NEW YORK'S ROADMAP FOR REDUCING GREENHOUSE GASES IN THE TRANSPORTATION SECTOR

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Many states are taking steps to address concerns relating to climate change and clean or renewable energy. New York, for example, generated more than twenty-nine billion metric tons of energy-related carbon dioxide in 2007 alone, more than one-third of which came from its transportation sector. New York commissioned a series of studies to explore the likely positive and negative impacts associated with development of a biofuels industry, the most recent, the Roadmap, came out in April 2010.

This Article provides a general overview of the main issues associated with the process and development underlying the Roadmap, as well as an analysis of the contents of the report. After discussing some of the Roadmap's underpinnings and major findings, this Article carefully discusses how the findings of the report should be interpreted, particularly given some of the necessary assumptions and uncertainties underlying its analysis. After conducting a thoughtful analysis of a "broad but realistic" examination of major issues and their interactions, the Article offers an insightful conclusion: although the Roadmap does not—and, perhaps, cannot—prescribe any particular course of action regarding whether New York should actively promote an expanded biofuels industry, the Roadmap nevertheless provides policymakers with a detailed examination of the major issues associated with such an expansion.

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I. INTRODUCTION

The challenge of developing a strong, independent, and clean energy sector in the United States is one of the most critical issues of our time. This is due primarily to the impact of energy on other societal concerns, such as the environment, national security, and jobs. Regarding climate change, for example, energy-related carbon dioxide (CO_2) emissions totaled 29,914 million metric tons in 2007, and in 2008, thirty-four percent of CO_2 emissions were from the transportation sector.[1] A host of climate change bills containing provisions designed to strengthen investment in renewables and energy efficiency and regulate greenhouse gas (GHG) emissions from the energy sector have been introduced in the House of Representatives and in the U.S. Senate.[2] Regarding liquid fuel, the Energy Independence and Security Act of 2007 (EISA) substantially increased the amount of biofuels that must be blended with transportation fuel in order to reduce GHG emissions and to pursue energy independence objectives.[3] The American Recovery and Reinvestment Act of 2009 (ARRA)[4] "will create a new generation of jobs, reduce dependence on oil and enhance national security" by making substantial investments in clean energy sources.[5] Among other things, ARRA provides for "investments in renewable generation and advanced energy manufacturing of $23 billion[,which] will likely create 253,000 jobs and leverage over $43 billion in additional investment that could support up to 469,000 more jobs," and "[o]ver $600 million in . . . grants . . . along with Federal loan guarantees, [which] will support 19 pilot, demonstration, and commercial-scale bio-refineries."[6]

In addition to action taking place at the federal level, many states have demonstrated initiative in working toward the achievement of climate change and clean energy goals. New York State, for example—where the transportation sector accounted for almost thirty-seven percent of total CO_2 emissions in 2007, the largest percentage compared to any other sector[7]—embarked on a process to develop the *Renewable Fuels Roadmap and Sustainable Biomass Feedstock Supply for New York* (Roadmap).[8] This comprehensive evaluation, which resulted in the is-

1. *U.S. Energy Facts Explained: Data & Statistics*, U.S. ENERGY INFO. ADMIN., http://tonto.eia.doe.gov/energyexplained/index.cfm?page=us_energy_home#tab3 (last updated Sept. 9, 2010).

2. *See infra* notes 3–4 and accompanying text.

3. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 202, 121 Stat. 1492, 1521–28 (codified at 42 U.S.C. § 7545(o)(2) (Supp. II 2009)).

4. American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 15.

5. Memorandum from Vice President Joseph Biden to President Barack Obama 1 (Dec. 15, 2009), http://www.whitehouse.gov/sites/default/files/administrationofficial/vice_president_memo_on_clean_energy_economy.pdf.

6. *Id.* at 2, 3.

7. *See State CO_2 Emissions*, U.S. ENERGY INFO. ADMIN. (Feb. 4, 2010), http://www.eia.doe.gov/oiaf/1605/state/state_emissions.html (follow "New York" xls link).

8. *See* N.Y. STATE ENERGY RESEARCH & DEV. AUTH., RENEWABLE FUELS ROADMAP AND SUSTAINABLE BIOMASS FEEDSTOCK SUPPLY FOR NEW YORK (2010) [hereinafter ROADMAP], *availa-*

suance of the Roadmap in April 2010, explores the likely positive and negative impacts associated with development of a biofuels industry in New York, within a given set of predetermined conditions. It should be noted that the study is not intended to recommend any particular course of action over another, but rather to provide "relevant data, expert opinion and the best available information to date in order to provide information that will assist State policymakers" as they consider the possibility of developing a biofuels industry in New York.[9]

This Article provides a general overview of the main issues associated with the Roadmap process and development of the Roadmap. After discussing the policy context surrounding the decision to commission the Roadmap, we describe the history of its development. Next, we explore the contents of the Roadmap, focusing on its assumptions and major findings. Finally, we take a critical look at how the findings of the Roadmap should be interpreted given the necessary assumptions and uncertainties that had to be addressed. The Article concludes with policy suggestions designed to stimulate the development of a successful biofuels industry in New York.

II. NEW YORK STATE POLICY CONTEXT

A. Renewable Energy Task Force

The Roadmap has its origins in the work of the Renewable Energy Task Force (Task Force), created in 2007 by then-Governor Elliot Spitzer. Its 2008 report, *Clean, Secure Energy and Economic Growth: A Commitment to Renewable Energy and Enhanced Energy Independence*, describes the Task Force membership and responsibilities in the following manner:

> Compris[ing] . . . 20 members, this distinguished group of experts represents the broad array of stakeholders in the renewable energy field, including renewable energy and alternative fuel industries, environmental and agricultural communities, academia, local government, energy policy, green buildings, economic development, public utilities, as well as State government entities.
>
> The Task Force was charged with three primary goals: 1) Identify barriers in New York State to wider deployment and installation of renewable energy; 2) Recommend policies, including financial incentives to overcome those barriers to attract clean industries to economically depressed regions of the state; and, 3) Identify fu-

ble at http://www.nyserda.org/publications/renewablefuelsroadmap/ (follow "Renewable Fuels Roadmap" hyperlink).

9. *Id.* at 5-2.

> ture market areas where additional research and development investment is necessary.[10]

Members of the Task Force were divided into four subcommittees focused on specific areas of energy concern: (1) renewable fuels, "focusing on corn-based and cellulosic ethanol, biodiesel, butanol, liquefied biogas, hydrogen, and electric-based transportation"; (2) energy efficiency; (3) renewable electricity central generation; and (4) renewable electricity distributed generation.[11]

In its first report, the Task Force concluded, among other things, that a study assessing the various aspects of the development of a biofuels industry in New York should be commenced.[12] The Task Force noted the urgency with which New York must progress in terms of establishing a renewable fuels industry in light of the mandates required under EISA.[13] The Task Force also noted the considerable amount of marginal land in New York that potentially could be placed into biofuels production, and found that an in-state biofuels industry would help ensure that profits from transportation fuel remain in New York.[14] The report also stressed the importance of examining the environmental implications such an industry would place on existing resources.[15] In summary, "[a] carefully crafted renewable fuel policy can reduce [the amount of money lost to out-of-state transportation fuel producers], enhance the environment, and create economic opportunities for New Yorkers."[16]

In order to develop a study of the desired scope and depth, the Task Force recommended that the following topics be examined:

- The life-cycle environmental consequences including all upstream emissions and land use impacts (which are not part of current assessments) of expanding the development and deployment of renewable fuels;
- The development of best practices for supplying feedstocks on a sustainable basis;
- The current industrial and research base in New York that can participate in the renewable fuels market;
- The distribution infrastructure to bring fuels to market;
- An assessment of workforce and training needs;
- The financial resources necessary to build a sustainable renewable fuels industry; . . .

