ENERGY EFFICIENT RETROFIT MEASURES GUIDE

ENERGY EFFICIENCY RETROFIT PROGRAM
FOR LOW-INCOME HOUSEHOLDS – NPO COMPONENT

For nonprofit organizations (NPOs) established under Québec or Canadian law that are listed in the Québec Enterprise Register and that manage rental housing.
Make the right choice!

Doing renovations? Choose energy-efficient measures and you may be eligible for a rebate on the cost of the work under this Program.

Eligibility

1. General condition
   - Nonprofit organizations (NPOs) established under Québec or Canadian law that are listed in the Québec Enterprise Register and that manage rental housing are eligible.

2. Specific conditions
   - Buildings must be rental housing administered by NPOs of the type described above.
   - Eligible buildings are those appearing on the list produced on the basis of the general condition set out above.
   - Buildings must be equipped with permanent electric heating systems that are the main heating system and are used to heat the entire building.
   - Eligible retrofit measures
     - 4A – Replacement of windows and patio doors (sliding glass doors) with ENERGY STAR® certified models
     - 4B – Insulation upgrade – main walls
     - 4C – Insulation upgrade – roof with attic space
     - 4D – Insulation upgrade – roof without attic space
     - 4E – Insulation upgrade – foundation walls
     - 4F – Addition of heat recovery to mechanical ventilation
       (An engineer’s opinion is required; NPOs interested in this measure must contact their federation, which in turn will contact Hydro-Québec.)

The NPO has 12 months as of the date of the preretrofit assessment to have the work performed by a certified contractor and obtain the postretrofit assessment. Conditions applicable to retrofits differ from those applicable to general measures.

Hydro-Québec has established a list of eligible products for measure 4A only; windows and patio doors must be replaced by models that are ENERGY STAR certified for the climate zone where the building is located. Applicable criteria are outlined in the Appendix. For each measure (except measure 4A), Hydro-Québec requires confirmation of the information provided in Appendix – Section 2 by a member of one of the following professional governing bodies (the “competent professional governing bodies”), who will affix his or her seal to the documents and recommend the measure:

   – Ordre des technologues professionnels du Québec
   – Ordre des ingénieurs du Québec
   – Ordre des architectes du Québec

3. Eligibility period
   The work must be performed after January 1, 2008, and be completed before December 31, 2018.
   The request must be received within six months of the completion of the work.

Important
   • Read Specific Conditions of Participation in this guide for each type of measure carefully.
   • For further information, visit www.hydroquebec.com/org-osbl/en.
Procedure

1. Have the following on hand
   • Your organization number

2. Complete the entire Retrofit Measures form
   • Section 1 – General information
   • Section 2 – Information on work performed
   • Section 3 – Total rebate and customer’s undertaking
   
   NOTE: Each building must be identified by its complete address and the building number must be indicated.

3. Enclose the following
   • The Retrofit Measures form, duly completed and signed
   • Appendix – Section 2 of the Retrofit Measures form:
     - Measure 4A: copies of the invoices or validated by a member of one of the following professional governing bodies, as well as the corresponding ENERGY STAR data sheets.
     - Measures 4B, 4C, 4D, 4E and 4F: validated by a member of one of the following professional governing bodies, who will affix his or her seal to the documents:
       – Ordre des technologues professionnels du Québec
       – Ordre des ingénieurs du Québec
       – Ordre des architectes du Québec
   
   NOTE: All information requested on the form must be provided.

4. Mail in the rebate application and supporting documents
   Hydro-Québec – Soutien aux programmes
   Complexe Desjardins, tour Est, 24e étage
   C. P. 10000, succ. Place Desjardins
   Montréal (Québec) H5B 1H7

Processing time
   Hydro-Québec will issue a cheque within 30 days of receiving your application, provided that the form is properly filled out and accompanied by the required supporting documents.
Completing the rebate application

To obtain a rebate, you must enter the information required about the work performed. The rebate may not under any circumstances exceed the cost of products purchased or measures applied. The detailed information provided in Section 4 must be checked and signed by a member of a competent professional governing body, who must specify the nature of the work performed in each eligible building and the thermal resistance before and after the retrofit for each measure applied (except measure 4A).

Specific Conditions of Participation

Characteristics

Hydro-Québec has not established a list of eligible products (except in the case of windows and patio doors) for the retrofit measures. However, Hydro-Québec does require that thermal resistance be confirmed before and after each retrofit measure (except measure 4A) by a member of a competent professional governing body.

Eligible retrofit measures

- 4A – Replacement of windows and patio doors (sliding glass doors) with ENERGY STAR® certified models
- 4B – Insulation upgrade – main walls
- 4C – Insulation upgrade – roof with attic space
- 4D – Insulation upgrade – roof without attic space
- 4E – Insulation upgrade – foundation walls
- 4F – Addition of heat recovery to mechanical ventilation
  (An engineer’s opinion is required; NPOs interested in this measure must contact their federation, which in turn will contact Hydro-Québec.)
Using the tables to complete the rebate application

Measure 4A – Replacement of windows and patio doors with ENERGY STAR® certified models

<table>
<thead>
<tr>
<th>Zone¹*</th>
<th>Heating degree-day range</th>
<th>Amount of rebate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3,500–6,000</td>
<td>$40/m²</td>
</tr>
<tr>
<td>3</td>
<td>6,000</td>
<td>$50/m²</td>
</tr>
</tbody>
</table>

1. Climate zone as defined in the ENERGY STAR qualifying criteria for residential doors, windows and skylights sold in Canada and not according to the Regulation respecting energy conservation in new buildings.

