Commissioner Kemerait, Presiding; Chair Mitchell and Commissioners Brown-Bland, Clodfelter, Duffley, Hughes, and McKissick, Jr.
PLACE: Raleigh, NC
DATE: Monday, July 10, 2023
TIME: 2:00 p.m. – 5:00 p.m.
DOCKET NO.: E-34, Sub 54 and E-34, Sub 55
COMPANY: Appalachian State University d/b/a New River Light and Power Company
DESCRIPTION: In the Matter of Application of Appalachian State University d/b/a New River Light and Power Company for General Rate Case and Petition for an Accounting Order to Defer Certain Capital Costs and New Tax Expenses

VOLUME NUMBER: 2

APPEARANCES
See Attached

WITNESSES
See Attached

EXHIBITS
See Attached

REPORTED BY: Joann Bunze	TRANSCRIPT PAGES:	150
TRANSCRIBED BY: Joann Bunze	PREFILED PAGES:	136
DATE FILED: July 14, 2023	TOTAL PAGES:	286

PLACE: Dobbs Building, Raleigh, North Carolina

DATE: Monday, July 10, 2023

TIME: 2:00 p.m. - 5:00 p.m.

DOCKET NO: E-34, Sub 54 and E-34, Sub 55

BEFORE: Commissioner Karen M. Kemerait, Presiding

Chair Charlotte A. Mitchell

Commissioner ToNola D. Brown-Bland

Commissioner Daniel G. Clodfelter

Commissioner Kimberly W. Duffley

Commissioner Jeffrey A. Hughes

Commissioner Floyd B. McKissick, Jr.

IN THE MATTER OF:

Appalachian State University d/b/a

New River Light and Power Company

E-34, Sub 54

Application for General Rate Case

and

E-34, Sub 55

Petition for an Accounting Order to Defer Certain

Capital Costs and New Tax Expenses

VOLUME 2

A P P E A R A N C E S:

FOR APPALACHIAN STATE UNIVERSITY d/b/a
NEW RIVER LIGHT AND POWER COMPANY:
M. Gray Styers, Jr., Esq.
David Drooz, Esq.
Fox Rothschild LLP
434 Fayetteville Street, Suite 2800
Raleigh, North Carolina 27601

FOR APPALACHIAN VOICES:
Nicholas Jimenez, Esq.
Munashe Magarira, Esq.
Southern Environmental Law Center
601 West Rosemary Street, Suite 220
Chapel Hill, North Carolina 27516

FOR NANCY LAPLACA, INTERVENOR:
Nancy LaPlaca, Pro Se
LaPlaca and Associates, LLC
239 Wildwood Lane
Boone, North Carolina 28607

A P P E A R A N C E S Cont'd.:

FOR THE USING AND CONSUMING PUBLIC:

Thomas J. Felling, Esq.

William E.H. Creech, Esq.

William S.F. Freeman, Esq.

Public Staff - North Carolina Utilities Commission

4326 Mail Service Center

Raleigh, North Carolina 27699-4300

TABLE OF CONTENTS

EXAMINATIONS

E X H I B I T S

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 7-5-2023 **DOCKET NO.:** E-34, Subs 54 & 55

ATTORNEY NAME and TITLE: M.Gray Styers, Jr

FIRM NAME: Fox Rothschild

ADDRESS: 434 Fayetteville Street, Suite 2800

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27601

APPEARANCE ON BEHALF OF: New River LIght & Power

APPLICANT: x **COMPLAINANT:** ____ **INTERVENOR:** ____

PROTESTANT: ____ **RESPONDENT:** ____ **DEFENDANT:** ____

Non-confidential transcripts are located on the Commission's website. To view and/or print transcripts, go to https://www.ncuc.net/, hover over the Dockets tab, select Docket Search, enter the docket number, and click search, select the highlighted docket number and select Documents for a list of all documents filed.

ONLY fill out this portion if you have signed an NDA to receive **CONFIDENTIAL** transcripts and/or exhibits:

n/a **Yes, I have signed the Confidentiality Agreement.**

Email: gstyers@foxrothschild.com

SIGNATURE: GStyers Digitally signed by GStyers Date: 2023.07.05 21:36:55 -04'00'

(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 7-10-23 **DOCKET NO.:** E-34, Subs 54 & 55

ATTORNEY NAME and TITLE: David Drooz

FIRM NAME: Fox Rothschild

ADDRESS: 434 Fayetteville Street, Suite 2800

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27601

APPEARANCE ON BEHALF OF: New River Light & Power

APPLICANT: x **COMPLAINANT:** ___ **INTERVENOR:** ___

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

Non-confidential transcripts are located on the Commission's website. To view and/or print transcripts, go to https://www.ncuc.net/, hover over the Dockets tab, select Docket Search, enter the docket number, and click search, select the highlighted docket number and select Documents for a list of all documents filed.

ONLY fill out this portion if you have signed an NDA to receive **CONFIDENTIAL** transcripts and/or exhibits:

N/A **Yes, I have signed the Confidentiality Agreement.**

Email: ddrooz@foxrothschild.com

SIGNATURE: _____

(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 07/10/23 **DOCKET NO.:** E-34, Sub 84 and Sub 55

ATTORNEY NAME and TITLE: Nick Jimenez, Senior attorney, and Munashe Magarira, Staff Attorney

FIRM NAME: Southern Environmental Law Center

ADDRESS: 601 W Rosemary St, Suite 220, ~~Chapel~~

CITY: Chapel Hill **STATE:** NC **ZIP CODE:** _____

APPEARANCE ON BEHALF OF: Appalachian Voices

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** ✓

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

Non-confidential transcripts are located on the Commission's website. To view and/or print transcripts, go to https://www.ncuc.net/, hover over the Dockets tab, select Docket Search, enter the docket number, and click search, select the highlighted docket number and select Documents for a list of all documents filed.

ONLY fill out this portion if you have signed an NDA to receive **CONFIDENTIAL** transcripts and/or exhibits:

☑ **Yes, I have signed the Confidentiality Agreement.**

Email: MMagarira@selcnc.org; njimenez@selcnc.org

SIGNATURE: _____

(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 7/10/23 **DOCKET NO.:** E34 Sub 54

ATTORNEY NAME and TITLE: Self-represented
Nancy LaPlaca (NRLP customer)

FIRM NAME: LaPlaca and Associates LLC

ADDRESS: 239 Wildwood Lane, B

CITY: Boone **STATE:** NC **ZIP CODE:** 28607

APPEARANCE ON BEHALF OF: Self (an actual customer)
residential

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** X

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

Non-confidential transcripts are located on the Commission's website. To view and/or print transcripts, go to https://www.ncuc.net/, hover over the Dockets tab, select Docket Search, enter the docket number, and click search, select the highlighted docket number and select Documents for a list of all documents filed.

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Email: _____

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(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION
PUBLIC STAFF - APPEARANCE SLIP

DATE: July 10, 2023

DOCKET #:E-34, Subs 54,55
New River Light & Power

PUBLIC STAFF ATTORNEYS: Thomas J. Felling, William E.H. Creech, William S.F. Freeman

TO REQUEST A **CONFIDENTIAL** TRANSCRIPT, PLEASE PROVIDE YOUR EMAIL ADDRESS BELOW:

ACCOUNTING_____
CONSUMER SERVICES_____
COMMUNICATIONS_____
ENERGY_____
ECONOMICS_____
LEGAL thomas.felling@psncuc.nc.gov;
William.creech@psncuc.nc.gov; William.freeman@psncuc.nc.gov
TRANSPORTATION _____
WATER _____

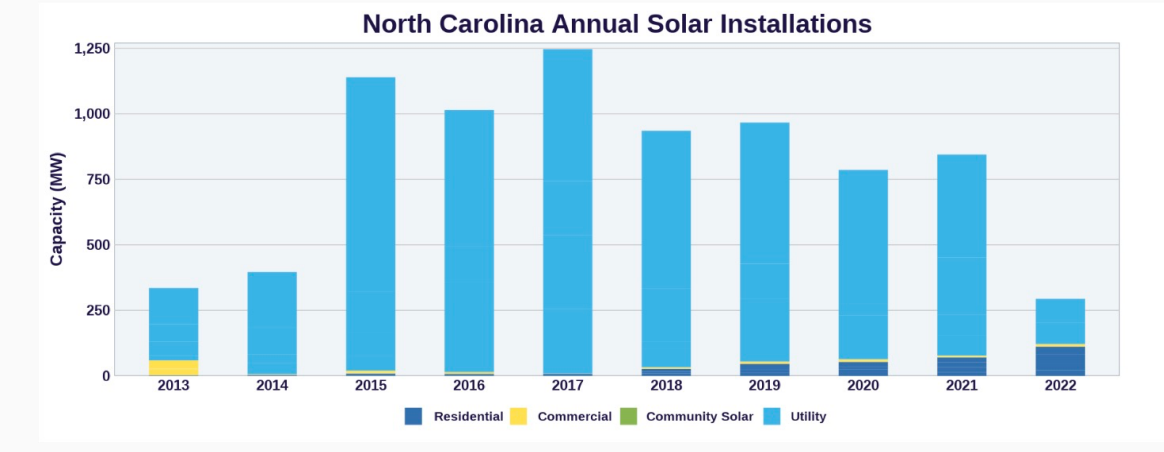
Non-confidential transcripts are located on the Commission's website. To view and/or print, please access https://ncuc.net.

COUNSEL/MEMBER(s) REQUESTING A **CONFIDENTIAL** TRANSCRIPT WHO HAS SIGNED A CONFIDENTIALITY AGREEMENT WILL NEED TO SIGN BELOW.

