Denver Journal of International Law & Policy

Volume 44
Number 3 *Spring*
48th Annual Sutton Colliquium

Article 4

January 2016

Model Law on Lighting for Developed Countries

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Keywords
Developing Countries, Electricity, Hotels

DEVELOPMENT AND DISSEMINATION OF CLEAN LIGHTING

MODEL LAW ON LIGHTING FOR DEVELOPED COUNTRIES

A BILL

To promote the development and deployment of lighting products to save lives, improve livelihoods, protect children, empower women, and combat climate change by creating a thriving global market for clean, affordable, and efficient indoor lighting solutions, and for other purposes.

Be it enacted by the [legislative organ] of the [developed country] assembled,

§ 1. Short Title

This Act may be cited as the "*Development and Dissemination of Clean Lighting* Act of [year]."

Effective Date. This Act becomes effective on [*date*].

§ 2. Findings

[*Legislative organ*] finds that:

(1) [*Name of country*] is a member of the community of nations that has accepted well-recognized principles of international law and policy establishing –

(A) the right of developing countries to sustainable development;

(B) the common but differentiated legal and moral rights of [*name of country*] and other developed nations to institutionally, financially, and technologically support sustainable development among developing countries by alleviating energy poverty and providing access to safe and sustainable lighting products; and

(C) that there is an urgent and pressing need to promote the use of renewable energy resources and technologies to supply energy needs, including lighting.

(2) [*Name of country*] seeks to support sustainable and renewable development and carry out its common but differentiated legal and moral

responsibility (CBDR) pertaining to energy poverty and access to safe and sustainable lighting products through this Act.

(3) It is estimated that of the 1.5 billion people worldwide without access to electricity, most rely on kerosene for illumination.

(4) The use of kerosene for lighting generates indoor air pollution, contributing to the deaths of 1.8 million people per year. Kerosene fires kill more than 1 million people per year, and children suffer health problems and die from the accidental ingestion of kerosene.

(5) Lighting fuels, such as kerosene, are nonrenewable sources of energy. The National Institute of Environmental Health Sciences estimates that 77 billion liters of liquid fuel, mostly kerosene, are used annually to light houses without electricity.

(6) The burning of kerosene for lighting in developed countries is estimated to cause the emission of 223 tons of carbon dioxide into the atmosphere per year, contributing to global climate change. Kerosene lamps are also major emitters of black carbon, which is both dangerous when inhaled and a major agent of climate change.

(7) Without adequate indoor lighting, women and children cannot engage in educational or economic activities after dark. Lack of adequate lighting also contributes to insecurity and danger at night.

(8) Explosions and fires from kerosene-related accidents lead to hundreds of thousands of burn deaths each year, and burn survivors often sustain permanent injuries ranging from debilitating scarring to loss of movement.

(9) The development and deployment of improved indoor lighting products is essential for achieving the United Nations Sustainable Development Goal#7: Ensure access to affordable, reliable, sustainable and modern energy for all.

(10) Improved indoor lighting products positively impact the quality of life and the environment by –

(A) Enabling women and children to engage in educational and economic endeavors after dark;

(B) Promoting gender equality and women's empowerment;

(C) Improving health and safety;

(D) Advancing environmental stability by reducing reliance on fossil fuels;

(E) Reducing contributions to global climate change; and

(F) Ensuring and facilitating access and delivery of medical care, particularly endeavors after dark.

§ 3. Policy

It is the policy of [*name of country*] to –

(1) Encourage universal access to lighting;

(2) Encourage energy supplies from renewable and sustainable resources;

(3) Encourage national and international efforts to promote, distribute, enable, and maintain universal access to lighting;

(4) Encourage national and international research, development, and deployment of lighting products;

(5) Encourage research, development, and deployment of safe lighting products which are safe and utilize renewable energy generation sources;

(6) Encourage the establishment of National Minimum Quality and PerformanceStandards such as United Laboratories or IEEE accepted standards; and

(7) Encourage technology transfer of renewable and sustainable energy development and universal access to lightning.

§ 4. Definitions

In this Act:

(1) "Lighting Product" means one that:

(A) employs appropriate durable, affordable, renewable, harmless, and accessible sustainable energy technologies;

(B) has been prototypically demonstrated, tested, and certified as meeting-

(i) Brightness Standards; and

(ii) indoor ambient air quality standards; or

(iii) if a developing country determines that indoor ambient air quality standards cannot be achieved, the reasonable interim air quality standards established by the developing country that improve existing indoor ambient air quality; and

(C) meets minimum durability standards based on the needs and conditions of such developing country and its peoples.

(2) "Brightness Standards" means that lighting products for general household use must provide an output of 20 lumens or illuminate an area equal to 2 sheets of paper at 25 lux.

§ 5. Lighting Product Manufacturing, Promotion, and Distribution

(a) **In General.**

There is established within the [*ministry or agency for international aid*] a Lighting Product Manufacturing and Distribution Program.

(b) **Purpose.**

The purpose of the program established by subsection (a) is to provide international partnerships and local entrepreneurs with financial, institutional, and technological assistance to develop, manufacture, promote, distribute, and maintain certified safe, improved lighting products and charging stations in developing countries.

(c) **Funding.**

(1) The program established by subsection (a) shall be funded in the amount of $15,000,000 each year for 10 years.

(2) Criteria – The administrator of the program established by subsection

(a) shall establish criteria for the use of funds provided by paragraph (1) to carry out the purpose of the program.

(3) Consultation – The criteria established under paragraph (2) shall be developed in consultation with:

(A) governmental and community leaders in developing countries;

(B) indigenous and affected populations and other stakeholders;

(C) non-governmental organizations working to promote safe and sustainable indoor lighting;

(D) [*other relevant ministries or agencies within the developed country*]; and

(E) the interested public.

(4) Notice and Comment – The administrator of the program established by subsection (a) shall provide public notice and an opportunity for any interested party to comment on any proposal to this section or amendments thereto; (b) agency for receiving comments shall respond in a timely manner.

(5) Availability of funds – The funding provided by paragraph (1) shall be available to offices or programs within the [*appropriate agency or agencies within the ministry for international aid*] in accordance with –

(A) the criteria established under paragraph (2); and

(B) such other rules as are established by the [agency head].