Application

The table above shows the amount of the rebate for improving energy efficiency by replacing windows and patio doors separating a heated space from the outside air in a building in a municipality located in climate zone 2 or 3, as defined in the ENERGY STAR qualifying criteria for residential doors, windows and skylights sold in Canada (“eligible building”). The rebate amounts apply to all windows and all vertical patio doors (sliding glass doors).

Type of windows and patio doors

Windows and patio doors installed in an eligible building must be ENERGY STAR certified for the climate zone where the building is located*.

*The list of ENERGY STAR certified products for each climate zone (as defined in the ENERGY STAR qualifying criteria) is available on the Web site of the Office of Energy Efficiency, Natural Resources Canada. Products that are ENERGY STAR certified for zone 3 are automatically certified for zone 2, but not vice versa.

The rebate application must list the brand name, model number and energy rating (ER) of each window and patio door used. This information is available from the product supplier and at www.energystar.gc.ca.
Net surface area

Net surface area (m²) of windows and patio doors replaced by high-efficiency models is measured between the exterior faces of the window or door frame and excludes any surface of any window or door for which a rebate is being claimed that does not meet the criteria specified in the preceding section.

General comments

• Certain frames allow better vertical alignment of the glazing and the sash, such that the window is as close as possible to the interior surface of the wall. This improves energy efficiency. As much as possible, windows should be selected to take this into consideration.

• In general, windows and patio doors with the highest ER are the most energy-efficient, particularly in buildings without air-conditioning and with identical window exposure on all four sides. ERs that meet the CSA A440.2 standard, *Energy Performance of Windows and Other Fenestration Systems*, are available for all ENERGY STAR certified windows.

• Solar heat gain: Low-emissivity (low-e) coatings minimize heat loss by radiation and heat gain by solar radiation. The characteristics of these coatings can be selected based on the orientation of the window or patio door to maximize performance. Building energy simulation models or the specifications in the CSA A440.3 standard can be used for this purpose.
Measure 4B – Insulation upgrade – main walls

<table>
<thead>
<tr>
<th>Final effective thermal resistance</th>
<th>Initial effective thermal resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RSI &lt; 2.11</td>
</tr>
<tr>
<td></td>
<td>RSI = 2.11 &lt; 2.47</td>
</tr>
<tr>
<td></td>
<td>RSI = 2.47 – 2.66</td>
</tr>
<tr>
<td>RSI = 2.82–3.16</td>
<td>$17/m²</td>
</tr>
<tr>
<td>RSI = 3.17–3.60</td>
<td>$21/m²</td>
</tr>
<tr>
<td>RSI = 3.61–4.04</td>
<td>$21/m²</td>
</tr>
<tr>
<td>RSI ≥ 4.05</td>
<td>$25/m²</td>
</tr>
<tr>
<td></td>
<td>$32/m²</td>
</tr>
</tbody>
</table>

The table above shows the amount of the rebate for improving the thermal resistance (reducing the thermal conductivity) of main walls separating a heated space from the outside air. The rebates apply to aboveground wall assemblies but not to walls or parts of walls in contact with the ground.

Walls with slopes less than 60° to the horizontal are considered to be roofs, and roofs with slopes of 60° or more to the horizontal are considered to be walls.

**Effective thermal resistance**

Initial and final effective thermal resistance (preretrofit and postretrofit) of wall assemblies concerned must be determined using the method described in Appendix C of the *Model National Energy Code of Canada for Houses 1997* (MNECH).

**Net surface area**

Net surface area (m²) of the main walls whose thermal resistance is to be improved is measured horizontally between the interior faces of the exterior intersecting walls and vertically between the interior face of the roof assembly and the top of the foundation walls (or ground level). Net surface area excludes

- any surface not insulated to the final effective thermal resistance for which a rebate is being claimed (specifically areas adjacent to floors that cannot be insulated to improve effective thermal resistance as indicated) and
- openings created by doors, windows or other glazed surfaces, measured from the exterior faces of their frames.

**General comments**

The wall components and assemblies whose thermal resistance is to be improved must be designed and built in accordance with good practice to resist or adjust to all environmental loads to which they may be exposed, particularly temperature, water vapor, wind and precipitation levels, differences and fluctuations.