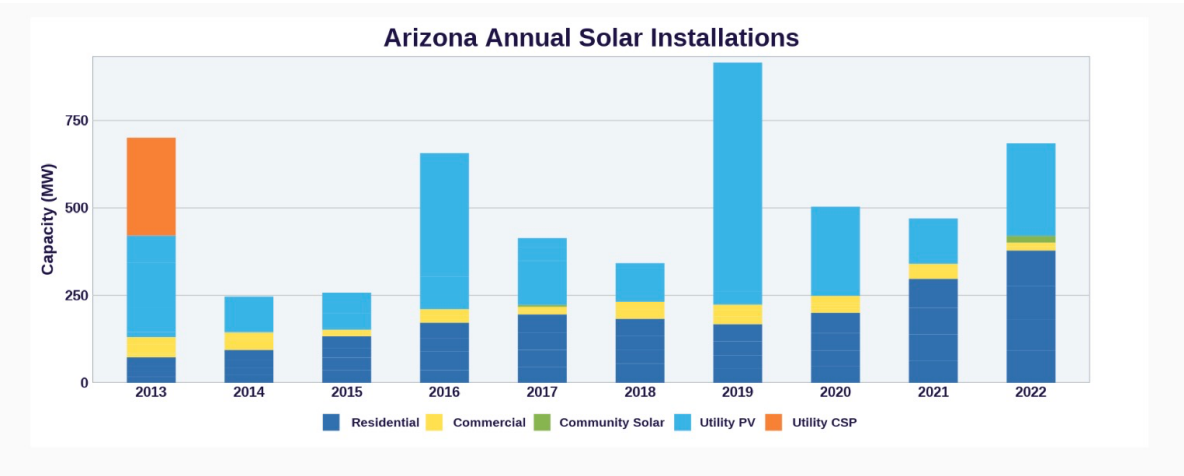
/s/ Thomas J. Felling
/s/ William E.H. Creech
/s/ William S.F. Freeman

LaPlaca

ATTACHMENT A



North Carolina's solar installations slowed down considerably, so that 2022 installations were as low as in 2013, nearly a decade ago. As you can see from the chart, NC had practically no residential solar until ~2018. NC's total solar capacity as of the end of 2022 is 8,179 MW.[31]



Due to poor policies, the sunny state of AZ lags in solar, with a total capacity of 6,330 MW at the end of 2022. Although residential solar took a big hit due to solar-inhibiting rules in 2013 and

[31] Source: SEIA website, accessed 6/5/23 https://www.seia.org/state-solar-policy/north-carolina-solar

I/A

Docket No. E-34, Subs 54 and 55
Exhibit JWH-1

JASON W. HOYLE

1155 Kildaire Farm Rd.
Suite 202
Cary, North Carolina, 27511

EDUCATION

Master of Business Administration, August 2003
Appalachian State University, Boone, North Carolina

Bachelor of Science in Mass Communications, May 2001
Concentration: Print Journalism
Appalachian State University, Boone, North Carolina

EXPERIENCE

Principal Energy Policy Analyst March 2022 – Present
EQ Research, LLC | Cary, North Carolina

- Lead consulting engagements for clean and distributed energy sector clients, including writing reports, conducting research and analysis on state energy policy and market issues, and supporting regulatory and legislative advocacy.
- Manage EQ Research's services tracking U.S. electric utility rate cases, including reviewing and analyzing electric rate cases and managing subscriber-facing database.
- Research, track, and summarize state-, regional-, and national-level regulatory and legislative energy policy developments for EQ Research's policy tracking services.
- Coordinate EQ Research's regulatory and compliance consulting services for Community Choice Aggregation programs in California, including regulatory monitoring and analysis, compliance reporting, litigation support, and resource procurement planning.

Instructor August 2012 – December 2021
Department of Sustainable Technology and the Built Environment, Appalachian State University | Boone, North Carolina

- Developed undergraduate- and graduate-level course curriculum in the sustainable technology program focused on the policy, market, and economic context for the development of energy projects. Specific course topics included regulatory oversight roles, energy and related environmental attribute markets, power purchase agreements, tax-based and other incentives, and implications of emerging technologies and business models in power markets.

Senior Research Associate January 2020 – January 2021
Research Associate January 2010 – January 2020
Center for Economic Research & Policy Analysis, Appalachian State University | Boone, North Carolina

- Led development and implementation of research proposals on topics of electricity and emissions markets and regulation, ecosystem valuation, and economic development.
- Oversaw and supervised collection and analysis of energy and economic data for research projects, reports to legislative commissions and committees, and expert witness testimony.
- Managed development and implementation of process for obtaining customer consent and anonymization of electric utility customer data in partnership with electric utilities for energy-related behavioral economics experiments.

Research Analyst August 2005 – January 2020
Research Associate August 2003 – August 2005

Appalachian Energy Center, Appalachian State University | Boone, North Carolina

- Managed development and implementation of research and program initiatives on state- and national-level energy policy and regulations, including renewable energy incentives, retail rate design and analysis, wholesale electricity markets, greenhouse gas emission and carbon offset markets, sustainability accounting, and greenhouse gas inventories.
- Oversaw and led consultation services for clients from government, industry, academia, and non-profit sectors on energy- and greenhouse gas-related policies, including due diligence, legal and regulatory analysis, pro forma financial and valuation analysis, and negotiated PPA contracts and contracts for the sale of both carbon offsets and renewable energy certificates.
- Developed curriculum for and taught professional continuing education courses on renewable energy policy, finance, and regulation offering AIA Learning Units (LU), engineering Professional Development Hours (PDH), CPA (CPE) credits, Continuing Legal Education (CLE) credits, SWANA Continuing Education Units (CEU), and Continuing Forestry Education (CFE) credits.

SELECTED SERVICE & AFFILIATIONS

Scientific Peer Reviewer, Landfill Gas Destruction and Beneficial Use Projects v2.0, American Carbon Registry (2020-2021)

- Reviewed proposed methodology update to landfill gas project protocol (Landfill Gas Destruction and Beneficial Use Projects v2.0) for adherence to commonly accepted carbon offset principles.
- Provided comments and feedback to maximize practical usefulness and conformance with carbon accounting principles of proposed methodology update.

Workgroup Member, Landfill Project Protocol Version 5.0, Climate Action Reserve (2018-2019)

- Reviewed and advised Climate Action Reserve on proposed changes to U.S. Landfill Project Protocol Version 5.0.
- Provided information and guidance on economic, financial, and market factors used in establishing the protocol's Performance Standard Analysis (i.e. basis for differentiating between common practice and eligible project activities).

Graduate Faculty, Department of Sustainable Technology and the Built Environment, Appalachian State University (2014 – Dec. 2021)

Graduate and Honors Thesis Committees, Department of Sustainable Technology and the Built Environment, Appalachian State University (2015 - 2019)

Advisory Council, International Hydrail Conference (since 2005)

- Coordinated with conference hosts (from North America, Europe, and Asia) on conference planning, logistics, and promotion.
- Reviewed proposed presentation and provided recommendations on conference agenda and proposal acceptance.
- Compiled data and information on worldwide development and deployment of hydrogen-based rail technology, and advised government, industry, and academia on technology, policy, and deployment topics related to hydrogen trains and the broader hydrogen economy.

Advisory Board, N.C. Farm Center for Innovation and Sustainability (2009-2014)

- Advised on program development and greenhouse gas offset project opportunities (specifically carbon offsets from forestry and biochar).

- Prepared market analysis of biochar products and carbon offsets from biochar.
- Conducted operations analysis of mobile biochar production technology with focus on labor cost function and maximizing equipment capacity utilization.

Advisory Board, Western N.C. Clean Energy Leadership Group (2009-2012)

Advisory Board, N.C. Green Business Fund (2007-2009)

- Advised on design and review of Request for Proposals for new state investment fund focused on supporting development of businesses engaged in sustainable technology.
- Evaluated proposals for funding and presented evaluation to grantmaking committee.
- Participated as member of the grantmaking committee to prioritize grant proposals and select proposals for funding.

SELECTED PUBLICATIONS & PRESENTATIONS

Books, Articles & Reports

"Measuring the Economic Impact of COVID-19-Related Business Interruptions on the Regional Economy" (with O. Ashton Morgan) *N.C. Policy Collaboratory*. Report. December 2020. Chapel Hill, N.C.

"Trash to Treasure: Predicting Landfill Gas Flow to Optimize Electricity Generation." (with Dan Emery, Edgar Hassler, Joseph Cazier) *JISAR*, *13*(3), 29. (2020)

"Optimizing sequestered carbon in forest offset programs: balancing accounting stringency and participation." (with Wise, L., Marland, E., Marland, G., Kowalczyk, T., Ruseva, T., Colby, J. & Kinlaw, T.) *Carbon balance and management*, *14*(1), 1-11. (2019)

"Trash to Treasure: Predicting Landfill Gas Flow to Optimize Electricity Generation" (with Dan Emery, Edgar Hassler, Joseph Cazier) *Conference on Information Systems Applied Research*. Conference Paper. Nov. 6-9, 2019. Cleveland, Ohio.

"Small-Scale Landfill Gas Offset Protocol" (with S. Steury and J. Dees) Appalachian State University. 2017.

Understanding and Analysis: The California Air Resources Board Forest Offset Protocol. (with Eric Marland, Grant Domke, Gregg Marland, Laurel Bates, Alex Helms, Benjamin Jones, Tamara Kowalczyk, Tatyana B Ruseva, Celina Szymanski) Springer Briefs in Environmental Science, 2017.

"Accounting for harvested wood products in a forest offset program: Lessons from California" (with L. Bates, B. Jones, E. Marland, G. Marland, T. Ruseva, and T. Kowalczyk) *Journal of Forest Economics* 27 (2017): 50-59.

"Additionality and permanence standards in California's Forest Offset Protocol: A review of project and program level implications" (with T. Ruseva, E. Marland, C. Szymanski, J. Hoyle, G. Marland, T. Kowalczyk) *Journal of Environmental Management* 198 (2017): 277-288.

"UNC Wilmington Greenhouse Gas Inventory and Sustainability Action Plan" (with D. Ponder, A. Toneys and J. Mosteller) report to UNC-Wilmington. August 2014.

"Summary of Avoided Cost Rates & N.C. Utility Commission Proceedings Update" report to Appalachian Institute for Renewable Energy, Doc. No. 12-0194_006. July 2013.

"Value from Solid Waste Management" report to Board of Commissioners, Rockingham County, NC. March 2013.

"Performance-based potential for residential energy efficiency" *CICERO Report*. January 2013.

"Behind-the-Meter Sale of Unbundled RECs" report to Appalachian Institute for Renewable Energy, Doc. No. 12-0194_002. May 2012.

"Energy Internships in North Carolina: An Evaluation of Experiences and Indicators for the Future" (with M. Hoepful and L. Murphy) report to State Energy Office, N.C. Department of Commerce. April 2012.

"Electricity Sales & Generating Facility Leases in North Carolina" report to Appalachian Institute for Renewable Energy, Doc. No. 12-0194_001. February 2012.

"Standard Purchase Offers for Power & Environmental Assets in North Carolina" Appalachian Energy Center Report. October 2011.

"Comments on Proposed Changes to the Climate Action Reserve Landfill Project Protocol" submitted to Climate Action Reserve. June 2011.

"Monetizing Green Assets & Incentives: Watauga County, NC" report to Board of Commissioners, Watauga County, NC. January 2011.

"Electricity Service Options at the Watauga County Landfill" report to Board of Commissioners, Watauga County, NC. August 2010.

"Retail Carbon Offset Survey 2009" (with J. Little, T. Cherry, H. Whalan and D. Six) report to Environmental Credit Corporation. May 2010.

"Expectations in an Uncertain Economy" (with T. Cherry and B. Toney) Center for Economic Research and Policy Analysis Research Report, March 2010.

"Landfill Gas Project Financial Analysis: Edgecombe County" report to Board of Commissioners, Edgecombe County, NC. March 2010.

"Landfill Gas Financial Analysis: Rutherford County" report to Board of Commissioners, Rutherford County, NC. March 2010.