(6) Grants and other aid –The program established by subsection (a) may, in accordance with the criteria established under paragraph (2) and without the need for any matching or base funds, use up to 20 percent of the funding provided by paragraph (1) to provide grants, loans, or other methods of financial support to businesses and other non-governmental organizations working to develop, manufacture, promote, distribute, or maintain improved lighting products in developing countries.

(d) Monitoring; Reporting.

The administrator of the program established by subsection (a) shall –

(1) monitor and evaluate the effectiveness of the program; and

(2) report every 2 years after the date of enactment of this Act to the [*appropriate developed country officials and entities*] and the public on the effectiveness of the activities supported by and carried out under the program.

(e) **Accounting.**

The administrator of the program established by subsection (a) shall account for the funds it receives and distributes. The accounting shall comply with generally accepted accounting principles and shall be made available to the [*appropriate developed country officials and entities*] and the public within 90 days of the end of each fiscal year. The program shall be audited by independent auditors, selected by the executive committee of the Agency, at the end of every other fiscal year.

§ 6. Grant Program

(a) **In General.**

There is established within the [*ministry or agency for applied energy research and design*] to facilitate a Lighting Product Research, Development, and Demonstration in partnership with stakeholders in developing countries.

(b) **Purpose.**

The purpose of the grant program established by subsection (a), is to enable and facilitate the research, development, testing, and demonstration of:

(1) effective and efficient appropriate sustainable energy technologies that provide alternatives to the use of damaging fuel-based lighting;

(2) alternative lighting products and components thereof;

(3) accessible and user-friendly centralized charging mechanisms and stations;

(4) conduct and support research and monitoring on household, local, and global production of black carbon and other pollutants emitted by fuel-based lighting;

(5) conduct and support research and monitoring on the adverse human health and environmental effects associated with the black carbon and other pollutants emitted by fuel-based lighting;

(6) research and develop best practices and programs to reduce the adverse human health and environmental effects associated with black carbon and other pollutants through the use of fuel-based lighting; and

(7) inform governments, researchers, and the public of the research, monitoring, best practices, and programs developed under paragraphs (4) through (6).

(8) leverage existing research and development in the Sustainable Energy sphere—wind turbines, hydro-electric (coastal, rainshed), solar, biofuel—and cooperatively integrate renewable, sustainable, affordable lighting components therein.

(c) **Funding.**

(1) In general –The program established by subsection (a) shall be funded in the amount of $15,000,000 each year for 10 years.

(2) Criteria – The administrator of the program established by subsection (a) shall establish criteria for the use of funds provided by paragraph (1) to carry out the purpose of the program.

(3) Consultation – The criteria established under paragraph (2) shall be developed in consultation with:

(A) domestic and international businesses, academic institutions, and non-profit institutions that are developing or are interested in the research, development, testing, or demonstration of safe and sustainable lighting products;

(B) [*other relevant ministries or agencies within the developed country*];

(C) indigenous and affected populations/community leaders in developing countries, and other stakeholders; and

(D) the interested public.

(4) Notice and Comment – The administrator of the program established by subsection (a) shall provide public notice and an opportunity for any interested party to comment on any proposal under paragraph (2) or amendments thereto.

(5) Availability of funds – The funding provided by paragraph (1) shall be available to offices or programs within the [*ministry or agency for applied energy research and design*] in accordance with:

(A) the criteria established under paragraph (2); and

(B) such other rules as are established by the [*agency head*].

(6) Grants and other aid – The administrator of the program established by subsection (a) shall, in accordance with the criteria established under paragraph (2) and without the need for any matching or base funds, use up to 80 percent of the funding provided by paragraph (1) to provide grants, loans, or other methods of financial support to academic, business, and other non-governmental entities for research, development, testing, or demonstration of safe and sustainable lighting products.

(d) **Monitoring; Reporting.**

The administrator of the program established by subsection (a) shall:

(1) monitor the effectiveness of the program; and

(2) report every 5 years after the date of enactment of this Act to the [*appropriate developed country officials and entities*] and the public on the effectiveness of the activities supported by and carried out under the program.

(e) **Accounting.**

The administrator of the program established by subsection (a) shall account for the funds it receives and distributes. The accounting shall comply with generally accepted accounting principles and shall be made available to the [*appropriate developed country officials and entities*] and the public within 90 days of the end of each fiscal year. (b) The program shall be audited by independent auditors, selected by the executive committee of the Agency, at the end of every other fiscal year.

§ 7. Health and Environmental Research

(a) **In General.**

There is established within the [*ministry or agency for health or environmental research*] a Lighting Product Health and Environmental Research Program.

(b) **Purpose.**

The purpose of the program established by subsection (a) is to:

(1) conduct and support research and monitoring on household, local, and global production of black carbon and other pollutants emitted by fuel-based lighting;

(2) conduct and support research and monitoring on the adverse human health and environmental effects associated with the black carbon and other

pollutants emitted by fuel-based lighting;

(3) research and develop best practices and programs to reduce the adverse human health and environmental effects associated with black carbon and other pollutants through the use of fuel-based lighting; and

(4) inform governments, researchers, and the public of the research, monitoring, best practices, and programs developed under paragraphs (1) through (3).

(5) collaborate and integrate with existing research programs and standards to ensure relevance and interoperability globally

(c) **Funding.**

(1) In general – The program established by subsection (a) shall be funded in the amount of $15,000,000 each year for 10 years.

(2) Criteria – The administrator of the program established by subsection (a) shall establish criteria for the use of funds to conduct the research, monitoring, and other activities described in subsection (b).

(3) Consultation – The criteria established under paragraph (2) shall be developed in consultation with:

(A) domestic and international businesses, academic institutions, and non-profit institutions that are interested in reducing the adverse health and environmental effects of fuel-based lighting;

(B) domestic and international businesses, academic institutions, and non-profit institutions that are developing or are interested in the development of fuel-based lighting;

(C) the [*other relevant agencies within the developed country*];

(D) indigenous and affected populations/community leaders in developing countries, and other stakeholders; and

(E) the interested public.

