

Technology Development Fund

Program Guidelines



Welcome!

Thank you for your interest in the Technology Development Fund at the Ontario Power Authority.

The Technology Development Fund is a collaboration of the Ontario Power Authority, the Ontario Centres of Excellence and CEATI International.

This document is intended to serve as a guide only. Please contact the OPA to discuss your initiative prior to making an application.



About the Ontario Power Authority

The Ontario Power Authority (OPA) was established under the *Electricity Restructuring Act, 2004*, and started operations in January 2005. It is a not-for-profit corporation without share capital and is governed by an independent Board of Directors, with its activities and programs directed by a Chief Executive Officer. The OPA reports to the Ontario Legislative Assembly through the Minister of Energy and Infrastructure and is licensed and regulated by the Ontario Energy Board.

In pursuit of its mandate to ensure an adequate, long-term supply of electricity for Ontario, the OPA leads and coordinates initiatives to build a conservation culture, ensures adequate investment in new supply infrastructure, performs long-term electricity system planning and supports the continued evolution of the electricity sector.

One of the key elements of a reliable power system is the ongoing development of new technologies that can help reduce electricity consumption or demand, or provide additional cleaner and/or renewable supply options.

Since the restructuring of Ontario's electricity market, there has been limited research and development activity in the sector. Policy uncertainty has severely curtailed

capital investment and, as a result, technology progress is limited at a time when Ontario is embarking on an unprecedented period of system planning and reinvestment. According to the Ontario Centres of Excellence, the Ontario energy sector's investment in research and development currently represents only about 0.5 percent of annual revenues. In comparison, investment in research and development in the telecommunications sector is more than 20 percent of annual sector revenues.

To help address this gap, the OPA established the Technology Development Fund.

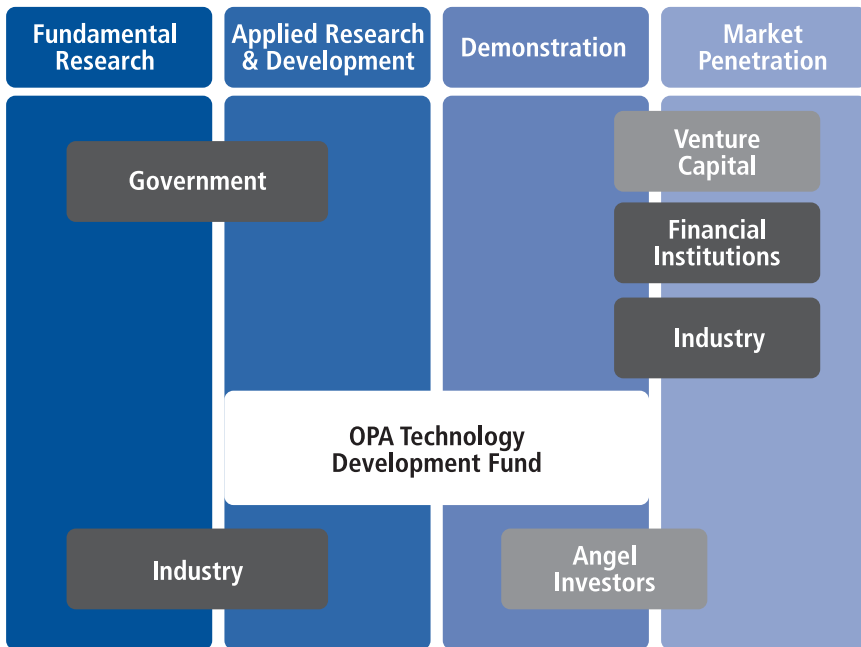
About the Technology Development Fund

The OPA established the Fund in 2006 to provide funding for projects that promote the development and commercialization of technologies or applications that have the potential to improve electricity supply, conservation or demand management. The Fund focuses exclusively on technologies or applications that are pre-commercial or are facing barriers to commercialization, and provides funding for further study, development, demonstration or performance verification.

The Fund has an annual budget of \$1.5 million. Since its inception, the Fund has committed \$3.1 million in funding to 30 projects. This funding has leveraged more than \$35.6 million in partner support.