10. RENEWABLE ENERGY TASK FORCE, CLEAN, SECURE ENERGY AND ECONOMIC GROWTH: A COMMITMENT TO RENEWABLE ENERGY AND ENHANCED ENERGY INDEPENDENCE i (2008), http://aceny.overitmedia.com/files/lt_RETF_Report1.pdf.

11. *Id.*

11. *Id.* at vi.

13. *Id.* at 12.

14. *Id.* at 11–12.

15. *Id.* at 12.

16. *Id.* at 11.

- The economic development benefits to rural and agricultural regions of the State[;]
- . . . .
- The health, environmental (including air quality and climate impacts), and land use effects of the production and use of renewable fuels, the metrics of sustainable management, and models and measurement tools to assess management;
- Land use and resource condition, standing biomass and suitability for future bio-energy crops; [and]
- Feedstock supply including identification, techniques for planting, harvesting, production, storage, transportation, and processing.[17]

B. Executive Order No. 2 and the State Energy Plan

Two months after the release of the first Task Force report, in April 2008, Governor Paterson issued *Executive Order No. 2: Establishing a State Energy Planning Board and Authorizing the Creation and Implementation of a State Energy Plan* (Executive Order No. 2).[18] After acknowledging the impacts of fossil fuel-based energy sources on air pollution, climate change, and economic stability, Executive Order No. 2 required the establishment of a State Energy Planning Board (Board), consisting of representatives from major state government offices and agencies. The primary task of this Board was to develop a State Energy Plan (Energy Plan) designed to provide guidance to policymakers regarding a variety of critical energy issues, such as policy options, demand forecasts, analyses of existing generation sources, transportation, impacts on human health and the environment, and climate change, among many others.[19] Notably, Executive Order No. 2 required a significant amount of public participation through hearings and written comments, and the Board was required to consider all comments submitted.[20]

After months of drafting and public meetings and comment periods, the Board released the *2009 State Energy Plan* in December 2009.[21] The following summarizes the major objectives and recommendations:

> The 2009 New York State Energy Plan (Plan or Energy Plan) sets forth a vision for a robust and innovative clean energy economy that will stimulate investment, create jobs and meet the energy needs of residents and businesses over its 10-year planning horizon.

17. *Id.* at 13.

18. Exec. Order No. 2: Establishing a State Energy Planning Board and Authorizing the Creation and Implementation of a State Energy Plan, 30 N.Y. Reg. 119 (May 7, 2008).

19. *Id.*

20. *Id.* at 120.

21. STATE ENERGY PLANNING BD., 2009 STATE ENERGY PLAN (2009), *available at* http://www.nysenergyplan.com/stateenergyplan.html.

> To that end, the Plan provides the framework within which the State will reliably meet its future energy needs in a cost-effective and sustainable manner, establishes policy objectives to guide State agencies and authorities as they address energy-related issues and sets forth strategies and recommendations to achieve these objectives.
>
> The Plan's strategies and recommendations have been designed to meet five policy objectives:
>
> - Assure that New York has reliable energy and transportation systems;
> - Support energy and transportation systems that enable the State to significantly reduce greenhouse gas (GHG) emissions, both to do the State's part in responding to the dangers posed by climate change and to position the State to compete in a national and global carbon-constrained economy;
> - Address affordability concerns of residents and businesses caused by rising energy bills, and improve the State's economic competitiveness;
> - Reduce health and environmental risks associated with the production and use of energy across all sectors; and
> - Improve the State's energy independence and fuel diversity by developing in-state energy supply resources.
>
> Five strategies are outlined in the Plan, which simultaneously achieve these multiple policy objectives. The strategies are: (1) produce, deliver and use energy more efficiently; (2) support development of in-state energy supplies; (3) invest in energy and transportation infrastructure; (4) stimulate innovation in a clean energy economy; and (5) engage others in achieving the State's policy objectives.[22]

Regarding renewable energy and transportation fuel in particular, the Energy Plan notes that, although New York seems to have the ability to harvest a significant amount of feedstock that could be used to produce transportation fuel for the State, this potential must be analyzed in terms of sustainability, economic growth, infrastructure, and policy developments.[23] The Energy Plan makes a number of references to the soon-to-be-completed Roadmap as satisfying this need, noting that it "will be used to more accurately estimate New York's indigenous biomass technical/practical potential, to understand the economic and environmental impacts of biofuels, and to develop comprehensive bioenergy

22. 1 STATE ENERGY PLANNING BD., *supra* note 21, at xiii, http://www.nysenergyplan.com/final/New_York_State_Energy_Plan_VolumeI.pdf [hereinafter STATE ENERGY PLANNING: OBJECTIVES].

23. *See id.* at 41–43; *see also Renewable Energy Assessment*, *in* 2 STATE ENERGY PLANNING BD., *supra* note 21, at 42–44, http://www.nysenergyplan.com/final/Renewable_Energy_Assessment.pdf.

policies."[24] The Roadmap team is continuing to work closely with the Board in developing effective energy policy for New York.

C. Executive Order No. 24 and the Climate Action Council

In recognition of the ability of New York to not only provide leadership in national and international actions addressing climate change, but also to improve its economy and environment, Governor Paterson issued *Executive Order No. 24: Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan* (Executive Order No. 24) in August 2009.[25] As the title states, this Order established the "80x50" goal of reducing GHG emissions by eighty percent below 1990 levels by the year 2050. In furtherance of this goal, Executive Order No. 24 calls for the establishment of a Climate Action Council, which is tasked with developing a Climate Action Plan.[26] Similar to the efforts surrounding the development of the Energy Plan, the council comprises representatives from major state offices and agencies and must follow a process that accommodates public meetings and an opportunity to submit written comments.[27]

In the interests of facilitating broad stakeholder participation and incorporating the technical capabilities of interested parties, five Technical Work Groups (TWGs) were established: (1) Power Supply and Delivery; (2) Residential, Commercial/Institutional, and Industrial; (3) Agriculture, Forestry, and Waste; (4) Transportation and Land Use; and (5) Adaptation.[28] An Integration Advisory Panel also was established to integrate the work of the various TWGs into one comprehensive Climate Action Plan.[29] The TWGs and the Integration Advisory Panel both consist of distinguished stakeholders from the public, private, and academic sectors.[30] As these groups continue their work, the Climate Action Council is relying extensively on the Roadmap's data, assumptions, and conclusions, and several members of the Roadmap team are currently participating in the council.[31]

24. *Renewable Energy Assessment*, *supra* note 23, at 38.