(4) Notice and Comment – The administrator of the program established by subsection (a) shall provide public notice and an opportunity for any interested party to comment on any proposal to establish criteria under paragraph (2) or amendments thereto.

(5) Availability of Funds – The funding provided by paragraph (1) shall be available to any offices or programs within the [*agency for applied energy research and design*] in accordance with:

(A) the criteria established under paragraph (2); and

(B) such other rules as are established by the [*agency head*].

(6) Grants and Other Aid – The administrator of the program established by subsection (a) may, in accordance with the criteria established under paragraph (2) and without the need for any matching or base funds, use up to 80 percent of the funding provided by paragraph (1) to provide grants, loans, or other methods of financial support to academic and other non-governmental entities for the health and environmental research, monitoring, and other activities described in subsection (b).

(d) **Monitoring; Reporting**

The administrator of the program established by subsection (a) shall:

(1) monitor the effectiveness of the program; and

(2) report every 5 years after the date of enactment of this Act to the [*appropriate developed country officials and entities*] and the public on the effectiveness of the activities supported by and carried out under the program.

(e) **Accounting**

The administrator of the program established by subsection (a) shall account for the funds it receives and distributes. The accounting shall comply with generally accepted accounting principles and shall be made available to the [*appropriate developed country officials and entities*] and the public within 90 days of the end of each fiscal year.

COMMENTARY

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I. SECTION 2. FINDINGS

The most important aspect of the first proposed finding is the emerging acceptance of a shared global responsibility for communities to develop in sustainable ways, and in accordance with the community needs and wants.[1]

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1. *RIO+20 United Nations Conference on Sustainable Development*, U.N. SUSTAINABLE FUTURE 1-6 (2011), http://www.un.org/en/sustainablefuture/pdf/conf_brochure.pdf (this understanding was most apparent at the Rio+20 conference in 2012, where over ten days, more than 45,000 global leaders, including about 130 heads of state and government pledged $513 billion to build a sustainable future. Discussions centered around two main themes: how to build a green economy to achieve sustainable development and lift people out of poverty; and how to improve international coordination for sustainable development. Far greater costs will be incurred in the future if action is not taken now—poverty, instability, and the degradation of the planet will only increase with time); *see* Gwenaelle Legros et al., *The Energy Access Situation in Developing Countries: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa*, WORLD HEALTH ORG. 10 (2009),

Inequalities in energy access provide an opportunity for developed countries to support developing countries and the communities and businesses aspiring to this degree of sustainability. As the first and second proposed findings indicate, responsibility for Sustainable Development is "differentiated" in the sense that countries experiencing high levels of poverty bear the brunt of the responsibility to solve the poverty puzzle – but not alone. As global citizens, the wealthy and developed countries support developing countries in numerous ways to ensure sustainable development through access to energy for all.[2]

As noted in findings three through ten, a large part of the global community—as many as 1.5 billion people—rely upon unsafe or non-existent methods to provide lighting in their homes. The burning of kerosene or other non-renewable fuels correlates to health and safety issues, spanning the gamut from lung disease, fever, abdominal distension to explosion and fire. A lack of illumination all together leaves people vulnerable to crime and theft at night. Children in developing countries suffer particularly negative outcomes of this not only in their education, but also in their development as kerosene has drastic consequences on their health, particularly when children are malnourished.[3]

As highlighted by the ninth proposed finding, the development and deployment of improved indoor lighting products is essential to the U.N. Sustainable Development Goals, and to the overarching purposes of eliminating poverty.[4] Challenges in poverty often stem from a lack of access to resources; without the capacity to read after the sun sets, the energy poor have less of a chance to reach their goals of education. One important way to combat this issue is a legal mechanism that overcomes this inequality.[5] Children are specifically vulnerable in an energy poor environment with little to no illumination capacities.[6]

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http://content.undp.org/go/cms-service/stream/asset/?asset_id=2205620.

2. Charlotte Epstein, *Common But Differentiated Responsibilities*, BRITANNICA (2015), http://www.britannica.com/topic/common-but-differentiated-responsibilities; *see also The Principle of Common But Differentiated Responsibilities: Origin and Scope*, CISDL Legal Brief to the World Summit on Sustainable Development (Aug. 26, 2002), http://cisdl.org/public/docs/news/brief_common.pdf.

3. Nicholas L. Lam et al., *Kerosene: A Review of Household Uses and Their Hazards in Low- and Middle-Income Countries*, 15 J. TOXICOLOGY & ENVTL. HEALTH, 15, 17-21 (2012), http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3664014/pdf/nihms447641.pdf; Debajit Palit & Jarnail Singh, *Lighting a Billion Lives—Empowering the Rural Poor*, 59 BOILING POINT 42, 42 (2011); P. Gupta et al., *Kerosene Oil Poisoning—A Childhood Menace*, 29 INDIAN PEDIATRICS 979, 979-83 (1992), http://www.indianpediatrics.net/aug1992/979.pdf.

4. *See* Legros et al., *supra* note 1.

5. Simon Batchelor, Joy S. Clancy & Margaret Skutsch, *The Gender-Energy-Poverty Nexus: Finding the Energy to Address Gender Concerns in Development*, 7 (2002), http://www.riaed.net/IMG/pdf/DFID_Doc_Energy_Gender.pdf.

6. *See* Lam et al., *supra* note 3; Batchelor, *supra* note 5; Kristine Pearson, *Kerosene: A Burning Issue in Women's Rights, Human Rights*, LIFELINE ENERGY BLOG (Oct. 2, 2011), http://lifelineenergy.org/kerosene-a-burning-issue-in-human-rights/; William D. McNally, *Kerosene Poisoning in Children: A Study of 204 Cases*, 48 J. PEDIATRICS 296 (1956) (children may not have time to complete their studies during daylight hours, and are therefore unable to take full advantage of their education since it is impossible to read at night without lighting sources. It is postulated that there are

Lighting with kerosene can have drastic consequences on not just health, but also on global development and degradation of resources. Fossil fuels are not only unsustainable; but in addition, the burning of fossil fuels is dangerous.[7] Illness and injury do not wait for daylight to strike. Reliable lighting sources will better facilitate the access and delivery of medical care, particularly after dark.[8]

II. SECTION 3. POLICY

Section 3 sets out seven proposed policies that support this legislation. These policies are written in sparse terms allowing for their more complete expression by each country that adopts them. Most of the proposed policies relate directly to discrete sections within the proposed Model Law. Two of them do not directly relate: Policy No. 2, which promotes renewable energy technologies, and Policy No. 6 which suggests minimum performance standards.