Secondary Economic Impact Analysis of Greenhouse Gas Mitigation Options for North Carolina. (with D. Ponder and J. Tiller) report to North Carolina Climate Action Plan Advisory Group. Center for Climate Strategies. October 2008.

"Aspects of Energy Use and Capacity in North Carolina" (with D. Grady). *Popular Government*. Vol. 73, No. 3, pp. 5,6,10-11,22-23. 29-30. Spring Summer 2008.

Presentations

"Community engagement strategies for capturing co-benefits from offset projects" Achieving Corporate Climate Ambitions with Carbon Offsets, Climate Action Reserve Webinar. 8 November 2018.

"Accounting for negative CO2 emissions" (with Marland, E., Marland, G., Kowalczyk, T., Ruseva, T., and Wise, L.). International Conference on Negative CO2 Emissions, Gothenburg, Sweden 22-24 May, 2018.

"Negative Electricity Prices" RECONNECT 2017. Department of Mathematics, Appalachian State University, Boone, NC. June 2017.

"Third Party Ownership Structures and Net Metering Considerations" North Carolina State Energy Conference. NC State University, Raleigh, NC. 20-21 April 2016.

"Investigating the Economic Viability of a Solid Waste-To-Biofuel Facility in Western North Carolina" (with G. Rockwell, L. Preston, C. North, J. Ferrell, J. Ramsdell, A. Morgan and M. McKee) Invited Lecture and Poster Presentation, NC Department of Agriculture Bioenergy Field Day, Mills River, N.C. 27 August 2015.

"Renewable Energy & Energy Efficiency in Commercial Construction" Construction Professionals Network of North Carolina, Mid-Year Educational Conference. Greensboro Marriott Downtown Hotel, Greensboro, NC. 3 Oct. 2014. Invited Presentation. (offering CEU credits)

"Energy, Economy and Environmental Policy: Balancing Need and Constraint" UNC-Charlotte Lecture Series. University of North Carolina at Charlotte, Department of Civil Engineering, Charlotte, NC. 10 Sep. 2014. Invited lecture.

"Negative Marginal Cost Electricity: An opportunity for low-cost value-added hydrogen production" 8th International Hydrail Conference, Ryerson University, Toronto, Canada. June 2013.

"Watauga County, NC: 195 kW or Bust" 16th Annual Landfill Methane Outreach Program, U.S. Environmental Protection Agency. Baltimore, MD, USA. January 2013.

"Economic Valuation Methods for Public Investment in Hydrail" 7th International Hydrail Conference, University of Birmingham, Birmingham, U.K. July 2012.

"State Energy Internship Program Evaluation" (with M. Hoepful) 9th Annual Sustainable Energy Conference, State Energy Office, N.C. Department of Commerce. Raleigh, NC, USA. April 2012.

"Facilitating Statewide Community-Based LFG: 6 years, 14 counties, and 10 projects" 15th Annual Landfill Methane Outreach Program Conference, U.S. Environmental Protection Agency. Baltimore, MD, USA. January 2012.

"The Value of Hydrail" 6th International Hydrail Conference, Istanbul, Turkey. July 2010.

"Carbon Credit Purchasing in the Local Decision Context" 13th Annual Landfill Methane Outreach Program Conference, U.S. Environmental Protection Agency. Baltimore, MD, USA. January 2010.

"North Carolina Economic and Energy Outlook for Local Governance" (with T. Cherry) presentation to NCAPA Summer Planning Institute. May 2009.

"New Renewable Energy Markets for North Carolina Companies" 6th Annual North Carolina Sustainable Energy Conference, State Energy Office, N.C. Department of Commerce. Raleigh, NC, USA. April 2009.

"Competitive Insight into the Energy Economy: Charlotte Region" invited lecture at Central Piedmont Community College, Charlotte, NC. November 2008.

"Accelerating Development of the Renewable Energy Economy" Workforce Partnership Conference, N.C. Department of Commerce. Greensboro, NC, USA. October 2008.

"Market Adoption Factors of Hydrail Technology" 4th International Hydrail Conference, Valencia, Spain. June 2008.

"Economic Development from Landfill Gas: Carbon Credits Facilitate Job Creation" 11th Annual Landfill Methane Outreach Program Conference, U.S. Environmental Protection Agency. Baltimore, MD, USA. January 2008.

"Utilization of Rockingham County Landfill Energy Source" (with D. Grady) presentation to Board of Commissioners, Rockingham County, NC. August 2007.

"Landfill Gas Taskforce Update" presentation to Board of Commissioners, Columbus County, NC. May 2007.

"North Carolina Opportunities in Renewable Energy Manufacturing" presentation series to AdvantageWest, Research Triangle, NC Southeast, NC Northeast, and Charlotte Economic Development Partnerships. 2005.

SELECTED GRANT & CONTRACT AWARDS

"Measuring the Economic Impact of COVID-19 on the Regional Economy" N.C. Policy Collaboratory. $97,850. 2020 (Co-PI)

"Exploring the Viability of Small-Scale Forest Carbon Offsets" UNC General Administration Inter-Institutional Planning Grant. $75,000. 2018 (Co-PI)

"The OFFSET Workshop: Offsets for Future Forest Stewardship & Education Together" The Clabough Foundation. $6,610. 2017 (Investigator)

"Curriculum Development Contract TEC 3533/5533" College of Fine & Applied Arts, Appalachian State University. $3,200. 2017 (PI)

"Biogas as Local Economic Engine and Agent for Social Change" Eastern Research Group. $20,154. 2017 (Investigator)

"North Carolina Integrated Electric Utility Research Laboratory" (with J. Ramsdell, T. Cherry, B. Raichle, E. Miller and D. Young) UNC General Administration Research Opportunities Initiative Planning Grant. $48,307. 2016 (Co-PI)

"Appalachian Energy Center State Appropriation - FY16 and FY17" NC Department of Environmental Quality. $337,953. 2016 (Investigator)

"Examining metrics in compliance carbon offset protocols in U.S. forest projects" USDA NRE US Forest Service. $20,000. 2015 (Investigator)

"Subcontract for UNCW Greenhouse Gas Inventory" Good Company (Hinrichs, Proudfoot, and Skov, Inc). $5,928. 2014 (PI)

"Examining metrics in compliance carbon offset protocols in U.S. forest projects" USDA NRE US Forest Service. $40,000. 2014 (Investigator)

"Appalachian Energy Center - North Carolina University Energy Center Program July 1, 2013 through June 30, 2015" N.C. Department of Environment and Natural Resources. $506,930. 2014 (Investigator)

"Investigating the Economic Viability of a Municipal Solid Waste-to-Biofuels Facility in WNC" (with J. Ramsdell, A. Morgan, J. Ferrell and M. McKee) Biofuels Center of North Carolina/N.C. Department of Agriculture and Consumer Services. $65,722. 2013 (PI)

"Research Assistance to AIRE" Appalachian Institute for Renewable Energy. $24,975. 2012 (PI)

"Energy Savings: Environmental Performance Contracting in the United States" (with T. Cherry) Center for International Climate and Environmental Research - Oslo (CICERO). $2,650. 2012 (Co-PI)

"Renewable Energy Manufacturing Supply Chain Workshops" Advantage West. $4,000. 2012 (PI)

"ARRA - Edgecombe County Landfill Gas Assistance" Edgecombe County. $10,000. 2012 (PI)

"ARRA - Rockingham County Landfill Gas Project" Rockingham County. $10,000. 2011 (PI)

"Foothills Landfill Gas Project-Rutherford" Foothills Connect. $11,000. 2011 (PI)

"ARRA Wilkes County Landfill" Wilkes County. $7,000. 2011 (Investigator)

"Community-based Landfill Gas Utilization in Brazil - Phase II and Extension" US Environmental Protection Agency. $120,000. 2011 (Investigator)

"Landfill Gas for Community Development-Construction Phase" Z. Smith Reynolds Foundation. $25,000. 2011 (Investigator)

"Landfill Gas Utilization for Columbus County" Cape Fear RC&D Council. $6,000. 2011 (Investigator)

"Appalachian Energy Internship Program" (with M. Hoepfl, J. Cazier, J. Ramsdell, D. Scanlin and J. Tiller), NC Department of Administration, State Energy Office. $10,080. 2010 (Co-PI)

"Watauga County Energy Project Analysis" Watauga County. $1,975. 2010 (Lead PI)

"Appalachian Energy Internship Program" (with M. Hoepfl, J. Cazier, J. Ramsdell, D. Scanlin and J. Tiller), NC Department of Administration, State Energy Office. $485,857. 2010 (Co-PI)

"Green Economic Asset Mapping" Z. Smith Reynolds Foundation. $34,602. 2010 (Lead PI)

"Community-based Landfill Gas Utilization in Brazil - Phase I" US Environmental Protection Agency. $120,000. 2009 (Investigator)

"Community TIES Landfill Gas Development Phase III" Z. Smith Reynolds Foundation. $55,000. 2008 (Investigator)

"Community-based LFG Development Phase II" Golden LEAF Foundation. $125,000. 2007 (Investigator)

"Rural Landfill Gas Economic Development Demonstration Project" Golden LEAF Foundation. $97,360. 2006 (Investigator)

"Phase III Implementation of the State Energy Plan" NC State Energy Office. $466,765. 2006 (Investigator)

New River Light and Power EE/DSM Pilot Examples

- Heat Pump Rebate Examples
  - Piedmont EMC Rebates to Help You Save | Piedmont Electric Cooperative (pemc.coop)
    - Heat pumps: $50/ton (SEER of 15 or higher and completely electric home). Up to $200 per system
  - Four County EMC Rebates – Four County Electric Membership Corporation (fourcty.org)
    - Energy Star Appliances (clothes washers, dishwashers, refrigerators): $50/unit rebate
    - Heat pump: $100/ton. Minimum 16 SEER and 50 gallons
      - See savings potential above
    - Heat Pump Water heater: $300/unit
      - Can save a medium household around $350 a year (source)
  - Fayetteville PWC Full-Programs-Terms-and-Conditions-12-6-2023.pdf (faypwc.com)
    - Heat pumps: $250 - $400 depending on SEER
  - Duke Energy Carolinas Smart $aver - HVAC Install - Duke Energy (duke-energy.com)
    - Heat pumps: $300 - $400 per unit
    - Program estimates over $300 per year in EE savings for customers
    - Similar program in Duke Energy Progress Smart $aver - HVAC Install - Duke Energy (duke-energy.com)

- Demand Response/Smart Thermostat Program Examples
  - Piedmont EMC Smart Thermostats | Piedmont Electric Cooperative (pemc.coop)
    - Smart thermostat incentive: $50/thermostat
      - Users save 10-23% on energy bills per year (source)
      - PEMC notes that the demand response function of smart thermostats helps reduce their peak demand, which can be expensive with their wholesale contract.
        - "Help keep rates low! When we work together to reduce energy use on the hottest days in the summer, it helps us keep rates low for everyone."
  - Connect to Save Program (source)
      - Partnership of multiple cooperatives (source)
      - Automatically manage your energy use on select days (or "events") when electric demand is high, or nearing peak demand
      - Customers receive up to $144 off the purchase price of a new qualifying smart thermostat and $50 each year of continued participation. You may receive an additional $50 when you opt for

the installation of a water heater load control device. FAQs (connecttosavenc.com)