25. Exec. Order No. 24: Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan, 31 N.Y. Reg. 113 (Sept. 2, 2009).

26. *Id.*

27. *Id.*

28. *Technical Work Groups*, N.Y. STATE CLIMATE ACTION COUNCIL, http://www.nyclimatechange.us/technical_work_groups.cfm (last visited Feb. 5, 2011).

29. *Integration Advisory Panel*, N.Y. STATE CLIMATE ACTION COUNCIL, http://www.nyclimatechange.us/integrationpanel.cfm (last visited Feb. 5, 2011).

30. *See supra* notes 28–29.

31. *See* ROADMAP, *supra* note 8, at ES-1.

D. The Energy Independence and Security Act of 2007 and the Renewable Fuel Standard

In an effort to increase the energy security of the United States, reduce dependence on fossil fuels, and improve the quality of the environment, Congress established the Renewable Fuel Standard (RFS) program through the Energy Policy Act of 2005 (EPAct 2005).[32] The RFS mandated that transportation fuel in the United States must be blended with increasing amounts of renewable fuels, namely biofuels.[33] Under EPAct 2005, 7.5 billion gallons of renewable fuels were required to be blended by 2012.[34]

EISA, adopted two years later, expanded the mandates of the RFS and required much more ambitious levels of renewable fuels to be blended, leading to the creation of the second RFS, or RFS2.[35] Under this statute, 36 billion gallons of renewable fuels from different categories must be blended in transportation fuel by the year 2022.[36] In addition to these increases, EISA requires that fuel must meet certain life cycle GHG emission thresholds before it may be considered renewable.[37] For example, cellulosic biofuel must meet a sixty percent emission threshold, meaning that all of the GHG emissions released during its production must be sixty percent less than those emitted by the fuel it is intended to replace at 2005 levels.[38]

Enactment of EISA undoubtedly had an effect on the development of renewable fuels policy in New York. In the first Task Force report discussed above, for example, it states:

> The recent enactment of the federal Energy Independence and Security Act of 2007 increased the renewable fuel standard significantly, calling for this increase to be derived from advanced biofuels with specific carve-outs for cellulosic ethanol and biomass-based diesel. With this new mandate and the increase in the number of proposed facilities here in New York, there is a need to move expeditiously with assessing the appropriate policy, financial incentives, and economic development strategy.[39]

The Energy Plan also cites the RFS2 as a federal policy driver that had an impact on the development of renewable energy technology in the State.[40]

32. Pub. L. No. 109-58, tit. 15, 119 Stat. 594, 1067 (codified as amended at 42 U.S.C. § 7545 (2006)).

33. 42 U.S.C. § 7545(o).

34. *Id.* § 7545(o)(2)(B)(i).

35. Energy Independence and Security Act of 2007, Pub. L. No 110-140, tit. 2, 121 Stat. 1492, 1519–22 (codified at 42 U.S.C. § 7545 (Supp. II 2009)).

36. 42 U.S.C. § 7545(o)(2)(B)(i).

37. *Id.* § 7545(o)(1).

38. *Id.* § 7545(o)(1)(E).

39. RENEWABLE ENERGY TASK FORCE, *supra* note 10, at 12.

40. STATE ENERGY PLANNING: OBJECTIVES, *supra* note 22, at 44.

III. ROADMAP HISTORY

A. Pace Selected to Lead Roadmap Team

After the release of the 2008 Task Force report, the New York State Energy Research and Development Authority (NYSERDA) was assigned responsibility for developing the Roadmap in consultation with the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Agriculture and Markets (NYSDAM). In mid-2008, NYSERDA issued a Request for Proposals to solicit proposals from interdisciplinary teams interested in conducting the Roadmap study.[41]

The Pace Energy and Climate Center (Pace) was ultimately awarded the $750,000 contract, the funding for which was provided equally by NYSERDA, NYSDEC, and NYSDAM.[42] The Pace team, led by Zywia Wojnar, Research Director for Science and Policy Partnerships at Pace, consisted of a group of more than forty professionals with expertise in a variety of fields necessary for the completion of a comprehensive study. Members of the Roadmap team were from the following organizations: Antares Group, Inc.; Cornell University; Cornell Cooperative Extension of New York; Energy and Environmental Research Associates, LLC; Energetics Incorporated.; Farm Credit of Western New York; Northeast States for Coordinated Air Use Management; and SUNY College of Environmental Science and Forestry. Individual partners included Rick Handley and James Wolf.[43]

B. Setting the Stage: Visioning Meeting and Stakeholder Input

Much like the priorities involved in developing the Energy Plan and Climate Action Plan, a major concern of the Roadmap team was ensuring sufficient opportunity for comment from stakeholders and the public at large. The first opportunity for comment was the Visioning Meeting. This meeting provided the opportunity for informed stakeholders representing not-for-profits, regulators, and industry with relevant areas of expertise to discuss barriers impeding the establishment of a biofuels industry in New York and how they envisioned that industry developing. After this meeting, the following Visioning Statement was developed based on the input of the attendees:

> By 2030, New York State will have a vibrant, world-class biofuels industry that
>
> - Uses its highly diverse state and regional biomass feedstocks in the most sustainable manner possible;

41. ROADMAP, *supra* note 8, at 5-1 to 5-2.
42. *Id.* at iv.
43. *Id.* at v, vi.

- Cost-effectively and significantly reduces New York State greenhouse gas (GHG) emissions and petroleum imports while improving environmental quality;
- Establishes New York State as the leader in education and technology research, development, and deployment (RD&D), making ongoing contributions to enhanced sustainability and the development of fuels that are almost chemically identical to conventional fuels but are significantly cleaner to use and that release minimal CO_2. ([C]ommonly termed "next generation" fuels.);
- Significantly contributes to economic revitalization throughout New York State, ensuring stable and secure communities; and
- Employs an efficient supply and distribution infrastructure to provide an economical, reliable fuel supply for all New Yorkers.[44]

The other opportunities for public comment were through public stakeholder meetings. Pace organized eleven meetings throughout New York to ensure that stakeholders from across the state would have the opportunity to participate. Pace also worked extensively with the Cornell Cooperative Extensions throughout New York to provide outreach to members of the agricultural sector who might not otherwise have been aware of these meetings. The input received at these meetings revealed common themes: "property owner rights, food security, environment, decentralized industry structure, cost of production, need for technology improvement, new ways to integrate energy into farming, new business and technology concepts, and use of greener fuels."[45]

The information gathered from both the Visioning Meeting and the stakeholder meetings played an important role in shaping various aspects of the Roadmap. The Visioning Statement, for example, helped inform the development of the Scenarios, which will be explained below. The comments received during stakeholder meetings contributed to the Roadmap findings, recommendations, and analysis of competing uses, among others. Upon completion of the Roadmap, the public was also provided an opportunity to submit comments on NYSERDA's website. These comments will be considered in the first of the two subsequent annual updates to be developed.