The choice of power source is an undercurrent of power that is important to consider in the promotion of sustainable lighting technology. As Policy No. 2 and No. 3 suggest, this is an important problem that requires significant consideration because perceived low kerosene costs may impede the adoption of sustainable lighting technologies and frustrate the goal of this statute. A solar bulb or a microgrid tied to a wind generator will have significant up-front costs.[9] However, over the long term, kerosene begins to become expensive, potentially costing many times more than some electric light bulbs. A 2003 study conducted in Berkeley found that LEDs of that time cost five cents per thousand lux hours, while non-pressurized kerosene lamps could cost as much as $3.80 per thousand lux hours.[10] Accordingly, starting with the policies, and at each level of implementation, it is important for the grant, entrepreneurial, tech-transfer and research programs created under this Model Law to consider how to overcome the financial barriers to the implementation of renewable resources.

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approximately 1.3 billion people living in poverty and 70% of this population are women; many of these women live in female-headed houses in rural areas. The energy inequality hinders their decision making within the household and community while preventing their abilities perform rudimentary tasks with any degree of efficiency.).

7. Francis X. Johnson & Fiona Lambe, *Energy Access, Climate and Development*, COMMISSION ON CLIMATE CHANGE AND DEVELOPMENT 3 (2009), http://www.sei-international.org/mediamanager/documents/Publications/Climate/ccd_energyaccessclimateanddev2009.pdf; Nancy Floyd et al., *Sustainable Energy Development in Emerging Markets*, 24 U. PA. J. INT'L. ECON. L. 759, 799 (2003), ("often up to one-third of their disposable cash income to purchase energy services of rather poor quality . . . 35-45 cents/kilowatthour or more . . . through poor energy, batteries and the night candles, kerosene and the like."); Gautam S. Dutt, *Illumination and Sustainable Development Part I: Technology and Economics*, 1 ENERGY FOR SUSTAINABLE DEV. 23 (May 1994).

8. Batchelor, *supra* note 5; Kamil Kaygusuz, *Energy Services and Energy Poverty for Sustainable Rural Development*, 15.2 RENEWABLE AND SUSTAINABLE ENERGY REVS. 936, 940 (Feb. 2011).

9. Kaygusuz, *supra* note 8; Evan Mills, *The Specter of Fuel-Based Lighting*, 308 SCI. 1263, 1263 (2005), http://light.lbl.gov/pubs/mills_science_fbl_enhanced.pdf.

10. Evan Mills, *Technical and Economic Performance Analysis of Kerosene Lamps and Alternative Approaches to Illumination in Developing Countries*, LAWRENCE BERKELEY NAT'L LAB. 3 (June 28, 2003), http://evanmills.lbl.gov/pubs/pdf/offgrid-lighting.pdf.

An additional policy that is proposed is the encouragement of minimum quality and performance standards (No. 6). Those products that are being endorsed or funded by international aid should be subject to testing and standards to ensure their performance. The worst potential outcome would be a situation where the assistance provided at substantial costs yields only ineffective or defective products that do not supply the needed light.

III. SECTION 4. DEFINITIONS

Section 4 provides important definitions for the development and dissemination of clean lighting. Paragraph (1) addresses three important components of the definition of a "Lighting Product." First, the definition refers to the essential qualifications that lighting products made from sustainable energy technology possess, which are "appropriate durable, affordable, renewable, harmless, and accessible." There is no prioritization in the process of qualification, as all of them are equally important and thus have to be met.

Second, "Lighting Product" has to satisfy two requirements that have to be "demonstrated, tested, and certified."[11] First, the "Lightning Product" has to fulfill agreed upon "Brightness Standard." Second, the "Lighting Product" has to satisfy "indoor ambient air quality standards."[12] Although the recommended standards are significantly incorporated within the definition of "Lighting Product," in some cases, satisfying such standards may be too burdensome or even practically unattainable for a particular developing country. Therefore, if a developing country determines that indoor ambient quality standards cannot be achieved, the developing country may establish the reasonable interim air quality standards that improve existing indoor ambient air quality and best serves the needs of the developing country and its communities.

Third, the "Lighting Product" has to meet minimum durability standards, which should be determined based on the needs, conditions, and abilities of that

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11. The method of demonstration, testing, and certification has not been provided in the body of the Model Law, as it has to cater to the specific needs and conditions of a developing country that is implementing this Model Law. Therefore, all actors and stakeholders involved in the establishment of lighting in that particular country should be engaged in structuring the method of demonstration, testing, and certification of "Lighting Products."

12. Stephen Katsaros & Elizabeth Neville, *Globalization of Markets for ASET, in* INTERNATIONAL ENERGY AND POVERTY: THE EMERGING CONTOURS 218, 220 (Lakshman Guruswamy ed., 2015) (addressing the bodily hazards of kerosene which have been linked to several health symptoms such as "abdominal distension, breathlessness, fever, convulsions, unconsciousness, cough, and, in some cases, death."); *see Air Quality and Health Fact Sheet No. 313*, WORLD HEALTH ORG. (Mar. 2014), http://www.who.int/mediacentre/factsheets/fs313/en/index.html; *WHO Guidelines for Indoor Air Quality: Selected Pollutants*, WORLD HEALTH ORG. 4 (2010), http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf ("the air quality guidelines for particulate matter recommended by the 2005 global update *(3)* are also applicable to indoor spaces and a new review of the evidence is not necessary at present."); *see also WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide: Summary of Risk Assessment*, WORLD HEALTH ORG. 8-13 (2006), http://apps.who.int/iris/bitstream/10665/69477/1/WHO_SDE_PHE_OEH_06.02_eng.pdf.

particular developing country and its people.[13] The requirement of minimum standard durability comes from the experience that has demonstrated that durability of lighting products is essential for a long-term success of the development in lighting sector.