- EV Charging
  - Utilities are increasingly using telematics programs to collect charging data. DSIRE 50 States of Electric Vehicles, Q1 2023 Quarterly Report Executive Summary (p.9)
  - Virginia Electric and Power Company (Dominion Energy Virginia) included two EV demand programs in its "Transportation Electrification Plan" filed May 1, 2023.
    - The "Residential Electric Vehicle EE/DR Program (marketed as EV Charger Rewards)" provides incentives to customers to install "smart" Level 2 EV chargers and enroll in the demand response portion of the program, which allows Dominion to "call" demand response during times of peak system demand to reduce load. This program has been up and running since March 2021 and has over 800 participants. (pp.4-5)
    - The "Residential EV Telematics Pilot" operates in parallel with the EE/DR Program and provides incentives to customers to allow Dominion to use the customer's on-board telematics to control EV charging in order to reduce load during periods of high demand. (p.7)

- Relevant IRA incentives that may provide a tailwind to participation in these programs
  - Source: Inflation Reduction Act Guidebook | Clean Energy | The White House
  - Households can claim a tax credit for 30% of the costs of buying and installing a heat pump, up to $2,000 including support for any electric system upgrades needed to make the home heat-pump-ready. (Source)
  - Beginning in 2023 state programs offer low- and moderate-income households rebates for heat pumps at the point-of-sale, cutting costs of purchase and installation up to $8,000. If home electrical upgrades are needed to integrate new heat pumps, rebates of up to $4,000 are available to households. (Source)

MOODY'S
INVESTORS SERVICE

RATING METHODOLOGY

US Municipal Utility Revenue Debt Methodology

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This rating methodology replaces the *US Municipal Utility Revenue Debt* methodology published in October 2017. We have added a section on "Other Considerations." We have also made editorial changes to enhance readability. These updates do not change our methodological approach.

Introduction

In this rating methodology, we explain our general approach to assessing credit risk of essential service US municipal utility revenue bonds, including the qualitative and quantitative factors that are likely to affect rating outcomes in this sector.

The primary factors that drive our credit analysis of revenue bonds issued by municipal utilities that provide essential services are the size and health of the system and its service area, the financial strength of its operations, the legal provisions governing its management, and the strength of its rate management and regulatory compliance.

We discuss the scorecard used for this sector. The scorecard[1] is a relatively simple reference tool that can be used in most cases to approximate credit profiles in this sector and to explain, in summary form, many of the factors that are generally most important in assigning issuer-level ratings to issuers in this sector. The scorecard factors may be evaluated using historical or forward-looking data or both.

We also discuss other considerations, which are factors that are assessed outside the scorecard, usually because the factor's credit importance varies widely among the issuers in the sector or because the factor may be important only under certain circumstances or for a subset of issuers. In addition, some of the methodological considerations described in one or more cross-sector rating methodologies may be relevant to ratings in this sector.[2] Furthermore, since ratings are forward-looking, we often incorporate directional views of risks and mitigants in a qualitative way.

As a result, the scorecard-indicated outcome is not expected to match the actual rating for each issuer.

[1] In our methodologies and research, the terms "scorecard" and "grid" are used interchangeably.

[2] A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Our presentation of this rating methodology proceeds with (i) the scope of this methodology; (ii) the sector overview; (iii) the scorecard framework; (iv) a discussion of the scorecard factors; and (v) other considerations not reflected in the scorecard. The appendix shows the full view of the scorecard factors, sub-factors, weights and thresholds.

Scope

This methodology is used to assign ratings to debt instruments where the primary pledge and source of repayment are revenues generated by US municipal utilities providing monopolistic services essential to public health and functional economies. The approach described in this methodology applies to six basic categories of US municipal utilities: water distribution, gas distribution,[3] electric distribution,[4] sanitary sewerage, stormwater disposal, and solid waste disposal.

This methodology does not apply to debt issued by regulated water utilities, regulated electric and gas utilities and networks, electric generation and transmission cooperatives, power generation projects; nor does it apply to other types of public utilities, such as telephone, cable television, or parking. This methodology also does not apply to utility revenue debt whose rating is based on a general promise of a state or local government to pay the debt (e.g., a general obligation pledge or a full faith and credit pledge).[5]

Sector Overview

The pledge and source of repayment for a municipal utility revenue bond is typically defined in a bond resolution or a trust indenture, which acts as a contract between the utility and its bondholders. The resolution or indenture most often includes a lien on the net revenues of the utility system after the payment of regular operating and maintenance expenses.

US municipal utilities provide many different services whose rates or fees are pledged to the repayment of debt. The utilities mostly fall into one or more of six basic categories:

- **Water utilities** take water from the ground, a river, a lake, or in special cases the ocean, treat it to a potable standard, and distribute it to customers for drinking, cleaning, and commercial, industrial, or agricultural use. These utilities can be involved in any or all of the functions of water supply: water treatment, long-distance transmission and retail water distribution. Some water utilities have no treatment capacity and purchase potable water wholesale.
- **Gas utilities** take natural gas from a wholesale pipeline, odorize it for safety detection and pressurize it for delivery to customers through a pipe network for uses such as heating, cooking or commercial and industrial applications.
- **Electric utilities** purchase electricity from wholesale suppliers and deliver it to residential, commercial and industrial customers for a wide range of power uses.

[3] This methodology covers municipal gas distribution utilities. These utilities typically purchase their supply from natural gas producers or intermediaries, and the gas is delivered via natural gas pipeline to the municipality's distributions system. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

[4] Only those municipal electric utilities that generate less than 20% of their own power are rated using this methodology. We rate public power utilities using different methodologies. For information, see our methodology that discusses US public power electric utilities with generation ownership exposure and also our methodology that discusses US municipal joint action agencies. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

[5] A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

- **Sanitary sewer** utilities collect and treat wastewater, discharging it into a waterway or injecting it underground, and landfilling or incinerating the residual sludge. Some sewer utilities with no treatment capacity gather wastewater and transmit it to another utility that treats it.
- **Stormwater** utilities collect and treat rainwater before discharging it into a body of water such as an ocean or a river. While every city or county addresses stormwater drainage as an integral element of its streets and highways, the stormwater systems that require capital markets financing are typically large in scale and are necessary to avert flooding from heavy seasonal rainfall.
- **Solid waste** utilities collect residential or commercial refuse and dispose of it through landfills, waste-to-energy plants, or other waste-disposal processes. A solid waste system can be complete or collection-only, relying on another municipal or private entity for long-haul removal and disposal through landfill or incineration.

Essential-service utilities typically operate as departments, boards or independent authorities of US states or local governments.

States and subdivisions of states, such as counties and cities, often issue bonds where the primary pledge and source of repayment are the net revenues generated by a utility system operated directly under government auspices, such as a city water department. In other cases, states or state subdivisions create an independent authority or special purpose district that operates the system and issues the bonds.

The credit quality of essential-service utility revenue bonds has generally been strong, based on the fundamental strength of utilities, which include the following characteristics:

- The provision of essential services, usually in a government-protected monopoly;
- Typically unregulated and independent rate-setting authority;
- The ability to discontinue service to delinquent accounts and in many cases to put a lien on the property for nonpayment;
- Utility cost burdens that are typically low relative to household income and to tax burdens;
- A generally strong federal and state regulatory framework that is designed to keep utilities functioning in order to protect public health and achieve environmental goals;
- A "special revenue" designation that may insulate a utility from a parent's bankruptcy.

Scorecard Framework

The scorecard in this rating methodology is composed of four factors. All of the sub-factors comprise a number of sub-factors. The scorecard also includes 20 notching factors, also known as below-the-line adjustments, which may result in upward or downward adjustments in half-notch or whole notch increments to the preliminary scorecard-indicated outcome.

EXHIBIT 1

US Municipal Utility Revenue Debt Scorecard Overview

Factor	Factor Weighting	Sub-factor	Sub-factor Weighting
System Characteristics	30%	Asset Condition (Remaining Useful Life)	10%
		System Size (O&M)	7.5%
		Service Area Wealth (Median Family Income)	12.5%
Financial Strength	40%	Annual Debt Service Coverage	15%
		Days Cash on Hand	15%
		Debt to Operating Revenues	10%
Management	20%	Rate Management	10%
		Regulatory Compliance and Capital Planning	10%
Legal Provisions	10%	Rate Covenant	5%
		Debt Service Reserve Requirement	5%
Total	100%	Total	100%

Source: Moody's Investors Service

The scorecard does not include or address every factor that a rating committee may consider in assigning ratings in this sector. We may use the scorecard over various historical or forward-looking time periods. Furthermore, in our ratings we often incorporate directional views of risks and mitigants in a qualitative way. Please see the "Other Considerations" section.

Discussion of the Scorecard Factors

In this section, we explain our general approach for scoring each scorecard factor or sub-factor, and we describe why they are meaningful as credit indicators.

To arrive at a scorecard-indicated outcome, we begin by assigning a score for each weighted sub-factor. Based on the scores and weights for each sub-factor, a preliminary scorecard-indicated outcome before notching factors is produced.

We also assess the notching factors. Our assessment of these notching factors may result in upward or downward adjustments to the preliminary outcome that results from the weighted scorecard factors. The most common notching factors related to each of the weighted scorecard factors are discussed below. In some circumstances, there may be notching for a credit event or trend that is not captured by the weighted scorecard sub-factors or the listed notching factors. We may also choose to make adjustments to the historical inputs to reflect our forward-looking views of how these statistics may change.

Below, we discuss each factor and subfactor, as well as the notching factors that we consider within each category of this methodology.

Factor: System Characteristics (30%)

EXHIBIT 2

System Characteristics (30%)		Aaa	Aa	A	Baa	Ba	B and Below
Asset Condition (10%)	Net Fixed Assets/Annual Depreciation :	> 75 years	75 years ≥ n > 25 years	25 years ≥ n > 12 years	12 years ≥ n > 9 years	9 Years ≥ n > 6 Years	≤ 6 Years
System Size (7.5%)	Water and/or sewer / Solid Waste:	O&M > $65M	$65M ≥ O&M > $30M	$30M ≥ O&M > $10M	$10M ≥ O&M > $3M	$3M ≥ O&M > $1M	O&M ≤ $1M
	Stormwater:	O&M > $30M	$30M ≥ O&M > $15M	$15M ≥ O&M > $8M	$8M ≥ O&M > $2M	$2M ≥ O&M > $750K	O&M ≤ $750K
	Gas or Electric:	O&M > $100M	$100M ≥ O&M > $50M	$50M ≥ O&M > $20M	$20M ≥ O&M > $8M	$8M ≥ O&M > $3M	O&M ≤ $3M
Service Area Wealth (12.5%)		> 150% of US median	150% ≥ US median > 90%	90% ≥ US median > 75%	75% ≥ US median > 50%	50% ≥ US median > 40%	≤ 40% of US median

Source: Moody's Investors Service

Why It Matters

This factor on the scorecard assesses a utility's capacity to fund its operations and capital needs based on the health of its capital assets, the size and diversity of its operations, and the strength and resources of its service base.

