



Green Power for Electricity Generation – Creating an Industry in Canada

August 2006

This paper is one of eight background reports on the Canadian Renewable Energy Alliance's model framework and recommendations for a comprehensive Canadian renewable energy strategy. This paper includes recommendations for provincial energy efficiency and conservation policies and for actions backed up by national enabling measures and international participation.

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The Canadian Renewable Energy Alliance (CanREA) is an alliance of Canadian civil society organizations from the non-profit or voluntary sector that share an interest in maximizing energy efficiency and conservation and promoting a global transition to low-impact renewable energy. Members of CanREA believe that this transition is needed to address global climate change, pollution, global energy supply, human security, poverty eradication and economic sustainability. CanREA recognizes that our window of opportunity is limited and that this global transition must begin now through individual country action, international co-operation and a range of innovative market instruments, regulatory measures, public education efforts and voluntary actions.

The organizations actively involved in the formation of CanREA include:

- Canadian Association for Renewable Energies
- BC Sustainable Energy Association
- The David Suzuki Foundation
- Falls Brook Centre
- The Halifax Initiative
- One Sky—The Canadian Institute for Sustainable Living
- The Ontario Sustainable Energy Association
- The Pembina Institute
- Pollution Probe
- The Saskatchewan Environmental Society
- The Sierra Youth Coalition
- STORM Coalition

For more information on CanREA and its members, visit our website at www.canrea.ca

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1. Introduction

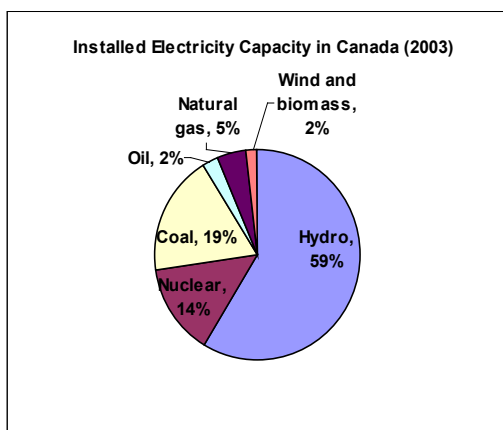
Global wind and solar markets have experienced double-digit annual growth rates for the past decade, with the world leaders benefiting through job creation and enhanced export markets. The European Union, for example, is expected to gain about 711,000 full-time jobs by 2010 under current Green Power policies, and another million by 2020.^a

Green Power is defined as low-impact sources of grid-tied renewable energy, including wind, solar, small hydro, biomass, geothermal, tidal and wave energy projects that meet the criteria for EcoLogo certification for electricity generation as developed by the Environmental Choice Program.

Across Canada, provinces and territories are facing major decisions about electricity generation related to poor air quality and health issues, increasing electricity demand and aging facilities. Canada has an international commitment to reduce GHG emissions to 6% below 1990 levels by 2008-2012. Thermal electricity generation is a major source of GHG emissions, contributing 18% of Canada's 2003 GHG emissions and 27% of total emissions growth between 1990 and 2003.^b

The use of Green Power to generate electricity offers many benefits beyond climate change mitigation and air pollution reduction – it offers opportunities for substantial job creation, rural development, price hedging, greater energy security, clean technology exports and Clean Development Mechanism projects. Canada lags behind many countries in taking advantage of Green Power resources. While there are a number of Green Power initiatives underway across the country, a national plan to promote Green Power does not exist. CanREA members believe that a strategy needs to be developed in a way that complements and enhances regional plans. The strategy should be based on a shared vision among all jurisdictions, and should have broad stakeholder and public support.

2. Overview of Green Power in Canada



Currently, Canada is ranked as the seventh highest country in the world for electricity production.^c Our electricity generation is approximately 590 terawatt-hours (TWh), with an installed Green Power capacity of approximately 3.5 per cent of total generation capacity.^{d,e}

Canada has substantial Green Power resources. It has been estimated that Canada has the technical potential to generate about half of its current electricity needs using Green Power – and an even higher percentage could be generated, if we used electricity more efficiently and further develop cogeneration and fuel substitution.^{f,g} Until recently, conditions in Canada have not been favourable to create thriving markets for electricity generation with smaller-scale,

low-impact renewable sources and technologies.