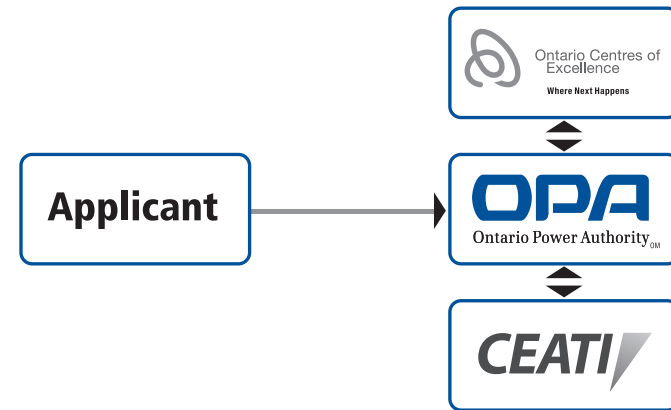
Pre-commercial technologies or applications typically face a greater challenge in

attracting the interest of venture capitalists and manufacturers due to the risk associated with projects at this stage. The Fund's objective is to help these technologies and processes evolve to more commercially viable stages so they can benefit Ontario's electricity consumers.



How to Apply for Funding

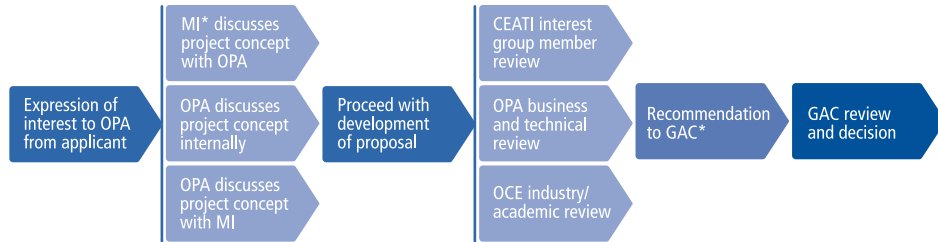
To apply for support from the Technology Development Fund, applications are to be made directly to the OPA. The OPA may then direct the application through one of the Fund's two managing institutions, the Ontario Centres of Excellence (OCE) for projects involving partnerships with Ontario academia and CEATI International for projects led by industry.



The OPA provides funding for selected projects either directly to the applicant or to the appropriate managing institution. The managing institution, in turn, pools this financial support with that of other funders to maximize the leverage of the OPA's contribution. The projects funded to date have obtained leverage funding of \$11 for every dollar of OPA support.

The OPA provides guidance to the managing institutions regarding funding priorities based on current research commissioned by the OPA for its proposed Integrated Power System Plan or by third parties. The OPA's senior program analyst for the Technology Development Fund is the key point of contact with the managing institutions and is fully involved in the project evaluation and management process.

The diagram below outlines how a funding application moves from proposal to approved project:



* MI = managing institution (either the OCE or CEATI International) and GAC = the OPA's Grant Award Committee, which is responsible for all grant decisions for the Fund

There are several entry points for prospective applicants to the Technology Development Fund. You may learn about the Fund through the OPA website or through discussion with OPA staff, at which point we will provide guidance on the suitability of the project concept and the best vehicle for the proposal (i.e., OCE, CEATI or the OPA process). Alternatively, you may have approached one of the managing institutions independently and without knowledge of the Fund. In this instance, projects that meet key Fund objectives are presented on a preliminary basis to OPA staff for initial review. If this review is favourable, the OPA will ask the managing institution to secure a full proposal from the applicant.

Each managing institution has a different process for reviewing and processing

applications. They will provide appropriate guidance should your proposal be accepted for submission and review.

Project results and other project information that is not commercially sensitive will be made available to the OPA. This information will be used to either support the OPA's long-term integrated power system planning process or to share with the public what has been learned from our collaborative investment.

For examples of the types of projects that have been funded to date, visit the OPA's website at www.powerauthority.on.ca/tdfund.

Alternatively, you may reach us using the contact information at the end of this document.

About the Managing Institutions

The roles of the managing institutions are to:

- attract promising projects that are consistent with the OPA's guidelines
- bring these projects to the attention of OPA staff to ensure a fit with the OPA's objectives
- manage the application process, including working with the applicant to develop a proposal
- assemble completed application packages for submission to the Technology Development Fund's Grant Award Committee
- manage the reporting, invoicing and progress of all approved projects.