The scope of this factor is broad. Each of the sub-factors contributes to an analysis of what magnitude of expenditures is necessary to keep the system functioning, and how large, diverse, and flexible the available resources are to meet those expenditures.

Sub-factor: Asset Condition (10%)

Input: Net fixed assets divided by most recent year's depreciation, expressed in years

The condition of a utility's capital assets determines its ability to comply with environmental regulations and continue delivering adequate service with existing resources.

Depreciation is an accounting concept that acts as a proxy for the rate at which a utility's plant and equipment are aging. Central to our analysis of capital adequacy is an assessment of how utilities "fund depreciation," meaning make capital replacements and repairs to address aging plant and equipment.

The consequences of failing to fund depreciation can be costly. Implicit in this measure is the concept of deferred capital investment. Utilities that delay investing in their systems, replacing aging plant and equipment, and modernizing their facilities often find it more expensive to do so later. Capital investments are ordinarily more expensive when deferred.

Further, systems whose facilities deteriorate often run afoul of environmental regulations. The failure to fund depreciation, which will manifest as a declining useful remaining life, can lead to sewage overflows, inflow and infiltration problems, or non-compliant wastewater discharges, resulting in civil fines, litigation, or regulatory consent decrees. These are usually more expensive than funding

depreciation through a prudent multi-year capital plan that replaces assets as they deteriorate or break down.

The inherent differences between types of utilities are manifested in their component parts, which can have very different useful lives. Because a solid waste utility is largely automotive-based, with collection vehicles and earth-moving equipment at the landfill, the useful life of its assets will be well under 20 years, compared to a water utility whose distribution mains and reservoir have useful lives of 40 to 100 years. We generally acknowledge these differences, which may be reflected in our scoring of notching factors.

For utilities whose asset condition ratios are not determinable, such as utilities that utilize cash accounting and do not report net fixed assets or depreciation, we are likely to assess the sufficiency of capital assets based on other available information.

Sub-factor: Service Area Wealth (12.5%)

Input: Median family income of the service area, expressed as a percentage of the US median

Most of the costs of operating a utility and maintaining its capital assets are borne by ratepayers. The income of the residents of the service base conveys the capacity of its rate-payers to bear higher rates to fund operations and capital upgrades.

Utilities that serve lower-income ratepayers may have more difficulty implementing higher rates, if utility costs consume a considerable share of residents' budgets. The US Environmental Protection Agency (EPA) considers wastewater costs exceeding 2% of median household income to be a heavy burden, for example, a threshold that would be reached more quickly for a utility serving lower-income ratepayers.

We believe MFI is the best proxy for the wealth of a service base, but other indicators such as the poverty rate, unemployment, home foreclosures, per capita income, and median home value supplement our analysis of ratepayer capacity.

Sub-factor: System Size (7.5%)

Input: Most recent year operations and maintenance expenditures, expressed in dollars

Larger systems tend to be more diverse and enjoy economies of scale. The size of a system implies the flexibility and resilience not only of its operations, but also of its service base.

Small systems present a number of risks. They are less likely to have redundancies, which allow a system to shut down some of its operations in an emergency or to make repairs without interrupting service. Small standalone water or sewer systems will typically depend upon a single supply of water or a single sewage treatment plant. They are more likely to be exposed to a concentrated customer base. They are more susceptible to the departure of a single large customer. An unexpected capital need is likely to be more costly relative to its annual budget. The collective engineering and scientific expertise is likely to be less robust than a larger system's.

We use different breakpoints for different types of systems in this subfactor, recognizing that not all types of utilities have the same cost structure. For instance, an electric distribution system is more expensive to run than a stormwater system. A distribution-only water system is likely to have a lower,

more predictable cost base, but also depend on an external system for water supply and pay prices largely out of its control.

Utilities that are wholesalers to municipal government customers may exhibit operating stability not captured by size or service area wealth. Many of a utility's risks may be shifted to its municipal customers if their service contracts prevent these customers from switching providers or decreasing payments. If service contracts are so strongly worded and unconditional that municipal customers would have to pay the utility's debt service under any circumstances, then the utility's bonds may effectively represent a claim on the combined credit quality of the municipal governments.

For utilities that are exclusively wholesalers to municipal customers, we typically consider the credit quality of large customers ("participants") and the nature of the participants' pledge to the utility. For bonds secured by a utility's net revenue pledge, we incorporate the strength of the large municipal customers' credit quality as an important factor in the utility's revenue base. For utilities whose pledges are essentially a pass-through of the municipal customers' underlying pledges, we may rate their bonds using our public sector pool programs and financings methodology, recognizing that bondholders enjoy a direct claim on the underlying municipalities' ability and willingness to pay. [6]

Notching Factors Related to System Characteristics

Additional service area economic strength or diversity: We would use this adjustment, upward or downward, if the MFI statistic incompletely or inaccurately depicts that capacity of the service base to bear higher rates.

Significant customer concentration: A large exposure to a single user or industry, or a small number of users, poses substantial risks that might not be captured in MFI. We may notch down if a large share of a utility's revenues comes from one or a small number of customers, or from a single industry. We would be more likely to use this adjustment for volatile, unpredictable, and mobile industries than for longer-standing, more stable ones. We are less likely to consider a wholesale customer as a factor contributing to concentration, as it is purchasing on behalf of end-users.

Revenue per customer greatly over/under regional average: Revenue per customer conveys additional information about users' capacity for higher rates that might not be captured in MFI. We might notch upward or downward if revenue per customer implies higher or lower ability to increase rates than MFI suggests.

Exposure to weather volatility, extreme conditions or market fluctuations: Large amounts of rain that infiltrate pipes or storms that destroy equipment are examples of credit risks that could result in downward notching. Weather can also affect the prices that distribution systems pay third-party providers for electricity or natural gas.

Resource vulnerability: Water, gas, and electric distribution utilities sell a product whose availability can be limited or expensive in some cases. For instance, a water provider in a drought-stricken region may have to purchase expensive third-party water, resulting in declines in billable flow due to conservation efforts. We may notch down if the availability of water, an adequate gas supply, or a dependable source of electricity is vulnerable or in doubt.

Sizeable or insufficient capacity margin: Our useful remaining life calculation is designed to assess the quality of existing capital assets, but it does not measure the adequacy of a system's capacity relative

[6] A link to an index of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

to demand. Areas that are growing need more water, gas, and electricity, and place greater demands on wastewater and trash disposal utilities. Systems that are close to capacity may face greater capital costs to expand in the future, suggesting larger debt burdens and posing additional risks that may result in downward notching. Alternately, systems with ample capacity may be notched up, given the lack of capital spending requirements implied by the excess capacity. Further, excess capacity can sometimes imply a revenue-generating opportunity, since utilities can often sell their product or service to other parties. We are less likely to view excess capacity as a positive if it is caused by a declining user base.

Unusual depreciation practices relative to industry norms: Utilities typically have some flexibility to determine the depreciation schedules of their assets. Utilizing unreasonably long useful lives or employing other practices that distort depreciation schedules would also distort our remaining useful life calculation. We may notch down if an unreasonable depreciation schedule is inflating a utility's remaining useful life. Likewise, we may notch up if an unusually rapid depreciation schedule understates remaining useful life.

Factor: Financial Strength (40%)

EXHIBIT 3

Financial Strength (40%)	Aaa	Aa	A	Baa	Ba	B and Below
Annual Debt Service Coverage (15%)	> 2.00x	2.00x ≥ n > 1.70x	1.70x ≥ n > 1.25x	1.25x ≥ n > 1.00x	1.00x ≥ n > 0.70x	≤ 0.70x
Days Cash on Hand (15%)	> 250 Days	250 Days ≥ n > 150 Days	150 Days ≥ n > 35 Days	35 Days ≥ n > 15 Days	15 Days ≥ n > 7 Days	≤ 7 Days
Debt to Operating Revenues (10%)	< 2.00x	2.00x < n ≤ 4.00x	4.00x < n ≤ 7.00x	7.00x < n ≤ 8.00x	8.00x < n ≤ 9.00x	≥ 9.00x

Source: Moody's Investors Service

Why It Matters

The financial health of a utility determines its flexibility to respond to contingencies, resilience against potential short-term shocks, and cushion against a long-term unfavorable trend.

We measure or estimate utilities' financial health by looking at cash and other liquid reserves, the burden that debt places on operations, and the magnitude by which revenues are sufficient to meet expenditures.

Sub-factor: Annual Debt Service Coverage (15%)

Input: Most recent year's net revenues divided by most recent year's debt service, expressed as a multiple

Debt service coverage is a core statistic assessing the financial health of a utility revenue system. The magnitude by which net revenues are sufficient to cover debt service shows a utility's margin to tolerate business risks or declines in demand while still assuring repayment of debt. Higher coverage levels indicate greater flexibility to withstand volatile revenues, unexpected outflows, or customer resistance to higher rates.

Utilities usually enter into a rate covenant under which they pledge to achieve a given level of debt service coverage each year. The covenant helps ensure that the utility utilizes its assets to generate sufficient income to pay bondholders.

The analysis of a utility system's debt service coverage demands ample context. If debt service escalates in future years, then the utility's current net revenues may be sufficient to cover debt service this year, but not in the future. Systems with greater revenue stability can operate comfortably at lower coverage levels. Systems with greater capital needs are likely to incur more debt, which will lead to increased debt service and decreased coverage. The debt service coverage calculation is the basis for a comprehensive analysis of a utility's financial flexibility and trend over the long term.

Rate covenants define a calculation method. These calculation methods vary, for example in the inclusion or exclusion of connection fees. Our coverage calculation will frequently differ from the coverage utilities report for purposes of complying with their rate covenants. Frequently, our analysis will consider several types of coverage, including maximum annual debt service (MADS) coverage, annual debt service coverage, coverage with and without connection fees, and coverage as calculated for the rate covenant. For entry on the scorecard, we include connection fees (when pledged) in revenues, recognizing that these are pledged revenues that are usually generated annually and are an important source of funding for expansion. If connection fees are particularly volatile, or if they represent an inordinate share of revenues, we may adjust below the line.

Sub-factor: Days Cash on Hand (15%)

Input: Unrestricted cash and liquid investments times 365 divided by operating and maintenance expenses, expressed in days

Cash is the paramount resource utilities have to meet expenses, cope with emergencies, and navigate business interruptions. Utilities with a lot of cash and cash equivalents are able to survive temporary disruptions and cash flow shortfalls without missing important payments. A large cash balance can also partially compensate for the lack of a debt service reserve fund. A low cash balance indicates poor flexibility to manage contingencies.