Canada currently has 1,049 MW of installed wind power capacity, representing about 0.5 per cent of electricity generation.^h The other main Green Power sources are small hydro and biomass.

Green Power Generation Capacity in Canadaⁱ

Technology	MW	Technology	MW
Small Hydro	3,172	Geothermal	0
Biomass	1,935	Offshore Wind	0
Onshore Wind	1,049	Wave Energy	0
Landfill Gas	80		
Tidal Energy	20		
Solar PV	18		
Total	6,274		

Recent Green Power development in Canada has been largely focused on wind energy, though small hydro and biomass currently have a greater installed capacity. In the 2001 federal budget, a Wind Power Production Incentive (WPPI) was put in place. Funds for the WPPI were fully committed by the summer of 2005. WPPI encouraged electric utilities, independent power producers and other stakeholders to gain experience in wind energy development by providing financial support for the installation of 1,000 MW of new wind energy capacity in Canada over a five year period (NRCan 2005).^j NRCan estimated that new wind turbine installations would result in GHG emission reductions of three megatonnes annually by 2010 (NRCan 2005). In February 2005, the federal budget quadrupled the original 1,000 MW target to 4,000 MW. CanWEA estimates that the expanded WPPI “will generate approximately \$6 billion in investment and will create more than 40,000 direct and indirect person-years of employment”. The new Conservative government froze the expanded WPPI and initiated an evaluation of the program. Since the introduction of the first WPPI, the Canadian wind energy industry grew from 137 MW in the year 2000 to 1,049 MW of installed wind power capacity today, with an additional proposed capacity of 2,725 MW by September 2006.

Federal support for Green Power under the current government is under review, with several programs and incentives put on hold in May 2006, including both WPPI and the not yet implemented Renewable Power Production Incentive (RPPI), which was designed to stimulate the installation of 1,500 MW of new renewable energy other than wind (NRCan 2005).^k

Most provinces have announced targets for Green Power development, with some provinces beginning to introduce feed-in tariff policy mechanisms (see appendix attached). Highlights include Ontario’s Standard Offer Contracts (see best practices below) and aggressive wind energy targets in Québec. Québec has linked wind power expansion to economic development by requiring 60 per cent Québec content. This includes 30 per cent regional content, including wind turbine manufacturing costs and; 30 per cent Québec content, including project development, turbine, construction, community enhancement initiatives and transportation costs. This will lead to the development of manufacturing as well as job and economic development opportunities within certain regions and throughout the province. The province is also developing wind and large-scale hydro in tandem to allow hydro resources to function as storage, which will overcome the variability of wind energy.

3. Best Practices

Substantial policy mechanisms to support Green Power are in place in Brazil, China, Denmark, France, Germany, India, Japan, Ontario, Portugal, Québec, Spain, Sweden, the U.S. and the U.K.

In 2005, approximately 58,982 MW of wind power was installed worldwide. The world leaders in wind development, as of December 2005, were Germany (18,428 MW), Spain (10,027 MW), the United States (9,149 MW), India (4,430 MW), and Denmark (3,128 MW). Canada (683 MW) ranked fourteenth in installed

wind power capacity (World Wind Energy Association 2006).^l

In 2005, 1,460 MW of solar photovoltaic (PV) was installed worldwide, representing an increase of 34% over 2004 figures. Germany was the leader, with an installed capacity of 837 MW and an increase of 53% over 2004 figures. Japan had an installed capacity of 1,656 MW, with an annual growth rate of 14% over 2004 figures.^m

Most of the leading Green Power countries are using feed-in tariffs, which allow for generators to sell power to the grid operator at government-set fees that vary depending on the technology, and which guarantee preferred access to the transmission grid. For example, Germany has different feed-in tariffs for hydropower, wind, solar, geothermal and biomass projects. If it becomes apparent that one technology is not being developed at a rate necessary to meet government targets, the fees can be adjusted. Grid operators are required by law to give priority connection to plants generating electricity from low-impact renewable energy sources.