About the Ontario Centres of Excellence – Centre for Energy

The Ontario Centres of Excellence (OCE) were founded in 1987 and consist of six centres, including the Centre for Energy. Collectively, the centres promote the economic development of Ontario through directed research, commercialization of technology and training for highly qualified personnel. The centres are among the few publicly funded institutions that systematically integrate and manage connections from university to marketplace to ensure the successful application of innovative science and technology to profitable new businesses.

The mandate of the Centre for Energy, launched in January 2005, is to invest in and promote leading-edge research and development in energy markets, new energy systems and emerging technology. The centre invests in research collaborations that:

- accelerate the development of new energy technologies

- integrate new technologies into energy systems
- help industry develop an understanding of energy-related behaviours and markets.

For information on the OCE and its application process, please visit its website at www.oce-ontario.org.

About CEATI International

CEATI International brings together electricity utility professionals from across the world through focused interest groups and collaborative projects to identify and address technical issues that are critical to electricity sector participants. Participants collaborate through interest groups to identify, develop and fund projects that respond to their and the OPA's strategic goals.

Fund projects managed by CEATI go through one of two interest groups—the Customer Energy Solutions Interest Group (CESIG) or the Strategic Options Interest Group (SOIG). OPA staff participate as members of each of these interest groups. The CESIG focuses on developing and funding projects that lead to the commercialization and dissemination of technologies and processes that make more efficient use of electricity and/or

reduce demand. The SOIG focuses on developing and funding projects that lead to the commercialization of sustainable power generation technologies that will result in an increase in power supply capacity and a reduction in greenhouse gas emissions.

For information on CEATI and its application process, please visit its website at www.ceati.com.

Significant lead-time is required before a full proposal is considered by the OPA's Grant Award Committee. To ensure the timely consideration of your initiative, we encourage you to contact the OPA as soon as possible. Contact information appears at the end of this document.

Funding Limits

The Fund's annual budget is \$1.5 million, and the maximum contribution by the OPA for any one project is \$250,000. Projects may be funded over a maximum of three calendar years. In-kind contributions may also be considered as part of the funding composition of a project but must be reasonable and verifiable.

Funding Priorities

The investment of the Fund budget will be guided in part by the following:

- results of emerging technology scans commissioned by the OPA
- published industry research
- business plans of the managing institutions.

The OPA may choose to issue a Request for Expressions of Interest to address any gaps it perceives in its investment portfolio. Please visit the Technology Development Fund website for updates.

The funding priorities are subject to change at any time. Please visit the OPA website for further information and subscribe for updates on the Technology Development Fund.



Eligibility Criteria

The eligibility criteria are as follows:

- Projects must propose to study, develop, demonstrate and/or verify the performance of an emerging, pre-commercial energy technology or application.
- Projects must be consistent with the Fund objective to support pre-commercial technology applications that have the potential to improve electricity supply, conservation or demand management.
- Projects must be led by applicants who demonstrate the financial and organizational capacity to undertake the project.
- Projects must be led by registered partnerships or corporations and not by individuals.

Evaluation Criteria

In addition to the criteria outlined by the managing institutions, all funding proposals will be evaluated against the following criteria:

- consistency with and supportiveness of the OPA mandate and mission, and potential for positive impact on Ontario's electricity system and electricity consumers
- amount of leverage funding from the applicant or other sources (recommended minimum 50 percent of the cost of the project, cash or in-kind)
- strength and practicality of the proposed methodology to measure results and report on the work
- strength of feasibility analysis and the extent to which meaningful measurable results are clearly outlined
- relevance of the mandate of the applicant to the proposed project
- strength of the project team in the area of inquiry, research or demonstration
- strength of working partnerships with relevant organizations or partners
- financial viability of the applicant, including a demonstrated ability to manage and sustain growth that may result from the grant.

Evaluation Process

The evaluation process for funding will encompass the following major stages:

Submission of an Expression of Interest (EOI)

The first step is for the proponent to complete an EOI using the template found on the OPA website. Deadlines for submitting an EOI are listed on the website. The EOI is designed to provide the OPA with a general sense of the technologies and scope of the project. Completed EOIs are screened and evaluated by the OPA as well as by external experts if necessary to ensure they comply with the eligibility criteria, objectives and priorities of the Fund. Applicants who submit EOIs that comply are invited to submit a proposal. EOIs must be submitted to techfund@powerauthority.on.ca.