Paragraph (2) defines the "Brightness Standard," as it directly correlates with the sustainability of the "Lighting Product." "Brightness Standard" contains the requirement that lighting products for general household use must provide an output of 20 lumens[14] of illuminate an area equal to 2 sheets of paper at 25 lux. Metrics for measuring brightness and luminosity are often based on lumens. A lumen measures one square foot of light that is produced by a candle one foot away from a wall.[15] Although lux and watts may also be acceptable measurement standards in some instances, this Model Law will use lumens.[16]

IV. SECTION 5. LIGHTING PRODUCT MANUFACTURING, PROMOTION, AND DISTRIBUTION

Section 5 establishes a program to support the manufacturing, promotion, and distribution of lighting products in developing countries. An adopting country may find that an existing office, agency, or program has the appropriate capacities to carry out the program;[17] in other cases, a new program or office may best serve the

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13. The process of determining what the minimum durability standards should be should include all parties working on the sustainable lighting under this Model Law. The aim of this collaboration is to reach an agreement that could be fulfilled by the investors and/or the developed countries without creating unreasonable burdens on the developing countries.

14. An output of 20 lumens is equated to a 4 watt night light bulb, which is the minimum of brightness in lumens. *See Lumens & LED Brightness*, POWERSURE, http://www.power-sure.com/lumens.htm#Led0 (last visited Feb. 4, 2016).

15. K. SOMAN, INTERNATIONAL SYSTEM OF UNITS: A HANDBOOK ON SI UNITS FOR SCIENTISTS AND ENGINEERS 16 (2009); *see also LED Flashlights Fact Sheet*, STARLINE INC, https://us.starline.com/content/image/Forms/distributor_resources/FactSheets/Starline_FactSheet_LED.pdf.

16. Wattage is a measure of power, and lux, a measure of the spread of light in an area, is defined as one lumen per square meter. Power does not necessarily translate into luminance; while a lightbulb may use a certain wattage, if it is especially inefficient it will emit a low light output. Lumens are appropriate to use here because they measure the total light output from a source, and are useful as a base or foundation measure from which to work out a lux measurement, for example, if a light bulb is fitted in a home. Further, not all lights are likely to be used indoors and lighting equipment often draw more attention to a lumens measurement than a lux measurement. For example, the United States Dept. of Energy's EnergyStar program now measures bulb brightness in lumens. *See Lighting Made Easy – Just Look for the Energy Star*, ENERGY STAR, https://www.energystar.gov/ia/partners/manuf_res/ES_Lighting_ConsumerFactsheet.pdf?0b551475. *See also Lumens and The Lighting Facts Label*, U.S. DEP'T OF ENERGY, http://energy.gov/energysaver/lumens-and-lighting-facts-label.

17. An example of a developed country's agency that has the appropriate capacities to carry out the goals of this model legislation is the Office of International Affairs ("IA") within the United States Department of Energy. The IA is primarily responsible for "international energy cooperation in energy, science, and technology . . .[by] lead[ing] and develop[ing] the Department's bilateral and multilateral R&D [research and development] cooperation, including investment and trade activities." *Office of International Affairs*, U.S. DEPT. OF ENERGY, http://www.energy.gov/ia/office-international-affairs (last visited Apr. 1, 2016).

goals of the model legislation.[18] In either case, the best course is likely to avoid duplication and leverage existing administrative infrastructure to support the implementation of lighting product development, manufacturing, promotion, and distribution projects in developing countries. In finding or creating a program, office, or agency that will implement this model legislation, the adopting country should consider how the entity will create and foster international partnerships and partnerships with local entrepreneurs.[19]

Multiple countries, non-governmental organizations, and donors have collectively and individually contributed to the efforts of providing lighting for everybody by assuring collaboration, funding, and resources to develop and promote the cause.[20] For instance, the United States has committed more than $7 billion over a period of five years to finance sustainable and long-scale solution to better access to energy, particularly lighting.[21] The overarching emphasis of such global efforts has been settled on a bottom-up approach in providing access to lighting.[22] The Model Laws on Lighting provides for a bottom-up solution, which is based on the partnership between developed and developing countries driven by the determined budget to implement sustainable development of lighting.

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18. In creating a new office, agency, or program, an adopting country has a number of internal options in creating a new entity. One option is to create a quasi-governmental agency with a private organization or companies that have expertise in lighting products. *See* KEVIN R. KOSAR, CONG. RESEARCH SERV., RL 30533, THE QUASI GOVERNMENT: HYBRID ORGANIZATIONS WITH BOTH GOVERNMENT AND PRIVATE SECTOR LEGAL CHARACTERISTICS 2 (2011) (explaining that a quasi-governmental entity is an "organization that has been assigned by law, or by general practice, some of the legal characteristics of both the governmental and private sectors."). Some examples of private companies working towards providing access to energy with lighting that an adopting country could partner with are Elephant Energy and Nokero, both of which are working towards creating and providing sustainable energy technologies. *See* NOKERO SOLAR, http://www.nokero.com/ (last visited Nov. 6, 2015); ELEPHANT ENERGY, http://www.elephantenergy.org/ (last visited Nov. 6, 2015).

19. An example of international partnership can be seen with the United States Environmental Protection Agency's working with Brazil's Sao Paulo Sanitation Technology Company (CETESB), a Sao Paulo State environmental agency, by sharing information on environmental management and risk reduction. *EPA Collaboration with Brazil*, U.S. ENVTL.. PROTECTION AGENCY, http://www2.epa.gov/international-cooperation/epa-collaboration-brazil#activities (last visited Nov. 4, 2015).

20. For example, according to the International Energy Agency, sub-Saharan Africa will require more than $300 billion in investment to achieve universal electricity access by 2030. Press Release, Office of the Press Sec., Fact Sheet: Power Africa, (June 30, 2013), https://www.whitehouse.gov/the-pressoffice/2013/06/30/fact-sheet-power-africa. Consequently, only with greater private sector investment can the promise of Power Africa be realized. The global effort to provide lighting to everyone has been shared by multiple governmental, non-governmental, and private actors, such as the Global Off-Grid Lighting Association ("GOGLA") (http://global-off-grid-lighting-association.org/); The World Bank Group & International Funding Corporation with their initiative the Lighting Global (http://www.lightingglobal.org/); the Elephant Energy (http://www.elephantenergy.org); and the U.S. Energy Department.