The feed-in tariff approach can be used to support the development of a balanced Green Power portfolio. If it includes long-term commitments and fair pricing, this approach can provide a stable investment environment and lead to the establishment of local Green Power manufacturing facilities. It can also result in a diverse ownership structure for Green Power involving farmers and municipalities, leading to more rural and economic development.

Ontario has emerged as the leader in Canada in the use of feed-in tariffs, with the development of its Standard Offer Contract Program. This program sets a fixed price for renewable energy projects that are 10 MW or less in size. Wind, biomass and small hydroelectric power generation will be purchased by the Ontario Power Authority at a fixed price of 11 cents per kilowatt-hour. Solar PV will receive a fixed price of 42 cents per kilowatt-hour. The program is expected to add 1,000 MW of Green Power by 2016. Expected benefits include the creation of new and high-skilled jobs, rural development, investment opportunities, potential development of a manufacturing base, renewable energy industry development, air pollution reduction and environmental protection, as well as relief for Ontario's strained electricity grid.ⁿ The farming industry, in particular, has labeled this as a 'revolution in farming' and the 'saving of the family farm'. Corn is currently selling at approximately \$900 a hectare, whereas farmers generating electricity from, for example, methane produced by biodigesters, will receive an annual income of about \$1,542 per hectare. Other renewable energy production options from fuel sources, such as wind power, can be implemented.^o

Another approach is to allow grid operators to use their own means to meet legal Green Power targets or a Renewable Portfolio Standard (RPS). Texas has become one of the most advanced wind power states using the RPS approach. At the end of 2005, Texas had an installed wind generation capacity of 1,995 MW.^p The RPS establishes escalating Green Power goals for the state and places responsibility for meeting those goals on the electricity retailers, with significant penalties for non-compliance. The RPS is supported by renewable energy certificate (REC) trading and the national Production Tax Credit (PTC). Due to the focus on low-cost Green Power, the RPS has been successful in stimulating wind power development. However, it has done virtually nothing for other Green Power resources. To remedy this, an RPS would have to assign distinct targets for different Green Power sources. Several members of the European Union have RPS or Renewable Obligations, including the United Kingdom and France.

4. Recommendations for Enabling Policies and Support Mechanisms

Although the provinces and territories are primarily responsible for electricity generation systems, the Government of Canada has a central role to play in Green Power development through the creation of a national renewable energy strategy. If Canada is to fully realize the benefits of Green Power development, it will require a coordinated approach, including strategies in each province, territory and region, as well as in municipalities.

The recommendations made on the following pages are based on multi-stakeholder discussions held across Canada. During 2003-2004, Pollution Probe, working with Summerhill Group, engaged more than 300 stakeholders in a series of workshops – experts in electricity generation, Green Power and policy development

– to discuss the potential for Green Power to meet Canada’s electricity needs and to help build a national consensus on a Vision and Strategy for moving forward.^q Following the national workshop series, Pollution Probe co-hosted three regional and provincial workshops with the Canadian Renewable Energy Alliance and various local partners in Atlantic Canada, British Columbia and Ontario from 2005 to 2006.^r Deliberations at these workshops resulted in regional and provincial recommendations to support Green Power development.

Recommended Provincial and Territorial Measures

Provinces and territories are primarily responsible for Canada’s electricity generation systems. Provincial and territorial Green Power strategies should be developed and supported by complementary measures.

Provincial and territorial Green Power recommendations include:

1. Leveling the Playing Field Measures should be implemented to achieve a level playing field, such as renewable portfolio standards, targets or equivalent policy commitments, a green power production incentive (GPPI), green power procurement, a renewable energy certificate system, and a system benefits charge.^s
2. Supporting Innovative Technologies Provinces should develop centres similar to Ontario’s Centre for Energy, which brings ideas around leading edge research and development in energy markets, new energy systems and emerging technologies to the market place.^t This demonstrates a provincial government program complementing national programs to promote the development of renewable energy.
3. Engaging Canadians Provinces should develop community engagement programs and a comprehensive public education and outreach strategy. Provinces should also facilitate community-based Green Power projects through the introduction of feed-in tariffs, which guarantee 20 year contracts with premium pricing and preferential connection to transmission grids, and the development of a cooperative fund to assist development.
4. Accessing the Transmission Grid Priority access should be granted to Green Power, and transmission upgrades should be targeted to locations with high Green Power potential. Studies and supporting policy actions should be urgently developed and implemented exploring integration of Green Power into transmission grids to avoid constraints on Green Power development.
5. Mapping Green Power Resources Further detailed Green Power resource mapping should be completed at the provincial level.
6. Establishing Mechanisms for Distributed Generation Policy frameworks should be developed to support distributed generation and reduce demand for central, large-scale electricity generation, as well as to reduce peak demand for grid-based electricity (i.e., peak-shaving).
7. Streamlining Zoning, Planning and Permit Requirements Regulations and institutional structures should be developed to reduce the administrative burden for Green Power projects. Policies that encourage community ownership can build support at the local level by providing benefits to local populations, thus facilitating faster and less costly permitting processes.
8. Developing Codes and Standards to Promote Green Power Development and Ensure Quality and Safety Standards at the provincial and territorial levels should be developed in accordance with legislation, such as building codes, to ensure effective implementation of renewable energy systems.
9. Preparing the Labour Force Provinces and territories should be proactive in preparing the labour force to support Green Power industry development and serve the need for geographically dispersed jobs throughout the country.
10. Setting Up Green Power Coordinating Bodies Coordinating bodies should be created at the provincial and

territorial levels to engage relevant ministries and stakeholders to oversee the establishment and implementation of targets for Green Power development and deployment.

Federal Support and Enabling Measures

The federal government should continue to provide national incentives for Green Power production, research and development. The federal government has a role to play in fostering communications across the country to facilitate coordinated regional strategies that lay the foundation for a national strategy. Support is required to upgrade and extend transmission grids, establish training programs, develop standards, map Green Power resources and develop a viable market through government procurement. A renewable energy coordinating body should be established to implement the national Green Power Vision and Strategy, identify barriers and engage in problem solving.

Federal government recommendations include:

1. Leveling the Playing Field National Green Power targets should be developed. The WPPI and RPPI should be unfrozen and expanded to 12,000 MW; approximately 8,500 MW from wind and 3,500 MW from non-wind sources (Clean Air Renewable Energy Coalition 2005).

2. Supporting Innovative Technologies Continued and expanded support should be provided for both developing technology and assisting in market penetration of renewables. Organizations that have been established, such as Sustainable Development Technology Canada (SDTC), should receive ongoing financial support.

3. Engaging Canadians The Government of Canada should develop a comprehensive public education and outreach strategy to catalyze and support provincial initiatives. Federal funding should be provided to support provinces in the development of community-based Green Power projects.

4. Mapping Green Power Resources More comprehensive Green Power resource assessments should be completed to facilitate Green Power development across Canada.

5. Establishing Mechanisms for Distributed Generation Aggressive national targets should be set for solar roofs, supported by capital buy-downs to facilitate their widespread use (e.g., Germany has a target of 100,000 solar roofs).

6. Developing Standards to Ensure Quality and Safety More Canadian engineering standards should be developed. National technical rulemaking is required to deal with conflicting standards and to clarify jurisdiction for technical matters.

7. Preparing the Labour Force Canada should support the development of enhanced Green Power education programs, including technical training and certification courses, as well as engineering and design programs.

8. Setting Up Green Power Coordinating Bodies Coordinating bodies should be created at the federal level to engage relevant ministries and stakeholders to advise on and support the establishment and implementation of national targets for Green Power deployment.

5. Recommendations for Other Green Power Actors

Action will be needed on several fronts in order to develop and deploy Green Power to its maximum potential. This will require a coordinated effort among many actors including:

Municipalities Local governments should streamline Green Power planning and permitting practices. They should also develop non-grid-connected renewable energy sources, as well as Green Power procurement

initiatives and they should support the development of sustainable communities, such as Okotoks in Alberta.^u

First Nations Increased funding, training and capacity building should be provided to First Nations to develop Green Power. The Squamish Nation in British Columbia is an example of an active community.^v Renewable energy development in First Nations communities offers many benefits, such as economic development by selling power to grid operators, the creation and preservation of jobs, education and skills development and enhanced community leadership and empowerment.