The OPA may direct an EOI to a managing institution, depending on the nature of the project and/or proponent. The decision to direct the EOI to a managing institution is made by the proponent and the OPA together. The managing institution's project approval process is used in these instances.

Development of Proposal Application and Submission

Proposal concepts are reviewed to ensure that they are consistent with the Fund guidelines and the OPA's objectives. This is accomplished through discussions among the applicant, the managing institutions and OPA staff. Proposals must be submitted to techfund@powerauthority.on.ca.

Business and Technical Review

For projects flowing through OPA internal processes, a business and technical review committee, comprised of OPA staff and an external reviewer if necessary, evaluates proposal submissions. The review committee is responsible for reviewing, scoring and recommending to the GAC proposals that should be approved for funding, if any.

For projects flowing through the Fund's managing institutions, the process is conducted according to the managing institution's process for reviewing project proposals. The OPA participates in the review panel for projects and works with the managing institution to ensure that project proposals meet the objectives of the Fund. Projects that pass the business and technical review are then recommended to the OPA's Grant Award Committee for approval.

Grant Award Committee (GAC)

The GAC is responsible for all OPA funding decisions. The committee includes the Chief Executive Officer, the Vice-President of Conservation and one external reviewer. The committee's approval is conditional on successful contract negotiations with the applicant.

If a project is approved for funding by the GAC, a contract between the OPA or the sponsoring managing institution and the successful applicant is developed and signed. These agreements include contract terms, an outline of the project's deliverables, reporting and payment milestones, and any conditions placed on the grant.

The OPA monitors the performance of all projects that receive grants through regular reports from proponents and the managing institutions.



A mirror alignment measurement device, developed at Sandia National Laboratories in Albuquerque, N.M., may soon make parabolic trough solar collector systems more affordable and energy efficient.

Eligible Expenses

- Planning, feasibility studies and field tests, including costs for qualified professional and technical consultants who are directly involved in the project
- Costs of purchasing office supplies that are required to complete the project activities
- Funding for participation in conferences, workshops and other proceedings where the event is deemed to be important to the execution of the project activity
- Travel costs necessary to complete the project activity
- Costs to consult with and educate a community or sector about the proposed project activity, including surveys, website development and other communication tools directly related to execution of the project activity
- Costs of pilot installations: construction or renovation/retrofit of facilities and structures and leases essential for completion of the project activity but that are limited to the life of the project activity
- Costs to develop a business case for commercialization.

Ineligible Expenses

- Budget deficits
- Activities completed or costs incurred before the funding is approved or after the project is completed
- Costs over \$50,000 for any single consultant or contractor that has not been selected through a tendering process
- Costs associated with the purchase of capital equipment or real estate
- Costs of purchasing office equipment and furniture
- Costs of purchasing office supplies that are not required for completion of the project activities
- Any overhead costs generated by the lead applicant or project activity partners, such as operating costs related to general maintenance and repair
- All costs related to education, training, outreach or promotion not directly related to the project activity.

Case Studies

Following are three examples of projects funded by the Technology Development Fund.

Micro-CHP: Cogeneration for the Residential Market

This project, led by Enbridge Gas Distribution, is focused on developing a micro-combined heat and power (CHP) system with domestic hot water (DHW), automatic back-up power and dispatch capabilities for the Canadian residential market by the 2009/2010 winter season.

The key deliverables of the project are:

- micro-CHP with DHW, automatic back-up power, dispatch capabilities and 5,000+ hours per year of operation
- a software model (educational, marketing and sales tool) that would demonstrate how to optimize the operation of a micro-CHP system in southern Ontario
- six retrofit and 40 new construction installations by 2009/2010 in Enbridge's territory.

The project consists of two major stages:

Stage 1: Six retrofit installations of the micro-CHP systems with space heating and power generation capabilities.

Objectives:

- to ensure product compliance with local codes and standards

- to create technology and product awareness with the Technical Standards Association, Electricity Safety Authority and local electricity utilities
- to facilitate contractor selection and training
- to understand and standardize the process for obtaining grid interconnection permits.