44. *Id.* at ES-2.
45. *Id.* at ES-3.

IV. SUMMARY OF FINDINGS

A. Description of Assumptions and Scenarios

As discussed above, the Roadmap process was intended to perform a comprehensive examination of the various factors affecting the ability of New York to develop a biofuels industry and explore the likely characteristics of such an industry. In order to study the possibility of an industry that does not yet exist, the Roadmap team developed a set of assumptions to guide an analysis based upon three distinct scenarios.[46] When reviewing these scenarios, however, it is important to understand that they "are not meant to provide side-by-side comparison for the 'best' possible pathway to the future, but rather to allow a broad but realistic consideration of the primary issues and impacts that arise under three different possible futures, based on where the emphasis is placed."[47] In other words, the Roadmap's scenarios, in and of themselves, are not meant to provide policymakers with a blueprint for developing a biofuels industry in New York. Rather, the Roadmap is intended to set boundaries in order to study how changes in certain parameters, discussed below, would affect the development of a hypothetical industry.

To analyze the scenarios, several assumptions were made. The following is a selection of some of the key assumptions:

- "All scenarios assume that existing and planned corn grain-to-ethanol production systems in New York (totaling 154 million gallons per year [MGY]) will continue, and that new production for liquid biofuels comes predominantly from lignocellulosic to ethanol pathways."
- "Land use change impacts are mitigated by design of the assessment . . . . [Specifically,] [i]t is assumed that New York forests will stay forests, and that areas in crop production will remain in agricultural production to support current agricultural industry capacity in the State."
- "The assessment assumes no future growth of the New York dairy industry, but assumes that current dairy industry capacity remains."
- "Additional land is brought into energy crop production in Scenarios 2 and 3 through the assumption that current trends in crop and milk production efficiency (higher yields on less land) continue, allowing today's crop and dairy production levels to be achieved on less total land."

46. *Id.* at ES-1.
47. *Id.* at ES-4.

- "New York transportation infrastructure (rail, roads, and waterways) are assumed to provide the same transportation system coverage and capacity in 2020 as today."[48]

The three scenarios analyzed in the Roadmap contain different parameters.[49] In Scenario 1, called the "Big Step Forward," no cropland or land used for food production is used to produce lignocellulosic feedstocks; rather, these feedstocks are grown on rural and otherwise available land. Facilities using currently existing technologies for producing ethanol are assumed to be operational, producing 508 million gallons of ethanol per year. In Scenario 2, called the "Giant Leap Forward," additional cropland is used, but only that which would become available from more efficient dairy practices. In addition to the currently existing technologies, this scenario assumes that twelve additional facilities utilizing new technologies, known as "second generation" technologies, would be ready for production and would be situated at centralized locations throughout New York. Operating at full capacity, these facilities would produce 1449 million gallons of ethanol per year. In Scenario 3, called "Distributed Production," the same parameters as those described for Scenario 2 apply, except that, rather than using a centralized model, twenty-four second-generation facilities will be dispersed throughout the state. All three scenarios were also modeled at two different price points for gallons of gas equivalents (gge)—$3 per gge and $4 per gge—to account for the fact that ethanol yields two-thirds the energy value compared to an equal amount of unleaded gasoline.[50]

B. Summary of Select Findings

The Roadmap includes several different components. First, the main body of the report provides a summary for policymakers that extracts and condenses the most important procedures, methods, findings, and recommendations from the individual studies. In addition, each member of the Roadmap team produced individual studies, referred to as Appendices, based on eleven Strategic Priority Tasks developed by the team. As stated in the Roadmap,

> [t]he analysis of these 11 priorities provides a framework for addressing the potential size and impact of the development of a renewable fuels industry in New York, considering the quantity of required and sustainably-produced feedstock resources, the environmental and economic impacts, and the relationship of the new industry to the larger New York State and regional economies.[51]

The Appendices include the following task reports:

48. *Id.* (citation omitted).
49. *Id.* at ES-4 to ES-5.
50. *Id.* at 4-5 & n.28.
51. *Id.* at 1-2.

- Stakeholder Input: Vision Document and Stakeholder Input Workshops (Appendices C and D)
- Analysis of Sustainable Feedstock Production Potential in New York State (Appendix E)
- Feedstock Transportation and Logistics (Appendix F)
- Life Cycle Analysis and Public Health Assessment of Biofuel Production, Transportation, and Use in New York State (Appendix G)
- Technologies for Biofuels Production (Appendix H)
- Biofuel Industry Economic Impacts and Analysis (Appendix I)
- Worker Training and Business Research Infrastructure for a Biofuel Industry in New York (Appendix J)
- Sustainability Criteria (Appendix K)
- Selected Future Production Pathways in New York (Appendix L)
- Policy Analysis and Inventory of Existing Relevant State and Federal Policies (Appendices M and N)
- Biofuels Markets in New York State & Integration in the Northeast Region and Competition for Biomass Resources (Appendices O and P)[52]

Although these studies were performed separately, members of the Roadmap team worked closely with one another during the development of their respective studies. The Appendices therefore share synergistic relationships with one another, in that the results and procedures used in one appendix were relied upon or considered in the development of the others. This helps ensure that, although these documents were created individually, the Roadmap as a whole provides a comprehensive and consistent look at the potential for a biofuels industry in New York.

The following are some of the findings derived from these Appendices.

1. Policy Environment

Although Appendix M did not rely upon the scenarios for its analysis, the Appendix explores the current policy atmosphere regarding biofuels and related markets in order to fully appreciate the broader context in which the rest of the findings can have possible implications.

Overall, the current state of the national biofuels market is bleak, with the Roadmap describing it as "under severe financial distress."[53]

52. *Id.* at ES-1 to ES-2.

53. Nathan Rudgers, Farm Credit of W. N.Y., *Appendix M: Policy Analysis*, *in* ROADMAP, *supra* note 8, at M-1, http://www.nyserda.org/publications/renewablefuelsroadmap/Appendix_M_Policy_Analysis.pdf.

This outlook is primarily the result of the impacts of the following factors: the economic crisis and associated credit impacts, oil prices, and demand for corn-based ethanol.[54] In addition to the fact that "[m]any corn grain ethanol refineries across the United States are in, on the verge of, or recovering from bankruptcy," the fragile economic state also has discouraged financiers from investing in the construction of new plants as they focus their efforts on "buying existing assets at much discounted prices."[55] Recently, the prices of oil and ethanol have decreased, though some projections show either stable or slightly increasing prices.[56] Further, the Roadmap states that "there are some who believe that the demand for oil in developed countries has peaked or will approach a peak very soon," meaning that market forces may no longer be enough to stimulate increases in market demand, and that there may instead be increasing reliance on "regulatory initiatives."[57]