Other Stakeholders Utilities should provide their expertise to support the development of regional Green Power strategies and should play a key role in implementation. They can identify effective ways to offer Green Power products to industrial and retail customers. The Canadian Standards Association (CSA) and other standard-setting bodies should develop appropriate Green Power standards. Universities and Community Colleges, and their national associations, should develop programs to educate and train the labour force.

7. Conclusion

Other countries are showing that there are tremendous benefits to Green Power development. For Canada to take full advantage of its vast resources in a timely manner, we need clearly defined policies, targets and strategies at the municipal, provincial, territorial and national levels. Coordinating bodies are needed to oversee the implementation of the strategies. Public support is essential. Most importantly, political will and vision are needed to make it happen.

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Green Power Provincial Targets and Policies

Information Updated: August 2006

Nova Scotia — RPS for 5 per cent of total generation must be renewables by 2010.

- September 2006 – RPS draft regulations to be released
- Sources include: small-scale hydroelectricity, wind power and biomass fuels
- Sources must be built after 2001 as per Electricity Act
- By 2006 – 70 MW of wind power to be in operation
- 100 MW of wind power either in operation or installed

New Brunswick — RPS for additional 10 per cent of total consumption by 2016.

- RPS established in regulation under the Electricity Act that includes a 1% addition per year of Environmental Choice Program approved generators between 2007 and 2016
- Most common sources include: wind, biomass, hydro and landfill gases
- By 2009 – 200 MW of wind power to be in operation.
- By 2016 — up to 400 MW of wind energy to be purchased by NB Power.
- Tidal-energy demonstration projects to be identified

Prince Edward Island — RPS for 15 per cent of total generation by 2010. Exploring 100 per cent by 2015.

- December 2005 — Renewable Energy Act proclaimed including an RPS and guaranteed feed-in tariff for community, wind cooperative and large systems
- RE Act requires utilities to acquire at least 15 per cent of their electrical energy from renewables by 2010. 100 per cent by 2015 will be proclaimed at a later date.
- Sources include wind, solar, hydro and biomass
- February 2005 — EOI for oil seed extraction and biodiesel manufacturing plant. Government preparing list of potential incentives
- Spring 2005 — announced intention to develop a wind-hydrogen village demonstration project
- April 2006 – contracts signed for additional 39 MWs of wind energy pending approval by the Island Regulatory and Appeals Commission (IRAC)
- By 2010 - province committed to development of at least 200 MW of wind energy

Newfoundland — RFP for 25 MW to be released December 2005.

- Nov. 2005 – Public Discussion Paper released Developing an Energy Plan for Newfoundland and Labrador. Consultations still ongoing
- Dec. 2005 – 25 MW wind RFP released. First phase completed. Finalized feasibility studies due in Aug.
- June 2006 – Newfoundland and Labrador Hydro to oversee a wind monitoring program

Québec — Targets for 4,000 MW of wind by 2015

- Contracts signed for approximately 1200 MW of wind
- 2000 MW of wind to deliver by Dec. 2013 (300 MW-Dec. 2009, 400 MW-Dec. 2010, 400 MW-2011, 450 MW-Dec. 2012, 450 MW-Dec. 2013)
- Wind power development to be facilitated by integration with large hydroelectric projects currently under development

Ontario — RPS for 5 per cent (1,350 MW) by 2007 and 10 per cent (2,700 MW) by 2010 of total generation to be new renewables.

- August 2006
- Wind: 139 MW (operating), 67.5 MW (complete), 1,104 MW (in progress)
- Small Hydro: 8 MW (operating), 43 MW (in progress)
- Biomass: 2.5 MW (operating), 5 MW (in progress)
- Fall'06- standard offer contract program to be introduced modeled after feed-in tariff. There is no limit but expected to result in 1,000 MW of green power by 2016

Manitoba — Target for 1,000 MW of wind by 2014.

- October 2004 — wind power strategy developed
- March 2006- 99 MW wind project operating
- March 2006 – EOI results announced for 1,000 MW of wind by 2016

Saskatchewan — Target for 150 MW of wind by 2005. 100 per cent of new generation until 2010 to be operations that do not add to GHG emissions.