Stage 2: 40 new construction installations of the micro-CHP system with space heating, water heating, power generation, dispatch and back-up power capabilities.

Objectives:

- to validate real-life performance of the developed system
- to verify energy savings.

The project aims to deliver a green cogeneration solution with an overall efficiency of up to 90 percent that can replace the current residential space and water heating system (with minimal risk to consumers), while adding back-up power and dispatch capabilities and bringing cost savings to Canadian households. Other potential benefits of this technology are:

- up to 50 percent reduction in electricity consumption and eight to 12 percent reduction in the overall utility bill for Ontario consumers
- peak shaving potential of 1.2 kilowatts per household and increased generating capacity

- quiet and reliable indoor automatic back-up power system with low nitrogen-oxide emissions.

Up to 100,000 new furnaces are installed in southern Ontario every year. This number represents a total annual market potential for the micro-CHP technology. A major challenge in this project will be compliance with the interconnection requirements of local distribution companies.

Initially, six units will be installed in a retrofit environment. During this installation, all the interconnection nuances will be addressed. The findings will be accounted for in the ensuing 40 new construction installations, which will be done in batches, so that any new issues can be identified during the initial installations, fed back and rectified in time for the remaining installations.

The micro-CHP unit combines two technologies, an advanced home heating system and a natural gas engine-generator. This hybrid heat and power generation package can yield benefits greater than what each system can provide alone.



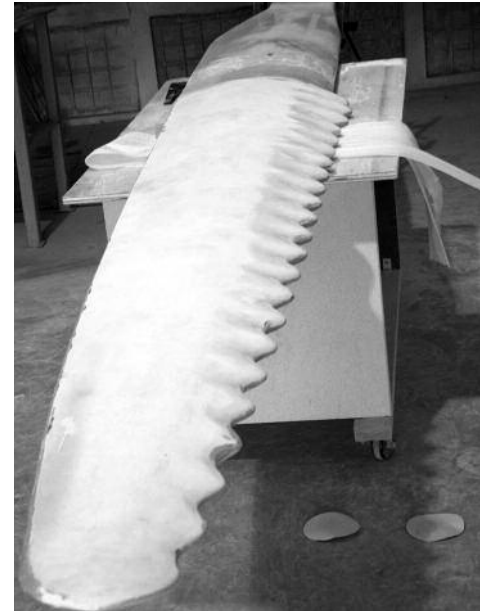
WhalePower – Tubercle Airfoils on Rotating Platforms

Wind turbines only generate their maximum electrical output above a certain minimum wind speed. The trick in siting a wind turbine is finding a wind regime that is near to or above this minimum speed enough to make the wind turbine economical. As the best wind regimes become exploited, profitable wind regimes become scarcer and the potential contribution of wind energy to the province's electrical system diminishes.

Whalepower's tubercle technology allows variable-pitch turbine blades to be pitched to a steeper angle of attack before stalling, increasing the potential lift at any given wind speed. This reduces the minimum windspeed at which the turbine can generate its maximum output, effectively increasing a turbine's capacity factor in any given wind regime. All other factors being equal, the higher the capacity factor of a turbine, the lower the cost per kilowatt-hour of generating electricity.

By shifting a turbine's power curve to the left, tubercle technology may allow for the exploitation of wind regimes in Ontario that were previously held to be uneconomical. With tubercle-enhanced blades, already exploited wind regimes will become more profitable as their capacity factors increase.

The first stage of a tubercle technology retrofit on a commercial turbine blade.



This project is testing whether tubercle-enhanced airfoils work as well on rotating platforms as they do on static airfoils, such as an airplane wing. Whalepower has retrofitted commercial turbine blades and is testing their performance at the Wind Energy Institute of Canada, Canada's leading testing and research institute for wind energy systems, on Prince Edward Island.

At the end of this project, Whalepower will have documented whether tubercles on turbine blades have the same effect as they do on static airfoils and how that translates into rotation in lower wind speeds.

The results to date have been promising, and WhalePower is already in discussions with more than 10 manufacturers, large and small, that have indicated they are interested in the tubercle leading edges for testing on their own products.

For more information please visit: www.whalepower.com.

Inspired by the flippers of humpback whales, Whalepower has developed tubercle technology, which takes its name from the bumps on the leading edge of the whale's flippers.