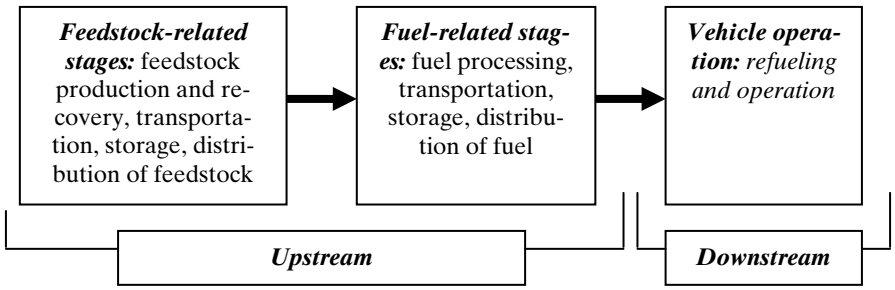
Finally, although the federal mandate implemented under EISA is expected to help drive demand for ethanol, it has already created uncertainty for investors.[58] EISA alters previous biofuels mandates by requiring that certain GHG thresholds be met and that the impacts of indirect land use change (iLUC) be considered in life cycle analyses.[59] As of the time of the writing of the Roadmap, the U.S. Environmental Protection Agency (EPA) had not yet promulgated any rules on this matter.[60] Further, the future of several biofuels tax incentives was unclear.[61] According to the Roadmap, "[t]hese uncertainties have in turn exacerbated the stagnation of investment in biofuels and corn ethanol development in particular."[62]

2. Life Cycle Analysis

A life cycle analysis quantifies the total amount of emissions released during the entire process associated with producing a certain fuel. Often referred to as "wells to wheels"—or, in this case, "field to wheels"—life cycle analyses used in biofuels studies consider both the emissions associated with the fuel's production as well as the ability of the feedstock to sequester carbon while it is growing.[63] Figure 1 below depicts the full spectrum of emissions quantified.

54. *See id.* at M-1 to M-3.
55. *Id.* at M-1.
56. *Id.* at M-2.
57. *Id.*
58. *See id.*
59. *See id.*; *see also supra* notes 32–38 and accompanying text.
60. Since the writing of the Roadmap, the EPA has issued a final rule implementing RFS2, which addresses GHGs, iLUC, and life cycle analyses. *See* Rudgers, *supra* note 53, at M-2 & n.3. The impacts of this rule will be addressed in the next annual update of the Roadmap.
61. *See id.* at M-2.
62. *Id.*
63. ROADMAP, *supra* note 8, at 4-30.

FIGURE 1[64]
COMPONENTS OF A TOTAL FUEL-CYCLE

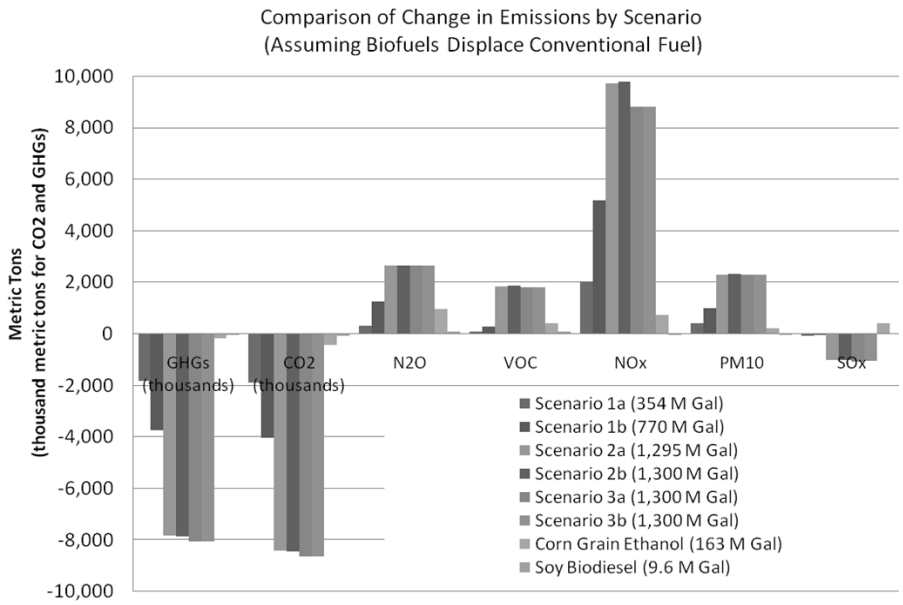


In the life cycle analysis study conducted for the Roadmap, life cycle analyses were modeled for all of the scenarios and for various fuel pathways (i.e., for different combinations of fuel types produced and conversion technologies employed). Results comparing various emissions produced under each scenario are illustrated in Figure 2 below. The study found that for lignocellulosic ethanol (LCE) production in all scenarios, GHG emissions were reduced by between sixty-seven and eighty-five percent versus an equal amount of gasoline compared on the basis of energy content.[65] The GHG reductions associated with corn ethanol and soy biodiesel production were smaller compared to those of LCE.[66]

Notably, however, emissions of other pollutants such as particulate matter, volatile organic compounds, and especially nitrogen oxides (NO_x), increased markedly.[67] This is due to the impacts of growing the feedstocks' associated fertilizer applications, as well as the fuel refining process, taking place within the state of New York. (In contrast, the extraction of petroleum and refining of petroleum-based fuels takes place outside of New York, so pollutants associated with the emissions from those processes have not affected New York's air quality.) If feedstock production and biorefining were to take place within the state, however, increased or similar emissions profiles, respectively, should be expected to be found in-state.[68]

64. *Id.* (citing James Winebrake, Michael Q. Wang & Dongquan He, *Toxic Emissions from Mobile Sources: A Total Fuel-Cycle Analysis for Conventional and Alternative Fuel Vehicles*, 51 J. AIR & WASTE MGMT. ASS'N 1073, 1076 (2001)).
65. *Id.* at ES-19.
66. *Id.* at 4-33.
67. *Id.* at 4-30 to 4-33.
68. *See id.* at 4-31.

FIGURE 2[69]
COMPARISON OF NET CHANGE IN EMISSIONS BY SCENARIO



3. Feedstock

The feedstock study attempted to quantify the potential amounts of biomass feedstock that could be harvested sustainably from both agricultural lands and forests. It concluded that the amount of sustainable biomass produced in New York would be enough to support an LCE industry.[70] According to the estimates, there are between 1 and 1.68 million acres of non-forest land and 15.8 million acres of forest that would be available to produce feedstock to supply an LCE industry, specifically between 4.2 and 14.6 million dry tons of lignocellulosic biomass annually.[71] If the total amounts of ethanol produced under each scenario are used (Scenario 1: 508 million gallons/year; Scenarios 2 and 3: 1449 million gallons/year), this amount of biomass would produce between 5.6% and 16% "of projected 2020 gasoline consumption in New York State."[72]

There are several key assumptions used in this analysis that should be kept in mind, however.

- "The lower estimate [one million acres of non-forest land] assumes that no cropland is used for new bioenergy feedstock pro-

69. *Id.*
70. *Id.* at 5-4.
71. *Id.* at 5-2 to 5-3.
72. *Id.* at 5-4.

duction; instead, the new production lands come from abandoned farmland, old pasture, and scrub and shrub lands not currently used for production."