- Projects include: wind (major component), energy conservation, small hydro, distributed generation (includes cogeneration), and Environmentally Preferred Power (EPP) Program (low environmental impact generation such as, flare gas and heat recovery systems)
- Dec. 2005 – 150 MW wind farm operating
- May 2006 – 25 MW wind power project selected for EPP
- Oct. 2006 – Short-term recommendations, including renewable energy, to be presented to the Premier
- June 2007 – Final report including a blueprint for the medium and long terms for renewable energy development and conservation to be presented to the Premier

Alberta — Target for 3.5 per cent of total generation by 2008.

- 3.5 per cent renewables target represents about 560 MW of new capacity
- A 900 MW “threshold” (maximum) of wind energy established due to transmission constraints. Ongoing analysis and stakeholder engagement to increase threshold
- 20 kW of solar PV to be installed on municipal buildings. Project began July 2006

British Columbia — 50 per cent of new generation to be “clean energy” by 2012.

- Voluntary goal for electricity distributors
- Sources include wind, solar, ocean, biomass, hydro, geothermal, fuel cells, efficiency measures and cogeneration
- April 2005 — release of Alternative Energy and Power Technology: A Strategy for BC
- 2006 RFP: 325 MW of wind, 140 MW of biomass and 238 MW of small hydro (defined as no greater than 50 MW)

Endnotes

- ^a Modeling and Monitoring Initiative for Renewable Energy, ALTENER Programme, Directorate General for Energy and Transport, European Commission. 2004. Meeting the Targets and Putting Renewables to Work – Overview Report. Retrieved from http://www.esha.be/fileadmin/esha_files/documents/publications/others/MITRE_Overview_Report.pdf
- ^b Environment Canada. 2003. Canada's Greenhouse Gas Inventory, 1990-2003. Retrieved from http://www.ec.gc.ca/pdb/ghg/inventory_report/2003_report/toc_e.cfm
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- ^d National Energy Board. 2003. Retrieved from http://www.neb-one.gc.ca/energy/supplydemand/2003/index_e.htm
- ^e Based on 2003 estimates.
- ^f Pollution Probe. 2004. Report of the Green Power in Canada Workshop Series. Retrieved from <http://www.pollutionprobe.org/whatwedo/greenpower/gpreportdwnldpg.html>.
- ^g Replacement of one fuel by another that produces less particulate pollution, such as replacement of coal with natural gas.
- ^h Based on a 30% capacity factor.
- ⁱ CanWEA. (2006). Canadian Wind farms. Retrieved from <http://www.canwea.ca/en/CanadianWindFarms.html>. All other sources personal communication with Natural Resources Canada, 2006. Note: small hydro is defined as no greater than 50 MW.
- ^j For more information on WPPI see <http://www.canren.gc.ca/programs/index.asp?Cald=107>.
- ^k For more information on RPPI see <http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=681>.
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- ^m Solar Buzz. 2006. Marketbuzz 2006: Annual World Solar Photovoltaic (PV) Industry Report. Retrieved from <http://www.solarbuzz.com/Marketbuzz2006-intro.htm>.
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- ^p American Wind Energy Association. 2006. Annual Industry Rankings Demonstrate Continued Growth of Wind Energy in the United States. Retrieved from http://www.awea.org/news/Annual_Industry_Rankings_Continued_Growth_031506.html.

^q Pollution Probe and Summerhill Group. 2004. A Green Power Vision and Strategy for Canada. Retrieved from <http://www.pollutionprobe.org/whatwedo/greenpower/index.html>.

^r For further information on the workshops including agendas and link to speaker's presentations see <http://www.pollutionprobe.org/whatwedo/greenpower/index.html>.

^s Pollution Probe and Summerhill Group. 2004. A Green Power Vision and Strategy for Canada. Retrieved from <http://www.pollutionprobe.org/whatwedo/greenpower/gpvisionstratdwldpg.html>.

^t For more information on the Centre for Energy see <http://www.oce-ontario.org/pages/aboutenergy.php>.

^u For more information on Sustainable Okotoks see <http://www.okotoks.ca/sustainable/overview.asp>.

^v Randall Lewis. 2006. Expanding the Options for Renewable Energy: Squamish Nation Ashlu Creek Green Power Project. Retrieved from http://www.pollutionprobe.org/Happening/pdfs/gp_march06_van/lewis.pdf.