Cornwall Ontario River Energy (CORE) Project

The primary goal of this project, led by Verdant Power Canada, is to develop 15 megawatts (MW) of kinetic (dam-less) hydropower in the St. Lawrence River at Cornwall, Ontario.



The long-term secondary goal is to help develop more than 15,000 MW of estimated kinetic hydropower potential from Canada's rivers, tidal streams and man-made channels, such as canals and aqueducts, using technologies such as axial-flow and cross-axis turbines in conjunction with flow-acceleration techniques. The tertiary goal is to help build a Canadian industry for the exportation of kinetic hydropower systems, particularly new river-deployed kinetic hydropower technologies. The program will adapt, build and demonstrate kinetic (dam-less) hydropower technologies applied to Canadian river sites.

The first 24 months of this five-year, two-phased project is to plan and permit a pre-commercial project at Cornwall, and to build and test a prototype/pre-commercial system to optimize the technologies for tapping the local Cornwall capacity.

This effort will be in collaboration with a consortium of local and Canadian institutions, including St. Lawrence College, St. Lawrence River Institute, City of Cornwall, Cornwall Electric, Mohawk Council of Akwesasne, Natural Resources Canada and others. The consortium will help assess and deploy river-based kinetic hydropower systems in the St. Lawrence River at Cornwall.

Phase two is to bring the technologies to commercialization for deployment and installation at the Cornwall site as well as others yet to be identified. Consequently, there would be economic, energy and environmental benefits to Ontario.

With this proposal, Verdant Power Canada has the opportunity to demonstrate and export new kinetic hydropower tech-

nological expertise and manufacturing for river sites. Expanding international markets to countries such as Brazil (where Verdant Power already is conducting feasibility studies), China and India also represents a long-term opportunity for a Canadian-based industry that builds on Canada's global reputation for hydropower excellence.

Verdant Power's integrated free-flow turbine systems represent a new sustainable source of distributed generation. Kinetic hydropower systems:

- produce power near its point of consumption using indigenous resources
- require no dams or impoundments and allow for safe fish passage
- have higher, more predictable average power production factors (80 to 85 percent) than wind or solar power (30 to 40 percent)
- are targeting competitive installation cost per kilowatt (kW) (\$2,500 – \$3,500) relative to solar cells (\$6,000 – \$8,000) and wind (\$1,500 – \$2,500)

- are designed to be scalable in configurations from one to 10 MW or more, and thus ideal for distributed generation and the integration of water supply, power generation and hydrogen production.

Deliverables

- Design of a 90 kW integrated "Generation-5" turbine suitable for commercial production
- Fabrication and deployment in test mode of one 90 kW integrated Generation-5 turbine
- Summary report of site analyses, technical and economic studies and permitting/licensing activities corresponding to the full 15 MW project rollout.



How to take the next step

If after reviewing these guidelines you believe that you may have a project that could be eligible for funding, please contact one of the following to discuss your proposal:

Ontario Power Authority

Phil Bosco

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Technology Development Fund*

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Other Potential Sources of Technology Development Funding

- Business Development Bank of Canada (BDC)
www.bdc.ca
- Canada Foundation for Innovation (CFI)
www.innovation.ca/index.cfm
- Canadian Agricultural Adaptation Program (CAAP)
www.agr.gc.ca/caap
- ecoENERGY Technology Initiative
www.ecoaction.gc.ca/ecoenergy-ecoenergie/technology-technologie-eng.cfm
- Federal Economic Development Initiative for Northern Ontario (FedNOR)
fednor.ic.gc.ca
- Green Municipal Fund
sustainablecommunities.fcm.ca/GMF
- Industrial Research Assistance Program (IRAP)
irap-pari.nrc-cnrc.gc.ca
- LDC Tomorrow Fund
www.mearie.ca
- Natural Science & Engineering Research Council of Canada (NSERC)
www.nserc-crsng.gc.ca
- Program of Energy Research and Development (PERD)
www.nrcan.gc.ca/eneene/science/perdprde-eng.php
- Scientific Research and Experimental Development (SR&ED) Tax Incentive Program
www.cra-arc.gc.ca/txcrdt/sred-rsde/menu-eng.html
- Sustainable Development Technology Canada (SDTC)
www.sdtec.ca



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