We include in this measure any cash or cash-equivalent that is both unrestricted and liquid. The measure does not include cash held in a debt service reserve fund, unspent bond proceeds, or cash that is restricted for capital.

Sub-factor: Debt to Operating Revenues (10%)

Input: Net debt divided by most recent year's operating revenues, expressed as a multiple

A utility's debt profile determines its leverage and fixed costs. Systems that carry a lot of debt have less ability to reduce costs if demand shrinks, and are generally more challenged to achieve higher debt service coverage.

A greater debt burden may also prohibit a utility from funding necessary capital upgrades, if a covenant prevents the issuer from incurring the debt necessary to fund those upgrades.

"Net debt" is a utility's long-term debt minus its debt service reserve funds.

Notching Factors Related to Financial Strength

Debt service coverage (annual or MADS) below key thresholds: A debt service coverage ratio below 1 times is an important threshold, because coverage below 1 times indicates the utility is not fully covering debt service with income generated from operations. If a utility fails to achieve 1 times coverage, we may notch down to reflect the financial imbalance of the utility's operations. Another key

threshold that would likely prompt us to notch down is if coverage were to fall below the utility's coverage covenant, even if that covenant is higher than 1 times. Management's willingness and ability to operate the system for bondholders' benefit is a crucial credit consideration, and a breach of covenant calls that willingness and ability into question. A coverage level that impedes the issuance of additional bonds under the utility's additional bonds covenant could also prompt us to notch score down, if we think it would prevent the utility from funding necessary capital upgrades.

Constrained liquidity position due to oversized transfers: It is common for utilities to transfer cash to their general governments regularly, either to share overhead costs, make payments in lieu of taxes for occupied property, or to help fund shared infrastructure. It is also common for parent governments to tap utilities' cash to fund General Fund operations. We may notch down if these types of transfers are large and begin to strain its own liquidity. We are more likely to make this adjustment if the general government is operationally reliant on utility transfers and has the authority to increase them, particularly if the general government is struggling financially. Even if a utility has never transferred cash to its parent, such transfers remain a possibility,[7] one of the reasons for the relationship between a revenue rating and the GO rating of its general government.

Outsized capital needs: A utility with significant capital needs will likely need to incur additional debt not communicated in the existing debt metric. We may notch downward for utilities under regulatory consent decree, or otherwise with great capital needs, that are likely to increase their debt levels.

Oversized adjusted net pension liability relative to debt, or significant actuarial required contribution underpayment: Employees of public utilities are usually members of a municipal pension plan. Most utilities either sponsor their own plan or participate in another entity's plan and are responsible for funding their share of the plan's pension liabilities. We may notch down if this liability is especially large, or if the utility has underfunded its contributions.[8]

Significant exposure to puttable debt and/or swaps, or other unusual debt structure: The risks of a debt portfolio can be magnified if it is significantly composed of puttable debt. Utilities generally set rates with the intention of covering operating expenses and debt service in the current year. A debt put, accelerated amortization under a term-out, or other unexpected calls on a utility's resources can impose immediate and substantial, unbudgeted cash outflows and upend that intention. We may notch down, potentially by several notches, if the composition of a debt portfolio, or cash-flow demands or unfavorable valuation of a swap, indicates a greater degree of risk than the scorecard debt metric.

[7] Unless the utility's flow of funds is closed-loop. A closed-loop flow of funds is stronger than an open one for this reason.

[8] For a description of how we calculate or estimate adjusted net pension liability, please see our cross-sector methodology that describes our adjustments to pension data reported by Governmental Accounting Standards Board (GASB) issuers.

Factor: Management (20%)

EXHIBIT 4

Management (20%)	Aaa	Aa	A	Baa	Ba	B and Below
Rate Management (10%)	Excellent rate-setting record; no material political, practical, or regulatory limits on rate increases	Strong rate-setting record; little political, practical, or regulatory limits on rate increases	Average rate-setting record; some political, practical, or regulatory limits on rate increases	Adequate rate-setting record; political, practical, or regulatory impediments place material limits on rate increases	Below average rate-setting record; political, practical, or regulatory impediments place substantial limits on rate increases	Record of insufficiently adjusting rates; political, practical, or regulatory obstacles prevent implementation of necessary rate increases
Regulatory Compliance and Capital planning (10%)	Fully compliant OR proactively addressing compliance issues; Maintains sophisticated and manageable Capital Improvement Plan that addresses more than a 10-year period	Actively addressing minor compliance issues; Maintains comprehensive and manageable 10-year Capital Improvement Plan	Moderate violations with adopted plan to address issues; Maintains manageable 5-year Capital Improvement Plan	Significant compliance violations with limited solutions adopted; Maintains single year Capital Improvement Plan	Not fully addressing compliance issues; Limited or weak capital planning	Not addressing compliance issues; No capital planning

Source: Moody's Investors Service

Why It Matters

While the legal provisions of the indenture or other bond documents may establish the minimum level of financial margin at which a utility must be run, the utility's management determines the actual level at which it is run.

Utility management refers to the dynamics of setting rates, planning for capital spending, budgeting for annual expenditures, and complying with environmental regulations. All of these factors interplay with one another to determine the credit strength of a utility system.

The scorecard captures two crucial aspects of management: rate-setting and capital planning. These two aspects encompass most of what is important in running a utility: keeping the system in good working order, and paying for it.

Sub-factor: Rate Management (10%)

User rates are the primary, and sometimes only, mechanism utilities employ to pay for their operations.

Ideally, rates increase marginally and steadily, rather than choppily. It is common for utilities to split their rates into a "base" charge (flat rate charged to all users) plus a "volumetric" charge (per unit costs based on flow/usage). Utilities funded to a greater extent by the volumetric charge face greater risks, since volume can be economically sensitive or decline because of a shift in consumption patterns.

Management's track record at setting rates appropriately and increasing them when necessary drives this score. We tend to give higher scores to utilities that set rate structures under which increases are automatic, and do not require annual approval for implementation.

Embedded into this factor is the length of time required to implement a rate increase. Many public utilities enjoy the authority to set their own rates and can enact a rate increase in short order by majority vote of the governing board. Some utilities must give the public a few weeks' or months' notice before increasing rates, or choose to do so by policy or practice. Some utilities require state approval to increase rates. Utilities that need state approval often have to file a rate case subject to public objection, and in some cases the state takes a long time to approve them or denies the full rate increase.

The longer it takes a utility to implement a rate increase, the less flexibility it has to quickly generate new revenues when faced with cash flow shortfalls.

Sub-factor: Regulatory Compliance and Capital Planning (10%)

The public utility sector is heavily regulated. Most public utilities are regulated by federal as well as state agencies.

The EPA enforces the Safe Drinking Water Act for water distribution utilities, the Clean Water Act for sanitary sewer and stormwater utilities, the Resource Conservation and Recovery Act for solid waste disposal systems, and the Clean Air Act for electric utilities. These statutes, and the methods employed to enforce them, are continually evolving, often intensifying over time. Additionally, many states have passed their own environmental regulations and are active enforcers.

This scorecard factor assesses utilities' compliance with relevant regulations and their plans for the capital expenditures required to comply in the future.

In addition to achieving environmental compliance, proper capital planning ensures the continued delivery of the product or service and the ongoing generation of revenues.

In our assessment, we look for indications of potential compliance gaps, such as environmental litigation, a delay in renewing a permit, or a consent decree with a state or federal enforcement body.

Notching Factors Related to Management

Unusually strong or weak capital planning: Continued violations of environmental laws and the associated litigation can impose extraordinary costs on utilities. We may notch down if these costs threaten to overwhelm a system's resources, in the form of a large consent decree, lawsuit, or other costs. Alternately, we may notch up if a utility's capital planning is particularly sophisticated or forward-looking. More sophisticated and forward-looking capital management is more important for systems facing resource vulnerability or extreme weather volatility.

Factor: Legal Provisions (10%)

EXHIBIT 5

Legal Provisions (10%)	Aaa	Aa	A	Baa	Ba	B and Below
Rate Covenant (5%)	> 1.30x	1.30x ≥ n > 1.20x	1.20x ≥ n > 1.10x	1.10x ≥ n > 1.00x	≤ 1.00x	
Debt Service Reserve Requirement (5%)	DSRF funded at MADS	DSRF funded at lesser of standard 3-prong test	DSRF funded at less than 3-prong test OR springing DSRF	NO explicit DSRF; OR funded with speculative grade surety		

Source: Moody's Investors Service

Why It Matters

The legal provisions of a public utility revenue bond form the backbone of its security.

When a municipality assigns its General Obligation pledge to a bond, it has promised to use any revenues or resources at its disposal to pay debt service.

A utility revenue bond enjoys no such open-ended pledge, making the legal edifice of the bond critical to bondholder security. Most commonly, the pledge for municipal utility revenue bonds is a lien on the net revenues of the system. Occasionally, bondholders enjoy a lien on the gross revenues of a system. We ordinarily do not consider a gross revenue pledge as materially stronger than a net revenue pledge, because systems need to pay operating and maintenance costs in order to remain functional.

The linchpin of a bond's legal structure is its covenants: the contractual compulsions the municipal utility agrees to when issuing the bonds.

Utilities abide by many different types of covenants. We consider three to be the most important: the rate covenant, the additional bonds test, and the debt service reserve fund. Also crucial in the analysis of a revenue bond's legal structure is whether the flow of funds is open-loop (accessible by another government entity) or closed-loop.

Strong covenants bind the utility to utilize its assets to benefit bondholders by operating with a comfortable financial margin, not taking on too much debt, and maintaining adequate cash available to pay debt service. Weak or nonexistent covenants allow the utility to operate on a thin margin or even at a net loss, incur a lot of leverage, transfer its money to other government entities, or maintain inadequate cash, in ways that are detrimental to bondholders.

Covenants specify the minimum factors management must contractually abide by. Utilities frequently exceed the minimum. Many of our ratings represent the expectation of performance at levels that exceed the covenants.

Sub-factor: Rate Covenant (5%)

Input: Covenant governing net revenues (operating revenues minus operating expenditures net of depreciation) divided by annual debt service, expressed as a multiple

The rate covenant is a pledge to set rates such that net revenues will be sufficient to cover debt service at a prescribed level. For example, a covenant may bind a utility to ensure that net revenues cover debt

service by 1.2 times. If net revenues fall short of this covenant in one year, the utility must raise rates to achieve a compliant coverage level the following year.

The rate covenant takes many forms. Some utilities pledge for net revenues to cover current year annual debt service by a given level. Others pledge to cover average annual debt service throughout the life of the bonds at that level. A strong coverage requirement would be for net revenues to cover maximum annual debt service (MADS) by a certain level.

Some rate covenant formats are materially weaker than this. Some utilities allow a "rolling" calculation, which includes outstanding cash from prior years' surpluses as part of the resources available to cover debt service. Many rate covenants allow connection fees to be included in available operating revenues.