- "The estimate also assumes that only about half of New York land owners would be interested in production."
- "The high-end of the estimate (1.68 million acres) assumes additional land (calculated to be approximately 0.68 million acres) becomes available by the year 2020 due to projected increased crop and milk yields such that the same amount of crops and milk can be produced as in 2009, but on less land . . . ."
- "The feedstock supply assessment assumed that the amount of forest land in New York will not change significantly in the future."
- "[T]echnological barriers to commercial scale production of lignocellulosic ethanol are overcome by the year 2020 . . . ."
- "[A]ll of the sustainably available biomass in New York is sold for lignocellulosic ethanol production."[73]

The significance of some of these assumptions is discussed further below.

4. Jobs and Economics

Two major indicators of a successful biofuels industry in New York are economic growth and job creation.[74] According to the study, which analyzed the three scenarios at the $3/gge and $4/gge price points, all three scenarios reveal noteworthy results in these two areas. In Scenario 1, between 3891 and 7780 jobs would be created and between $464.34 million and $931.72 million would be added to New York's GDP.[75] In Scenario 2, between 14,019 and 14,604 jobs would be created and between $1.66 billion and $1.73 billion would be added to the GDP.[76] Finally, in Scenario 3, between 14,189 and 14,236 jobs would be created and between $1.78 billion and $1.79 billion would be added to the GDP.[77]

While these scenarios model new and existing biorefineries throughout the state, most of the jobs created would not be located at these facilities. Rather, between 82% and 88% of all jobs created would be in the input sector, such as forestry- and transportation-based jobs, as well as miscellaneous positions, including those in the insurance, waste disposal, and financing sectors.[78] This study also concluded that sufficient

73. *Id.* at 5-2 to 5-4.

74. *See id.* at 4-23.

75. *Id.* at 4-24. Note that the upper and lower estimates correspond to the $3/gge and $4/gge price points, respectively. *Id.*

76. *Id.*

77. *Id.*

78. *Id.* at 4-26; Sam Swanson, Pace Energy & Climate Ctr., *Appendix J: Worker Training and Business Research Infrastructure for Biofuel Industry in New York*, *in* ROADMAP, *supra* note 8, at J-7,

training would be available for such workers if current programs remain operational.[79]

5. Competing Uses

When evaluating the quantities of biomass that would be available for biofuels production, it is necessary to examine other industries and practices that compete for the same feedstocks. In analyzing this area, however, it is important to note that the Roadmap "does not conclude that any one use should be given priority over the others."[80] Further, it "does not predict how the competition will play out, but it is designed to be limited to the scenarios that investigate whether biofuels could be produced without displacing other resources—assuming continued levels of certain resources."[81]

Although in decline over recent years, the largest existing competing uses for biomass in New York are the sawmill and pulp and paper industries.[82] With the addition of net wood exports and wood chip producers, the total biomass used for these four industries totaled roughly 2.3 million dry tons in 2007.[83] Firewood is also a major competing use of biomass in New York. Though difficult to quantify, the amount used for this practice was estimated to be approximately 1.6 million dry tons in 2007.[84] Biomass also currently is used for electricity generation in New York, and the potential use of biomass for combined heat and power systems continues to grow.[85]

In the future, the use of biomass for co-firing at electricity generation facilities regulated under the Regional Greenhouse Gas Initiative (RGGI) has the potential to increase.[86] RGGI, which imposes a carbon cap-and-trade requirement on electricity generation facilities 25MW or greater, allows these regulated parties to reduce their allowance requirements if they co-fire with biomass that meets certain criteria because of net CO_2 reductions.[87] Because co-firing with biomass "is currently the only low-cost opportunity for direct GHG reductions by RGGI coal plants," there is a chance that this competing use will see

http://www.nyserda.org/publications/renewablefuelsroadmap/Appendix_J_Worker_Training_and_Business_Research_Infrastructure.pdf.

79. ROADMAP, *supra* note 8, at 4-26 to 4-27.

80. *Id.* at 5-6.

81. *Id.*

82. *See id.* at 2-12.

83. *Id.*

84. *Id.*

85. *See id.* at 2-12 to 2-13.

86. *Id.* at 2-13 to 2-15.

87. *See generally* REG'L GREENHOUSE GAS INITIATIVE, OVERVIEW OF RGGI CO_2 BUDGET TRADING PROGRAM (2007), http://www.rggi.org/docs/program_summary_10_07.pdf.

growth.[88] In addition, biomass used for heating, particularly in the form of pellets, is expected to increase as well.[89]

V. ANALYSIS

Although the findings of the Roadmap may in fact come to pass (or at least are the favored pathways to take if New York is to pursue the development of a biofuels industry), it is important to keep in mind that the ultimate purpose of the Roadmap is to guide policymakers and provide them with a "broad but realistic" examination of the major issues and how they could interact with one another, rather than to recommend any particular course of action.[90] In order to provide this information to policymakers, the team had to define the scenarios based on a series of assumptions, and it necessarily had to manage many uncertainties that arose. These assumptions, therefore, should be kept in mind in order to fully appreciate the manner in which the findings were intended to be taken. In fact, the Roadmap acknowledges these uncertainties and identifies areas where future research is needed in order to provide more clarity and certainty to an analysis of a New York-based biofuels industry. In addition, it also provides a policy discussion and explores potential policy options that would address barriers currently hindering the development of a biofuels industry in New York.

A. Key Assumptions and Caveats

1. Feedstock Levels and Conversion Technologies

As discussed above, the Roadmap team determined that New York would be able to produce a maximum of 508 million gallons per year under Scenario 1 and 1449 million gallons per year under Scenarios 2 and 3,[91] that available land could supply between 4.2 and 14.6 million dry tons of lignocellulosic biomass annually,[92] and that this amount of biomass would produce between 5.6% and 16% "of projected 2020 gasoline consumption in New York State."[93]

Though these numbers seem promising and provide appropriate guidance to policymakers, they must be examined critically in the proper context. When the Roadmap team derived the maximum amounts of biofuels New York could produce, it set the assumption that not only will "existing and planned" first-generation biorefineries be fully operational, but also "that new production for liquid biofuels comes predominantly

88. ROADMAP, *supra* note 8, at 2-13.
89. *See id.* at 2-15 to 2-17.
90. *Id.* at ES-4.
91. *See supra* Part IV.A.
92. *See supra* Part IV.B.3.
93. *See supra* note 72 and accompanying text.

from lignocellulosic to ethanol pathways."[94] Although assessments of current technologies and interviews with some experts conclude otherwise,[95] there is a possibility that the LCE industry will not be ready to operate at that capacity in the timeframe examined. The percentages of gasoline consumption that could be displaced are premised on the hope "that the technological barriers to commercial scale production of lignocellulosic ethanol are overcome by the year 2020."[96] Further, it may be financially difficult to achieve commercial-scale production because "[t]here are no New York public funds either available currently or for the foreseeable future for such an effort, though the State has made direct investments in biofuels research and demonstration facilities."[97] On the other hand, less land-intensive technologies may be developed that could increase the amount of biofuels produced.[98]

There are several possible factors affecting which technologies will be available, when they will be available, and on what scale.