21. *Id.* The funding incorporated technical assistance, grants, risk mitigation in private sector energy transactions, assistance in structuring governmental policies to attract investment of private sector, investment in energy infrastructure, regulatory reforms, and institutional capacity building.

22. *Power to the People*, THE ECONOMIST (Sep. 2, 2010), http://www.economist.com/node/16909923.

Despite global attention and understanding of the urgent need to create an access to lighting for everyone, the current efforts fall short of what is necessary to bring the change. Financial, institutional, technological, and research support for access to lighting enjoy a track record of proven success, but these efforts have lacked the scale of collective engagement essential for adequate progress. There is no established international funding mechanism or institutional body with the ability to collect, deliver, and implement all of the resources needed to combat the lack of lighting in developing world. The adoption and implementation of the Model Law will have a significant effect on quality of human life, health, education, welfare, environment, and economy on both global and local scales.

The participation of the developed countries in programs under the structure of this Model Law is intended to complement and unify the global efforts of delivering sustainable electricity to every household. It is irrelevant whether the legislation is perceived as a means to implement pledges for international aid, to carry out the common but differentiated responsibility of developed nations to support sustainable development in developing countries, or to pursue other strategic or ethical agenda, developed country engagement in the effort should be recognized as obligatory and indispensable.

The developing rather than developed country should be responsible for the calculation and quantification of the amount needed for the funding in order to implement the Model Law within its territory.[23] It does not mean that a developed country should not have an input in finalizing or amending the funding. The estimated funding should be a product of collaborative effort and dialogue between developed and developing countries (and/or their representatives), as the input from both countries is principle for the ultimate success.[24] For the effective operation and development of the installations under the Model Law, both countries could create and implement options for addressing the risks.[25]

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23. In order to estimate an accurate amount needed for the funding of this project, first the agency that is in control needs to identify and prioritize the barriers for such installations. When assessing the needed funding, barriers faced by the developing country need to be evaluated. Professor Safty suggests taking into account four types of barriers: 1) economic; 2) technical; 3) political/institutional; 4) cultural/social/environmental. Mark Safty, *Assessing Challenges to Development*, *in* INTERNATIONAL ENERGY AND POVERTY: THE EMERGING CONTOURS, 133, 134-35 (Lakshman Guruswamy ed., 2015).

24. The primary requirement for foreign funding and investment is the reduction of an inherent risk of investment in developing countries. Commonly faired conditions include instability and uncertainty. Developing country could mitigate such uncertainty by creating competitive advantage in a form of incentives and/or recognitions. For instance, the developing country could implement certifications for investor's product recognizing investor's contributions to the development of lighting. It has been effectively implemented by several successful energy programs such as Elephant Energy. Developing State that is adopting the Model Law could also incorporate specific indemnities for the investors. *Id.* at 136. *African Ventures*, ELEPHANT ENERGY, http://www.elephantenergy.org/african-ventures.

25. Specific acknowledgement of the possibility of certain risks arising out of the implementation of the Model Law is beneficial for overall effectiveness of the project. Countries are encouraged to evaluate possible risks related to the local energy sector. If domestic conditions of the developing country allow, collaborating countries should identify governmental and/or non-governmental

The Model Law also calls for significant and transparent[26] monitoring, reporting, and accounting. Such practices are important for establishing and maintaining an effective and efficient international aid program of the kind that is called for here.[27]

V. SECTION 6. GRANT PROGRAM

Section 6 provides options that a ministry or agency may utilize in assisting in the development of sustainable lighting solutions in the developing world. Under Section 6, the agency will enable and facilitate: 1) the research and development of appropriate sustainable energy lighting technologies, and 2) the research of the

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structures and actors, specific project developers, communities and their representatives authorized to address prospective problems related to the installations under the Model Law. Countries could also specify, to a reasonable extent, the process and methods of communication between these authorized entities and actors in attempt to resolve problems.

26. Transparency, a growing international concept, calls for governments to be "more open, accountable, and responsive to citizens," which creates trust between the government and the citizens. OPEN GOVERNMENT PARTNERSHIP, http://www.opengovpartnership.org/ (last visited Nov. 11, 2015). The trust that transparency will build will help the adopting country implement and distribute Lighting Products more efficiently.

27. In determining the best course of action for monitoring, reporting, and accounting, the adopting country must determine what method of monitoring will work best for the implementation of this model legislation. There are a number of methods an adopting country can choose from. One example is Social Impact Assessment ("SIA"), which is "the [process] of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions." Frank Vanclay, *International Principles for Social Impact Assessment*, 21 IMPACT ASSESSMENT & PROJECT APPRAISAL 5, 5 (March 2003), http://www.tandfonline.com/doi/pdf/10.3152/147154603781766491. However, SIA is more of an "impact prediction mechanism" that will consider the "social impacts" on the affected communities. FRANK VANCLAY ET.AL., SOCIAL IMPACT ASSESSMENT: GUIDANCE FOR ASSESSING AND MANAGING THE SOCIAL IMPACTS OF PROJECTS, iv, INT'L. ASS'N. FOR IMPACT ASSESSMENT (April 2015), http://commdev.org/userfiles/IAIA%202015%20Social%20Impact%20Assessment%20guidance%20document.pdf Another example is the Logical Framework Approach ("LFA"), which is somewhat different than SIA in the fact that "LFA is an aid to logical thinking and a means by which a project may be structured and described for analytical purposes." Gilroy Coleman, *Logical Framework Approach to the Monitoring and Evaluation of Agricultural and Rural Development Projects*, 2 PROJECT APPRAISAL 251, 252 (December 1987), http://www.tandfonline.com/doi/pdf/10.1080/02688867.1987.9726638. LFA involves the use of a 4x4 matrix with the row representing project objectives and the columns representing how the objectives will be fulfilled. *Id.* Although LFA provides a clear picture of what a project will look like, LFA is more for the initial planning and preparation of a project, rather than a monitoring mechanism. A third example, and perhaps the most efficient method of monitoring and reporting, is IA. IA "brings together natural, social, and economic information" along with bringing "together scientists, policy makers, citizens, NGO, and industry representatives to evaluate" and making decisions. Keely Dinse et. al., BENEFITS OF INTEGRATED ASSESSMENT: INFORMATION FOR DECISION MAKERS, MICHIGAN SEA GRANT & GRAHM ENVTL. SUSTAINABILITY INST., 2 (2010), http://www.miseagrant.umich.edu/downloads/ia/10-200-Benefits-of-Integrated-Assessment.pdf. By brining numerous groups and individuals together, IA allows for generated reports to be "accurate, agreed upon information" that come from not only a local perspective, but also a regional perspective, which also allows for a smoother transition and change if the program needs to be changed. *Id.* at 4-6.