The rate covenant coverage thresholds are based on a covenant that is an annual debt service coverage calculation. Using the notching factors described below, we may adjust, upward or downward, for any departures from this format.

Sub-factor: Debt Service Reserve Requirement (5%)

Input: Debt service reserve requirement

Many issuers agree to hold a specified amount of cash or other resources in a debt service reserve fund (DSRF), which the trustee can tap to pay debt service in the event that net revenues are inadequate. The DSRF covenant ordinarily requires the utility to replenish any draws from the DSRF.

The DSRF protects bondholders by assuring the payment of debt service even if net revenues fall short in one year.

DSRF funds can be funded with cash, or with surety policies from an insurer. We generally consider cash to be superior to a surety, although this is unlikely to materially affect the assigned rating as long as the surety provider is rated investment grade.

One commonly used DSRF requirement is known as the "three-pronged test." Under tax law, the Internal Revenue Service limits the earning of interest on proceeds of a tax-exempt bond unless the invested proceeds comply with the three-pronged test. Under that test, the DSRF must be the lesser of 10% of principal, MADS, or 1.25 times average annual debt service. A DSRF set at the three-pronged test is usually weaker than one funded at MADS.

Revenue bonds have been issued without a DSRF in the past. This has resulted in a number of utilities with some bonds secured by a DSRF and other parity bonds secured by the same lien but no DSRF. We have rarely distinguished ratings between these parity bonds. The DSRF is a last-resort security measure, and most utilities comply with their coverage covenants and never have to tap their DSRF. We are most likely to distinguish between DSRF-secured bonds and bonds with no DSRF if the system holds narrow liquidity. A system operating with abundant liquidity can use its operating cash to meet debt service shortfalls, effectively executing a similar function to the DSRF. The combination of narrow liquidity and no DSRF exposes bondholders to greater risks of interrupted debt service payments and is therefore more likely to be reflected in ratings.

For a utility whose debt is mostly, but not all, secured by a DSRF, we will still enter the DSRF requirement into the scorecard. For a utility whose debt is mostly not secured by a DSRF, we will adjust the DSRF entry downward.[9]

Notching Factors Related to Legal Provisions

Coverage covenant other than annual debt service: The thresholds for the rate covenant sub-factor is based on net revenue coverage of annual debt service. A "rolling" coverage covenant that includes outstanding cash, or some other modification that weakens the meaning of the covenant, may prompt us to notch down. Conversely, a MADS coverage covenant may prompt us to notch up.

Structural enhancements/complexities: The scorecard is designed to capture covenants as they are most commonly constituted but cannot account for the myriad structures and complexities that arise in bond transactions throughout the sector. Enhancements such as a lock-box structure for debt service may lead us to notch up. Other shortcomings, such as a weak additional bonds test or the inclusion of cash in a coverage covenant, may lead us to notch down. Any characteristic of the legal provisions of a bond transaction may lead us to conclude that the scorecard does not adequately capture its risk profile, resulting notching or on a rating that is different from the scorecard-indicated outcome.

Other Considerations

Ratings may reflect consideration of additional factors that are not in the scorecard, usually because the factor's credit importance varies widely among the issuers in the sector or because the factor may be important only under certain circumstances or for a subset of issuers. Such factors include financial controls and the quality of financial reporting; the quality and experience of management; assessments of governance as well as environmental and social considerations; and possible interference from other levels of government. Regulatory, litigation, liquidity and technology risk as well as changes in demographic and macroeconomic trends also affect ratings.

Following are some examples of additional considerations that may be reflected in our ratings and that may cause ratings to be different from scorecard-indicated outcomes.

Environmental, Social and Governance Considerations

Environmental, social and governance (ESG) considerations may affect the ratings of municipal utilities. For information about our approach to assessing ESG issues, please see our methodology that describes our general principles for assessing these risks.[10]

Municipal utilities may be directly exposed to extreme weather events due to climate change, such as flooding or droughts, and this may affect credit quality. Government facilities or investments in physical assets could be affected by physical risks and by other sources of environmental risk. Utility systems providing service to coastal communities or communities that are greatly susceptible to drought are highly exposed to environmental risks. Environmental hazards, such as hurricanes, can result in significant system damage requiring unexpected capital spending for repairs, while longer-term environmental trends, such as rising sea levels or prolonged drought conditions, can cause more prolonged pressure on system budgeting and spending priorities.

[9] For example, if 1/3 of a utility's debt is secured by a DSRF funded at MADs and 2/3 is not secured by a DSRF at all, we may enter the DSRF requirement as a Baa.

[10] A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Social considerations such as staff turnover, aging workforce, labor shortages or unrest or changes in the demographics of a municipal utility's service area, the income level of its customers and the affordability of housing may influence credit strength.

Some governance considerations are reflected in the Rate Management and Regulatory Compliance and Capital Planning qualitative sub-factors, including revenue-raising flexibility and capital planning. Additional considerations may include debt management, multi-year fiscal planning and the timeliness of information disclosure. Weak or opaque governance can negatively affect a municipal utility's performance, which can reduce customer willingness to support rate increases and can also constrain a municipal utility's access to capital markets. Conversely, very strong governance can lead to high customer satisfaction that reduces public resistance to rate increases and capital investment.

ESG considerations are not always negative, and they can be a source of credit strength in some instances. For example, access to clean water, options for the safe disposal of wastewater, and a strong labor market and generally affordable housing can drive strong revenue trends and foster utility system growth. External support, such as state or federal government funds for natural disaster relief, can help mitigate the credit impact of ESG exposures.

Regulatory Considerations

Issuers in the municipal utility sector are subject to varying degrees of regulatory oversight. Effects of these regulations may entail limitations on operations, higher costs, and higher potential for technology disruptions and demand substitution. Regional differences in regulation, implementation or enforcement may advantage or disadvantage particular issuers.

Our view of future regulations plays an important role in our expectations of future financial metrics as well as our confidence level in the ability of an issuer to generate sufficient cash flows relative to its debt burden over the medium and longer term. Regulatory considerations also play a role in our assessment of an issuer's cost recovery framework, competitiveness and willingness to recover costs with sound financial metrics. In some circumstances, regulatory considerations may also be a rating factor outside the scorecard, for instance when regulatory change is swift.

Likelihood of Receiving Extraordinary or Ongoing Support

Some municipal utilities receive extraordinary support from their component local government or a higher level of government, such as the state, typically to help the municipal utility avoid a default on debt obligations. The circumstances surrounding extraordinary support for a municipal utility are often specific to the situation. In some cases, a state or local government may provide meaningful financial or managerial support to a municipal utility undergoing stress, thereby bolstering a weak fundamental credit profile and materially lowering the risk of a payment default. Conversely, a temporary infusion of funds may bolster financial performance in the short term but leave a municipal utility exposed to rapid financial deterioration if the aid does not continue. We typically assess whether the support will be ongoing and sufficient to stabilize the municipal utility. We also consider the associated benefits or risks of dependence on such support. Alternatively, many municipal utilities receive annual funding or low-interest loans from the federal, state or local government. This type of funding is often earmarked, and we do not consider it to be extraordinary support.

Parent Government Credit Quality

While some public utility systems are independent of a particular municipality,[11] municipally-owned utility systems typically have enduring credit linkages with their parent government. Important linkages often include a legal structure that could draw the utility system into a general government municipal bankruptcy, combined or intermingled financial operations, shared debt or pension obligations, and mutual or affiliated governance or management. Additional linkages that typically pertain to municipally-owned utility systems, including common boundaries, a common economic environment, and common demographics and income levels, may also apply to some independent utilities. As a result of these credit linkages, the credit quality of a municipally-owned utility's parent government and that government's ability to meet its general obligations are important considerations in the rating assigned to a municipally-owned utility.

Shared credit characteristics between a municipality and an owned utility often affect the metrics used to assess scorecard factors, including the notching factors. For example, a utility system's practice of transferring excess funds to its parent government is likely to be reflected in the assessment of its financial strength, especially in the Days Cash on Hand sub-factor. However, there can be credit linkages between a utility and its parent government that are not fully reflected in the scorecard. Based on these linkages, a municipally-owned utility's revenue rating is typically not higher than two notches above the issuer or general obligation rating of the parent government. Scenarios where a utility's revenue rating may exceed the issuer or general obligation rating of the parent government would be in cases where there is clear information indicating a de-linkage of credit profiles, for example in a distress scenario where it is clear that debt service will continue to be paid on the revenue debt despite a default or impending default of the municipality's general obligation debt. An additional potential example could be a case where a utility has a meaningfully larger service territory than the parent government's boundaries and benefits from a more robust economic environment than the parent.

Financial Controls

We rely on the accuracy of audited financial statements to assign and monitor ratings in this sector. The quality of financial statements may be influenced by internal controls, including the proper tone at the top, centralized oversight of operations, and consistency in accounting policies and procedures. Auditors' reports on the effectiveness of internal controls, auditors' comments in financial reports and unusual restatements of financial statements or delays in regulatory filings may indicate weaknesses in internal controls.

Additional Metrics

The metrics included in the scorecard are those that are generally most important in assigning ratings to issuers in this sector; however, we may use additional metrics to inform our analysis in specific cases. These additional metrics may be important to our forward view of metrics that are in the scorecard or other rating factors.

Event Risk

We also recognize the possibility that an unexpected event could cause a sudden and sharp decline in a municipal utility's fundamental creditworthiness, which may cause actual ratings to be lower than the scorecard-indicated outcome. Event risks — which are varied and can include natural disasters, sudden changes in state law or regulation, material litigation, pandemics or cybercrime events — can have a material credit impact on even a stable municipal utility.

[11] For example, we typically consider a stand-alone utility authority or special purpose district utility system that is not directly owned by a state or local government to be independent of a municipality.

Treatment of Different Liens on a US Municipal Utility's Net Revenues

It is common for utilities to issue debt secured by different liens on their net revenues. Senior bonds are secured by a first lien on net revenues, and subordinate bonds or loans secured by a subordinate, or junior, lien. Sometimes, utilities will issue debt secured by a third lien or lower.

Our practice is to evaluate the likelihood of default and the expected recovery in the event of default for each lien independently.

This will most commonly result in a rating distinction of one notch for each lien of subordination. In other words, if a municipal utility's senior lien is rated Aa3, its subordinate lien will most likely be rated A1 and the third lien will most likely be rated A2.

The reason for the typical one-notch-per-lien distinction is that subordinate liens are marginally more likely to default than senior liens, and subordinate liens' expected recovery in the event of default would be lower. Senior liens are typically afforded stronger legal protections under utilities' indentures, senior-lien debt service is usually paid earlier in the flow of funds, and the first lien would likely enjoy a better claim in bankruptcy.