> There is no guarantee that early demonstrations will be successful or that technologies that appear to be in early phases of development will not make a breakthrough earlier than expected. Further, other conversion technologies and fuels that do not strictly meet the product or timeline constraints of this assessment could potentially be incorporated in the transportation market in the future. For example, there is a potential for the use of compressed biogas as an alternative to natural gas for buses or specialized fleets. Biogas can be generated from manure and wastes via anaerobic digestion, and is also a by-product from landfills.[99]

In addition to technological uncertainties, regarding Scenarios 2 and 3, the models that generated these percentages did not account for competing uses. Rather, they assumed that "*all* of the environmentally and sustainably available resources would be consumed in production."[100] Because of these and other constraints, it is not likely that these levels of production would be achieved by 2020:

> This level of production is very unlikely if the model were to incorporate competition for those resources and accounted for the time it would take to build the infrastructure to supply these facilities. For this reason, Scenarios 2 and 3 would take much longer to actually implement even if the technology improvements were achieved by 2020. Furthermore, constraints for site permitting, competition for resources and logistical issues would further limit the actual capacity built by this time.[101]

94. ROADMAP, *supra* note 8, at ES-4.
95. *See id.* at 5-8.
96. *Id.* at ES-10.
97. *Id.* at 5-14.
98. *See id.* at 5-3.
99. *Id.* at 2-23.
100. *Id.* at ES-15.
101. *Id.*

2. Land Availability Issues

As discussed above, the Roadmap team concluded that there are between 1 and 1.68 million acres of non-forest land and 15.8 million acres of forest that would be available to produce feedstock to supply an LCE industry.[102] This conclusion, however, is based on assumptions about how the land may be used. For example, Scenarios 2 and 3 assume that "additional land . . . becomes available by the year 2020 due to projected increased crop and milk yields such that the same amount of crops and milk can be produced as in 2009, but on less land."[103] In Scenario 1, dairy production was assumed to remain the same. In order to set limits for such a multi-faceted analysis, however, the Roadmap team did not consider population growth or changes in eating habits. According to Appendix E (which addressed feedstocks), "[i]f greater amounts of food or feed are desired due to human population increases or changes in diet, additional land could of course be required to meet those needs either from within New York State or outside it."[104] Population growth and eating habits are variables which could significantly alter the results.

Another issue involves landowner preferences. When estimating how much land would be available for feedstock production, the Roadmap team assumed "that only half of New York land owners would be interested in using their forest and non-forest land for bioenergy feedstock production and that the other half of land owners might prefer to use the land for uses such as wildlife habitat and recreation."[105] This estimation was derived from models that looked at population density, finding "higher harvest rates from counties with low population density and lower amounts from counties with high population density."[106]

As the Roadmap itself notes, however, there is a great deal of uncertainty involved in determining landowner preferences. It recognizes that it is ultimately up to the personal decisions of individual landowners whether their land will be used for bioenergy production and that "[t]he presence of lands that could potentially produce feedstocks does not imply that landowners in this area would want to use their land for feedstock production."[107] Indeed, landowners expressed concern about this issue at stakeholder workshops in terms of ensuring that their rights to use their land as they wish remained intact.[108]

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102. *See supra* Part IV.B.3.

103. ROADMAP, *supra* note 8, at 5-3.

104. Peter B. Woodbury, Cornell Univ., *Appendix E: Analysis of Sustainable Feedstock Production Potential in New York State*, *in* ROADMAP, *supra* note 8, at E-44, http://www.nyserda.org/publications/renewablefuelsroadmap/Appendix_E_Analysis_of_Sustainable_Feedstock_Production_Potential_in_NYS.pdf.

105. *Id.* at E-iv.

106. *Id.* at E-18.

107. ROADMAP, *supra* note 8, at 5-7.

108. *See id.* at 3-3.

Finally, the issue of iLUC introduces several uncertainties into the Roadmap team's analysis of not only land availability, but also life cycle analysis. Indirect land use change occurs when land previously used for food production is then used for feedstock production, and this change causes land somewhere else, often in other parts of the world, to be converted to food production. The issue of iLUC has been the subject of contentious debate over the past few years since articles on the matter were published in *Science* magazine, stating that iLUC can cause substantial increases in GHG emissions globally and should be included in life cycle analysis.[109] The findings of these articles are also the subject of debate, but the Roadmap ultimately concludes that "the studies and responses demonstrate *indirect* land use change to be much more difficult to model than *direct* land use change and that new, more adequate global models are urgently needed so that biofuels policy is not misguided."[110]

The Roadmap team chose the following approach in addressing this particular issue:

> Without adequate global models for iLUC at this writing, the impacts of New York-specific iLUC are very difficult to quantify. It was therefore not feasible to conduct the required global scale analysis to attempt to quantify such findings. However, the Roadmap analysis was conducted so as to greatly reduce the likelihood of iLUC impacts from each of the three Roadmap Scenarios. Specifically, for each of the three Roadmap Scenarios, total food, feed, and forest production in 2007 was maintained even as production of feedstock for biofuels increases.
>
> By maintaining current levels of agricultural and forest production, the need to use new additional land outside New York State to meet the State's needs was avoided or substantially mitigated.[111]

As will be discussed below, the team concluded that further research into iLUC should be conducted, with the results to be addressed in future Roadmap updates.

B. Future Research Needs

In order to address these uncertainties, the Roadmap team took a hard look as to which areas warranted more extensive research in order to provide a more definite analysis in the future. Regarding feedstock production and land availability, for example, the team found that further research was necessary to evaluate landowner preferences.[112] Be-

109. *See id.* at 4-8; *see also* Joseph Fargione et al., *Land Clearing and the Biofuel Carbon Debt*, 319 SCIENCE 1235 (2008) (discussing biofuel carbon debt resulting from various methods of biofuel production); Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change*, 319 SCIENCE 1238 (2008).

110. ROADMAP, *supra* note 8, at 4-8.

111. *Id.* at 4-9.

112. *Id.* at 5-3.

cause much of the land in New York and the Northeast is divided into relatively small parcels, surveying "larger-plot land owners (i.e., > 100 acres) and smaller-plot land owners (< 100 acres) . . . help[s] clarify the amount of land that might actually be available for biomass energy feedstock production."[113] Further, to ensure that biomass is harvested sustainably, the Roadmap recommends further research to develop "site specific" best management practices that include "science-based, comprehensive criteria on GHG emissions of biofuels and co-products."[114] Finally, regarding iLUC, the Roadmap states that new research should be incorporated into its analyses as it becomes available in the future.[115] Specifically, it recommends:

- "Integration of New York biofuels life cycle analysis with indirect land use modeling is needed."
- "There should be an improved understanding of the potential for direct and indirect land use change with different bioenergy development scenarios."
- "Assess the potential for greenhouse gas emission changes resulting from new incentives and policies regarding biomass and other renewable sources of energy."[116]

On the related issue of competing uses, the Roadmap team recommended further research to properly evaluate the effects of multiple uses competing for biomass feedstock in New York. To study these effects, the team called for "comparative market" analyses in order to evaluate the effects of prices, changes in demand, growth in other competing areas, and future trends.[117]