efficacy of work to ensure access to lighting for all.[28]

Kerosene is significantly priced than alternative lighting solutions, but as demonstrated in Section 3, the risks greatly outweigh the benefits of a cheaper fuel source. One in three people use kerosene or other fuels as a light source but only receive 1% of the energy services due to mechanical inefficiencies. Funding will provide not only grounds for research, but also expansion of energy in places where energy poverty is extreme (for example the development of small scale microgrids and deployment of appropriate sustainable lighting technologies). In spending money on these efforts or research and sustainable development, it is estimated that there is the potential to save $75-115 billion a year when looking at factors outside the price of the fuels.[29] Researching the health and environmental benefits will provide more motivation for developed countries to support developing countries to ensure access to illumination.

Through the principle of common but differentiated responsibility, spearheading research on health and environmental benefits is a way developed countries with more sophisticated research institutions can lead research at a global level, as well as support research being done in developed countries on these issues. This public private partnership is currently noted as a placeholder figure that is expected to have fluctuations.[30] This once again points to the common but differentiated responsibilities of more established organizations in the promotion of energy equality. The service and distribution of funds must be the responsibility of the developed country intervening; it should not to be outsourced to a private third party.

To come to a complete understanding of a dynamic issue, all stakeholders must be represented and all viewpoints must be addressed in order to properly move towards a better future for the global community. Consultations must be inclusive and involve members at all levels of the established ministry or agency. When working cross-culturally and across borders, as is the foundation of the support outlined in this document, critical listening and building strong relationships must be a priority to ensuring the lasting impact of this work. This is done through consultations.

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28. Vijay Modi et al., ENERGY SERVICES FOR THE MILLENNIUM DEVELOPMENT GOALS, THE INT'L BANK FOR RECONSTRUCTION & DEV, THE WORLD BANK,& THE UNITED NATIONS DEV. PROGRAMME, 61 (2005), http://www.unmillenniumproject.org/documents/MP_Energy_Low_Res.pdf; Evan Mills, *Why We're Here: The $230-Billion Global Lighting Energy Bill*, 5th Int'l Conf. on Energy Efficient Lighting, Nice, France 369, 376 (2002), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.202.5663&rep=rep1&type=pdf [hereinafter Mills]; KRISTEN RADECSKY ET AL., SOLID-STATE LIGHTING ON A SHOESTRING BUDGET: THE ECONOMICS OF OFF-GRID LIGHTING FOR SMALL BUSINESSES IN KENYA, The Lumina Project, Technical Report #3, 2 (2009), .http://escholarship.org/uc/item/2714q6kz [hereinafter RADECSKY].

29. Mills, *supra* note 28, at 369. The IEA postulates that $70 billion will be needed to fix the problem of energy inequality. *Id.* at 376, 381, Table 5. Although this seems grandiose, the long term benefits will ultimately result in saved money for the global community. *Id.*; RADECSKY, *supra* note 28, at 2; McNally, *supra* note 6 at 296; Gupta, *supra* note 3; Adrian J. Bradbrook et al., *A Human Dimension to the Energy Debate*, 26 NO. 4 J. ENERGY & NAT. RESOURCES L. 526, 532 (2008).

30. Mills, *supra* note 28, at 376.

There is not a one size fits all solution to ensuring access to illumination for all. For example, needs will be completely different in Sub-Saharan Africa, versus arctic tundra environments. The purpose of the ministry or agency established is to best support access to lighting around the world, in widely different environments. Therefore, program goals should be determined through consultations with the parties outlined in paragraph 3 of Section 6. Consultations are not to be used as events to simply inform parties of the work being done. In order to ensure that all parties are represented, awareness of the opportunity, and power of the consultation, must be understood by all parties. It will be wise for this ministry or agency to employ locals where research is done to ensure the power of all voices present.

The established agency head will be the administrator and facilitator that manages the distribution of funds. This abides within the agreed upon ideals of international accounting principles. To ensure that the money is spent in an appropriate manner, 80% of the funds must be appropriated to the aforementioned sectors so that the complexities are being solved with appropriate spending. Robust financial controls must be implemented to ensure funds are used effectively, and not lost to the unfortunate realities of corruption in many nations. Sustainable development requires long-term commitment and continuous checks and balances so that the program can be most effective in addressing energy inequality. Two years will provide enough time for development to occur while also providing insight as to potential room for growth or improvement. Standard practice is to dedicate no more than 10% of budget specifically to monitoring and evaluating of the program work.[31] To ensure the proper usage of funding, like any sound business or agreed upon international standards, an accountant will be used to monitor fund spending and distribution.

VI. SECTION 7. HEALTH AND ENVIRONMENTAL RESEARCH

This section establishes a research program focused on the impacts that sustainable lighting can have both on health and environmental issues. As the purpose section mentions, the most obvious health and environmental impacts are linked physically by black carbon. Black carbon is known to contribute to global warming. "According to some estimates, black carbon . . . [is] the No. 2 contributor to climate change after carbon dioxide."[32] The impacts of carbon

31. *See* Dirk Meusel et al., *A Framework to Monitor And Evaluate Implementation: WHO Global Strategy on Diet, Physical Activity And Health* 8, WORLD HEALTH ORG. (2008).