For most investment grade municipal utilities, the probability of default for any lien is small, and so the notching distinction is driven primarily by a greater expected loss severity in the unlikely event of a default. This is comparable to our approach for ratings distinctions for different debt classes of investment grade corporations, where ratings distinctions are driven by differences in expected loss severities.[12] In contrast to corporates, however, there often is not an explicit cross-default of senior municipal debt in the event of a subordinate payment default.

In some instances, we may conclude that an investment grade municipal utility's subordinate lien has a default probability and expected loss severity that is nearly as low or just as low as the senior lien (in which case we may not make a ratings distinction), or a default probability and expected loss severity that is materially higher than the senior lien (in which case we may make a ratings distinction of more than one notch).

Such a conclusion would be based on the municipal utility's management of its system with respect to its liens, and the characteristics of the legal framework governing the liens: rate covenants, additional debt provisions, and cross-default and acceleration provisions in a senior lien's variable rate debt resulting from a default on the subordinate lien, for example. If a utility has only a very small amount of senior lien debt, we may choose not to distinguish between liens.

The distinctions among a municipal utility's liens become starker when it faces a material likelihood of default or bankruptcy. For these situations, the different characteristics of the liens are likely to drive greater disparities in default probabilities and expected recoveries for disparate liens. Thus, we are more likely to employ ratings distinctions other than one notch for speculative grade municipal utilities' different liens as the Loss Given Default approach drives more of the analysis.

In nearly all instances, the ratings on the different liens of the same utility will remain closely related. The reason for this is that municipal utilities are actively managed enterprises that continually need to generate net revenues sufficient not only to cover debt service but also to fund capital needs. Even if senior lien coverage is strong, a utility that is unable to pay its junior lien debt service is not generating excess funds for capital investment and does not have capacity for capital borrowing. Thus, while subordinate liens face greater default probability and higher loss expectations based on their first-loss positions, an increased likelihood of default on a subordinate lien implies an increased likelihood of insolvency for the utility as a whole.

For this reason, we enter the debt-oriented inputs into the scorecard on a consolidated basis. For the debt to revenues factor, we enter total debt (senior and junior). For the debt service coverage factor, we enter total debt service coverage. It is the municipal utility's ability to cover all of its debt service with net revenues that determines its viability as a going concern. Even for a senior lien with a large coverage factor by net revenues, a narrow coverage of all debt service implies pressure to maintain healthy operations and generate funds sufficient for capital reinvestment.

[12] For more information, see our cross-sector methodology that describes the alignment of corporate instrument ratings based on differences in security and priority of claim. A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Limitations

In the preceding sections, we have discussed the scorecard factors and many of the other considerations that may be important in assigning ratings. In this section, we discuss limitations that pertain to the scorecard and to the overall rating methodology.

» Limitations of the Scorecard

There are various reasons why scorecard-indicated outcomes may not map closely to actual ratings.

The scorecard in this rating methodology is a relatively simple tool focused on indicators for relative credit strength. Credit loss and recovery considerations, which are typically more important as an issuer gets closer to default, may not be fully captured in the scorecard. The scorecard is also limited by its upper and lower bounds, causing scorecard-indicated outcomes to be less likely to align with ratings for issuers at the upper and lower ends of the rating scale.

The weights for each factor and sub-factor in the scorecard represent an approximation of their importance for rating decisions across the sector, but the actual importance of a particular factor may vary substantially based on an individual issuer's circumstances.

Factors that are outside the scorecard, including those discussed above in the "Other Considerations" section, may be important for ratings, and their relative importance may also vary from issuer to issuer or from instrument to instrument. In addition, certain broad methodological considerations described in one or more cross-sector rating methodologies may be relevant to ratings in this sector.[13] Examples of such considerations include the following: how sovereign credit quality affects non-sovereign issuers, the assessment of credit support from other entities, and the assignment of short-term ratings.

We may use the scorecard over various historical or forward-looking time periods. Furthermore, in our ratings we often incorporate directional views of risks and mitigants in a qualitative way.

» General Limitations of the Methodology

This methodology document does not include an exhaustive description of all factors that we may consider in assigning ratings in this sector. Municipal utilities may face new risks or new combinations of risks, and they may develop new strategies to mitigate risk. We seek to incorporate all material credit considerations in ratings and to take the most forward-looking perspective that visibility into these risks and mitigants permits.

Ratings reflect our expectations for an issuer's future performance; however, as the forward horizon lengthens, uncertainty increases and the utility of precise estimates, as scorecard inputs or in other considerations, typically diminishes. Our forward-looking opinions are based on assumptions that may prove, in hindsight, to have been incorrect. Reasons for this could include unanticipated changes in any of the following: the macroeconomic environment, general financial market conditions, disruptive technology, or regulatory and legal actions. In any case, predicting the future is subject to substantial uncertainty.

[13] A link to a list of our sector and cross-sector methodologies can be found in the "Moody's Related Publications" section.

Appendix: US Municipal Utility Revenue Debt Scorecard

EXHIBIT 6

		Aaa	Aa	A	Baa	Ba	B and Below
Numerical score		0.5 to 1.5	1.5 to 2.5	2.5 to 3.5	3.5 to 4.5	4.5 to 5.5	5.5 to 6.5
System Characteristics (30%)							
Asset Condition (10%)	Net Fixed Assets/Annual Depreciation:	> 75 years	75 years ≥ n > 25 years	25 years ≥ n > 12 years	12 years ≥ n > 9 years	9 Years ≥ n > 6 Years	≤ 6 Years
System Size (7.5%)	Water and/or Sewer/ Solid Waste:	O&M > $65M	$65M ≥ O&M > $30M	$30M ≥ O&M > $10M	$10M ≥ O&M > $3M	$3M ≥ O&M > $1M	O&M ≤ $1M
	Stormwater:	O&M > $30M	$30M ≥ O&M > $15M	$15M ≥ O&M > $8M	$8M ≥ O&M > $2M	$2M ≥ O&M > $750K	O&M ≤ $750K
	Gas or Electric:	O&M > $100M	$100M ≥ O&M > $50M	$50M ≥ O&M > $20M	$20M ≥ O&M > $8M	$8M ≥ O&M > $3M	O&M ≤ $3M
Service Area Wealth (12.5%)		> 150% of US median	150% ≥ US median > 90%	90% ≥ US median > 75%	75% ≥ US median > 50%	50% ≥ US median > 40%	≤ 40% of US median
Financial Strength (40%)							
Annual Debt Service Coverage (15%)		> 2.00x	2.00x ≥ n > 1.70x	1.70x ≥ n > 1.25x	1.25x ≥ n > 1.00x	1.00x ≥ n > 0.70x	≤ 0.70x
Days Cash on Hand (15%)		> 250 Days	250 Days ≥ n > 150 Days	150 Days ≥ n > 35 Days	35 Days ≥ n > 15 Days	15 Days ≥ n > 7 Days	≤ 7 Days
Debt to Operating Revenues (10%)		< 2.00x	2.00x < n ≤ 4.00x	4.00x < n ≤ 7.00x	7.00x < n ≤ 8.00x	8.00x < n ≤ 9.00x	≥ 9.00x
Management (20%)							
Rate Management (10%)		Excellent rate-setting record; no material political, practical, or regulatory limits on rate increases	Strong rate-setting record; little political, practical, or regulatory limits on rate increases	Average rate-setting record; some political, practical, or regulatory limits on rate increases	Adequate rate-setting record; political, practical, or regulatory impediments place material limits on rate increases	Below average rate-setting record; political, practical, or regulatory impediments place substantial limits on rate increases	Record of insufficiently adjusting rates; political, practical, or regulatory obstacles prevent implementation of necessary rate increases
Regulatory Compliance and Capital Planning (10%)		Fully compliant OR proactively addressing compliance issues; Maintains sophisticated and manageable Capital Improvement Plan that addresses more than a 10-year period	Actively addressing minor compliance issues; Maintains comprehensive and manageable 10-year Capital Improvement Plan	Moderate violations with adopted plan to address issues; Maintains manageable 5-year Capital Improvement Plan	Significant compliance violations with limited solutions adopted; Maintains single year Capital Improvement Plan	Not fully addressing compliance issues; Limited or weak capital planning	Not addressing compliance issues; No capital planning
Legal Provisions (10%)							
Rate Covenant (5%)		> 1.30x	1.30x ≥ n > 1.20x	1.20x ≥ n > 1.10x	1.10x ≥ n > 1.00x	≤ 1.00x[14]	
Debt Service Reserve Requirement (5%)		DSRF funded at MADS	DSRF funded at lesser of standard 3-prong test	DSRF funded at less than 3-prong test OR springing DSRF	NO explicit DSRF; OR funded with speculative grade surety[15]		

Source: Moody's Investors Service

[14] Scores as a Ba.

[15] Scores as a Baa.

Adjustments/Notching Factors
Factor: System Characteristics
Additional service area economic strength or diversity
Significant customer concentration
Revenue-per-Customer greatly over/under regional average
Exposure to weather volatility, extreme conditions or market fluctuations
Resource vulnerability
Sizable or insufficient capacity margin
Unusual depreciation practices relative to industry norms
Other analyst adjustment to System Characteristics (Specify)
Factor: Financial Strength
Debt Service Coverage (Annual or MADS) below key thresholds
Constrained liquidity position due to oversized transfers
Outsized capital needs
Oversized adjusted net pension liability relative to debt, or significant under-payment of actuarial funding requirement
Significant exposure to puttable debt and/or swaps or other unusual debt structure
Other analyst adjustment to Financial Strength factor (Specify)
Factor: Management
Unusually strong or weak capital planning
Other analyst adjustment to Management factor (Specify)
Factor: Legal Provisions
Coverage covenant other than annual debt service
Structural Enhancements/Complexities
Other analyst adjustment to Legal Provisions factor (Specify)
Other
Credit Event/Trend not yet reflected in existing data set

Source: Moody's Investors Service

EXHIBIT 7

Scorecard-Indicated Outcome

Scorecard-Indicated Outcome	Aggregate Numeric Score
Aaa	0.5 to 1.5
Aa1	1.5 to 1.83
Aa2	1.83 to 2.17
Aa3	2.17 to 2.5
A1	2.5 to 2.83
A2	2.83 to 3.17
A3	3.17 to 3.5
Baa1	3.5 to 3.83
Baa2	3.83 to 4.17
Baa3	4.17 to 4.5
Ba1	4.5 to 4.83
Ba2	4.83 to 5.17
Ba3	5.17 to 5.5
B1	5.5 to 5.83
B2	5.83 to 6.17
B3 and below	6.17 to 6.5

Source: Moody's Investors Service

Moody's Related Publications

Credit ratings are primarily determined through the application of sector credit rating methodologies. Certain broad methodological considerations (described in one or more cross-sector rating methodologies) may also be relevant to the determination of credit ratings of issuers and instruments. A list of sector and cross-sector credit rating methodologies can be found here.

For data summarizing the historical robustness and predictive power of credit ratings, please click here.

For further information, please refer to *Rating Symbols and Definitions*, which is available here.

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