Regarding conversion technologies, the Roadmap team determined that it would be necessary not only to "[u]pdate models as new technologies are introduced," "[c]onsider multi-product integrated biorefineries that optimize use of biomass and maximize revenue streams," and "[i]mprove yield and conversion efficiencies," but also to explore issues associated with situating biorefineries, such as supply, facility design, and financial incentives.[118]

C. Policy Considerations

Based upon the analyses and findings discussed throughout this Article, it is apparent that increasing support is required from New York in order to reduce or remove the financial and technological barriers preventing the successful development of a biofuels industry within the

113. *Id.*
114. *Id.*
115. *Id.* at 5-14.
116. *Id.*
117. *Id.* at 5-7.
118. *Id.* at 5-8.

state. The Roadmap suggests some policies that could help stimulate the growth of this industry by focusing on several broad categories: (1) overarching policy considerations, (2) policies to increase demand for biofuels, (3) policies for the distribution of biofuels, (4) policies for the refining of biofuels, and (5) policies for feedstock production and the harvesting of biofuels feedstocks.

1. Overarching Policy Considerations

As mentioned above, many of the barriers to biofuels development in New York are based on uncertainties, whether they be financial, technological, or market related. The Roadmap addresses these barriers by describing some general principles that could guide effective policy decisions. One principle involves an integrated approach that supports the entire biofuels "value chain" comprehensively.[119] When possible, policies should not only focus on the construction of a biorefinery, for example, but they also should consider the feedstock supply necessary for its operations.[120] In order to promote investor certainty, policies should look not only to the short-term, but also to the mid- to long-term.[121] According to the Roadmap, "[l]onger-term policies allow project developers to produce financial projections which support the developing industry as it gets off the ground, eventually able to compete without continuing subsidies."[122] One final principle involves regional coordination.[123] A region-based approach, rather than a solely state-based approach, "would benefit all regional states and provide greater market certainty, demand and ability to support infrastructure."[124]

2. Increasing Demand for Biofuels

Because of the likelihood that demand for biofuels will need to be spurred by government action, policies structured to increase such demand are essential. Some examples of federal actions that could be altered or applied by New York at the state level include increasing the federal blend level from E10 to higher levels, such as E15 or E20.[125] This would stimulate production by making a demand for biofuels to meet the higher blending requirements. The adoption of a low-carbon fuel standard (LCFS) by New York also would support biofuels production.[126] LCFS programs require that all transportation fuels must meet certain

119. *Id.* at 5-16.
120. *Id.*
121. *Id.*
122. *Id.*
123. *Id.*
124. *Id.*
125. *See* Rudgers, *supra* note 53, at M-5. E10 means that gasoline sold at commercial pumps must contain ten percent ethanol.
126. *See id.*

GHG emission requirements on an energy-content basis, meaning that limits would be placed on how many GHG emissions will be permitted per unit of energy provided by the fuel. There is currently discussion among several Northeast states about a possible LCFS. Regarding heating oil incentives, New York could consider a "Cash for Clunkers" program, in which New York State would pay parties to replace old, inefficient heating oil burners with heaters using wood pellets or other biomass heating sources.[127] According to the Roadmap, such a program "can have a significant market impact," and "could complement the existing federal program that provides a 30% tax credit for the purchase of this type of equipment."[128]

3. Distributor and Refiner Policies

For both distributors and refiners of biofuels, various tax incentives could provide some assistance that would ease the financial burdens placed on them.[129] For refiners, however, "[g]rants and loan guarantees were identified in most of the interviews as the two highest priorities to achieve funding for any new biorefinery."[130] Such financial assistance allows refiners to address the barrier of high up-front costs more easily, especially during uncertain economic times.[131] As mentioned above, there is also great uncertainty surrounding the ability of conversion technologies to reach commercial-scale capacity in the relatively near future due to the wariness of investors. To overcome this barrier, policies supporting research and development programs are recommended.[132] Such new policies also could be built upon existing state and federal programs.[133]

4. Feedstock Producers and Harvesters

As the Roadmap's feedstock findings indicate, there is also significant uncertainty surrounding the amount of feedstock that actually would be available, in part due to unpredictable landowner preferences. To address financial risks often associated with feedstock production, the Roadmap recommends insurance for feedstock producers.[134] According to the analysis, "[p]lanting, growing and harvesting a feedstock that has no alternative uses other than biofuels or biomass combustion is a very risky business investment unless there is an assurance that a long-term market will exist for the biomass."[135] Properly structured insurance pro-

127. *See id.* at M-6.
128. *Id.*
129. *See* ROADMAP, *supra* note 8, at 5-17 to 5-18.
130. Rudgers, *supra* note 53, at M-6.
131. *See id.*
132. *Id.* at M-7.
133. *Id.*
134. *Id.*
135. *Id.*

grams can alleviate this risk by including "incentives to plant the supporting biomass crops" and providing price guarantees in the event the market price for a feedstock decreases.[136]

VI. CONCLUSION

New York State (as well as the rest of the nation) will continue to grapple with the most effective means of addressing the major environmental, economic, and energy-related issues of our day. Through its commitment of resources to development of the renewable fuels Roadmap, New York has demonstrated its continued commitment to take a leadership role on these issues, and to provide a sound basis upon which state policymakers can make important choices about the impacts of developing a robust biofuels industry in New York. Given the enactment of EISA and its aggressive renewable fuels standard, the renewable fuels industry throughout the United States can be expected to scale up in a significant manner to meet the mandated production levels. This poses significant challenges for state policymakers, to ensure that the industry develops in a manner that promotes sustainable harvest practices and minimizes environmental impacts. The Roadmap provides valuable guidance on the extent of biofuels feedstock in New York, as well as recommendations on some of the policy issues associated with encouraging sustainable development of these resources.

At the same time, development of an expanded biofuels industry in New York can help the state achieve its "80 x 50" GHG emissions reductions target by reducing reliance on fossil-based fuels for transportation. The lifecycle analysis performed by the Roadmap team quantifies the extent of the estimated GHG reductions and identifies some of the offsetting impacts of increased emissions of NO_X and volatile organic compounds. Expansion of the biofuels industry in New York also would produce additional jobs and provide valuable economic development benefits, an issue of increasing importance given the state's current near double-digit unemployment rate, and even greater joblessness in upstate New York, where biofuels production and processing would occur. The Roadmap quantifies these economic benefits, and provides valuable information to policymakers about the number and types of jobs that would be generated by expansion of the industry in New York. Infrastructure-related impacts—such as increased truck traffic on roadways or greater reliance on rail facilities—must also be considered by policymakers, in order to plan for the investment in infrastructure that may be necessary to support an expanded biofuels industry.

Thus, although the Roadmap does not prescribe any particular course of action with respect to whether or not the New York should take action to promote the development of an expanded biofuels indus-

136. *Id.*

try in New York, the Roadmap achieves its essential purpose of providing policymakers with a thorough and comprehensive examination of the major issues associated with such an expansion.