32. Bryan Walsh, *Black Carbon: An Overlooked Climate Factor,* TIME (Nov. 19, 2009), http://www.time.com/time/health/article/0,8599,1938379,00.html; Nicholas L. Lam, et al., *Characterizing Kerosene Demand for Light in India and Evaluating the Impact of Measures Affecting Access and Dependence, in* INNOVATING ENERGY ACCESS FOR REMOTE AREAS: DISCOVERING UNTAPPED RESOURCES: PROCEEDINGS OF THE INTERNATIONAL CONFERENCE 116, 116-19 (Martina Schäfer et al. eds., 2014). [hereinafter Lam, *Characterizing Kerosene Demand for Light in India and Evaluating the Impact of Measures Affecting Access and Dependence*]; Nicholas L. Lam et al., *Household Light Makes Global Heat: High Black Carbon Emissions From Kerosene Wick Lamps*, 46 ENVTL. SCI. TECH., 13531 (Nov. 19, 2012); *The New Black*, Global Warming, THE ECONOMIST (Jan. 19, 2013), http://www.economist.com/news/science-and-technology/21569686-soot-even-worse-

dioxide on the atmosphere last for decades, but black carbon's effects are short lived.[33] Unlike carbon dioxide, which remains in the atmosphere for centuries and even millennia,[34] black carbon attenuates in the atmosphere quickly when the source is removed.[35] As a result, reducing black carbon *production* would have a substantial impact on climate change – and it could have that impact *quickly*.[36] Indeed, as stated in recent testimony to the U.S. Senate Committee on the Environment and Public Works, "Multiple, peer-reviewed scientific studies have shown that aggressive reductions of those air pollutants that cause warming, in particular methane and black carbon, can reduce the rate of warming over the next several decades by approximately half."[37]

At the same time, using kerosene lamps exposes those using the lamps directly to the smoke guttering from the flame. "As much as 7-9% of kerosene consumed in kerosene lamps is converted to carbonaceous particulate matter that is

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climate-was-previously-thought-new-black. While it is clear that emissions from diesel locomotion, as well as black carbon from industrial facilities are major contributors to the problem, it would appear that controlling kerosene burning has potential to reduce climate change problems. *See* Bond et al., *Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment*, 118 J GEOPHYSICAL RES.: ATMOSPHERES 5380, 5380 (June 6, 2013) (after conducting a 4-year study, the authors conclude that "[p]redominant sources [of black carbon] are combustion related, namely, fossil fuels for transportation, solid fuels for industrial and residential uses, and open burning of biomass."). However, the impact of kerosene burning on black carbon emissions or the impact of black carbon emissions on climate change are not universally accepted. *C.f.,* Richard A. Kerr, *Soot is Warming the World Even More Than Thought* 339 SCIENCE 382 (Jan. 25, 2013) (discounting the impact of biomass burning on global warming).

33. *See* Bond, *supra* note 32, at 5381, 5385, 5387; Drew Shindell et al., *Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security*, 335 SCIENCE 183, 183 (Jan. 13, 2012); Robert F. Service, *Study Fingers Soot as a Major Player in Global Warming*, 319 SCIENCE 1745 (Mar. 28, 2008).

34. David Archer et al., *Atmospheric Lifetime of Fossil Fuel Carbon Dioxide*, 37 ANN. REV. EARTH & PLANETARY SCI. 117, 117, 121 (2009) (noting that the IPCC's initial statement that CO2 will be eliminated from the atmosphere in "50–200 years represents a timescale for equilibration with the ocean, a process that leaves a significant fraction of CO2 in the atmosphere."). The "IPCC reports in 1995 and 2001 compounded the mistake, revising the lower limit of the lifetime estimate down to only five years." *Id.* at 121. Archer points out that the 2007 IPCC report more accurately states that "[a]bout half of a CO2 pulse to the atmosphere is removed over a timescale of 30 years; a further 30% is removed within a few centuries; and the remaining 20% will typically stay in the atmosphere for many thousands of years." *Id.*

35. Gregory R. Carmichael et al., *Short-Lived Climate Forcing Agents and Their Roles in Climate Change*, 77 PROCEDIA – SOC. & BEHAVIORAL SCI. 227, 228 (2013) ("BC is a strong short-lived climate forcing agent.").

36. *Id.*; Nicholas Loren Lam, *Residential Use of Kerosene in Low-and Middle-Income Countries: Pollutant Emissions, Markers of Pollution, Drivers and Impacts*, 1 (2014) (unpublished Ph.D. dissertation, University of California, Berkeley) (on file with author) ("[a]s a source, the net effect of pollutant emissions from kerosene lamps on climate would be positive (warming) given the relatively small cooling effect of co-emitted pollutants.").

37. *Societal Benefits from Reductions in Emissions of Methane and Black Carbon: Hearing on the Super Pollutants Act of 2014 Before the S. Comm. on the Environment and Public Works*, 113 Cong. 2 (2014) (statement of Drew Shindell),
http://sites.nicholas.duke.edu/drewshindell/files/2015/01/Senate_EPW_testimony_Dec2014_Shindell_v3.pdf.

almost entirely black carbon."[38] The International Energy Agency ("IEA") predicts that the numbers of people expected to die from exposure to smoke from using ancient technologies like kerosene lamps and three stone fires is *likely to increase* over the next twenty to twenty-five years.[39] In real-world terms, the IEA's predictions mean that the number of deaths from smoke will in 2030 likely be essentially the same as the number of deaths caused by malaria, tuberculosis, and AIDS – combined – in that same year. As the IEA points out, such policies do not meet the goal of energy access for all.[40]

The remaining portions of Section 7 outlines a funding, monitoring and accounting program that is identical to the other programs set out in Sections 5 and 6. Accordingly, reference is made to the commentary of those sections concerning the financial aspects of Section 7.

38. Lam, *Characterizing Kerosene Demand for Light in India and Evaluating the Impact of Measures Affecting Access and Dependence*, *supra* note 32, at 119.

39. *See* INT'L. ENERGY AGENCY, *World Energy Outlook 2011*, at 489, fig. 13.10 (2011).

40. *Id.* at 469.