To minimize the risk of deterioration of materials, particular attention should be paid to the following:

- Measures to prevent condensation in the walls, including humidity control in the interior spaces of the building
- Measures to prevent water infiltration as a result of precipitation, notably flashings and sheathing membranes or materials
- Measures to promote evaporation of moisture that could accumulate in the walls and cause damage
- Use of low water-vapor permeance and low air permeance materials in walls
Measure 4C – Insulation upgrade – roof with attic

<table>
<thead>
<tr>
<th>Final effective thermal resistance</th>
<th>Initial effective thermal resistance</th>
<th>Rebate per m² of net surface area upgraded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RSI &lt; 2.29</td>
<td>$8/m²</td>
</tr>
<tr>
<td>RSI = 3.52–4.39</td>
<td>RSI = 2.29–3.51</td>
<td>$10/m²</td>
</tr>
<tr>
<td>RSI = 4.40–5.63</td>
<td>RSI = 3.52–4.40</td>
<td>$10/m²</td>
</tr>
<tr>
<td>RSI = 5.64–6.68</td>
<td>RSI ≥ 6.69</td>
<td>$10/m²</td>
</tr>
<tr>
<td>RSI ≥ 6.69</td>
<td>RSI ≥ 6.69</td>
<td>$10/m²</td>
</tr>
</tbody>
</table>

The table above shows the amount of the rebate for improving the thermal resistance (reducing the thermal conductivity) of roof assemblies separating a heated space from the outside air. The rebates apply in particular to roofs with vented attics where there is sufficient space to install thermal insulation; generally, the roof and the ceiling are separate assemblies.

A ceiling is deemed to be part of the adjacent roof, and the ceiling, the roof or both the roof and ceiling in this roof/ceiling assembly may be insulated in accordance with good practice. The table generally applies to roof assemblies where the ceiling is insulated and there is a space ventilated to the outside in accordance with good practice between the insulation and the roof sheathing.

Walls with slopes less than 60° to the horizontal are considered roofs, and roofs with slopes of 60° or more to the horizontal are considered walls.

**Effective thermal resistance**

Initial and final effective thermal resistance (preretrofit and postretrofit) of the roof assemblies concerned must be determined using the method described in Appendix C of the *Model National Energy Code of Canada for Houses 1997* (MNECH).

**Net surface area**

Net surface area (m²) of a roof assembly whose thermal resistance is to be improved is measured the length and width of the insulation between the interior faces of intersecting exterior walls and excludes

- any surface not insulated to the final effective thermal resistance for which a rebate is being claimed and
- openings created by skylights, chimneys or other large elements of this type.

**General comments**

Roof components and assemblies whose thermal resistance is to be improved must be designed and built in accordance with good practice to resist or adjust to all environmental loads to which they may be exposed, particularly temperature, water vapor, wind and precipitation levels, differences and fluctuations and accumulations of snow, ice and water.

To minimize the risk of deterioration of materials, particular attention must be paid to the following:

- Measures to prevent condensation in roof assemblies (including humidity control in the interior spaces of the building) and to ventilate to the outside the space between the insulation and the roof sheathing
- Measures (with respect to roof components, flashings, junctions and penetrations in particular) to prevent water infiltration as a result of precipitation and accumulation of snow, ice or water
- The structural strength of roof assembly frames, to ensure tolerance of potential snow, ice and water loads
Measure 4D – Insulation upgrade – roof without attic

<table>
<thead>
<tr>
<th>Final effective thermal resistance</th>
<th>Initial effective thermal resistance</th>
<th>Rebate per m² of net surface area upgraded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RSI &lt; 0.88</td>
<td>RSI = 0.88–1.75</td>
</tr>
<tr>
<td>RSI = 1.76–2.10</td>
<td>$9/m²</td>
<td></td>
</tr>
<tr>
<td>RSI = 2.11–2.99</td>
<td>$17/m²</td>
<td>$9/m²</td>
</tr>
<tr>
<td>RSI = 3.00–3.86</td>
<td>$24/m²</td>
<td>$17/m²</td>
</tr>
<tr>
<td>RSI ≥ 3.87</td>
<td>$31/m²</td>
<td>$24/m²</td>
</tr>
</tbody>
</table>

The table above shows the amount of the rebate for improving the thermal resistance (reducing the thermal conductivity) of roof assemblies separating a heated space from the outside air. The rebates apply in particular to roof assemblies without attics ventilated to the outside where the thermal insulation is not between the roof framing members but rather above them, as is the case with heavy timber or concrete roof decks with rigid insulation. The rebates also apply to roof assemblies with limited space for satisfactory installation of insulation, particularly those where the frame consists of parallel joists with rigid insulation installed above them.

A ceiling is deemed to be part of the adjacent roof, and the ceiling, the roof or both the roof and ceiling in this roof/ceiling assembly may be insulated in accordance with good practice. The table generally applies to roof assemblies where the roof is insulated in accordance with good practice.

Walls with slopes less than 60° to the horizontal are considered to be roofs, and roofs with slopes of 60° or more to the horizontal are considered to be walls.

**Effective thermal resistance**

Initial and final effective thermal resistance (preretrofit and postretrofit) of the roof assemblies concerned must be determined using the method described in Appendix C of the *Model National Energy Code of Canada for Houses 1997* (MNECH).

**Net surface area**

Net surface area (m²) of a roof assembly whose thermal resistance is to be improved is measured the length and width of the insulation between the interior faces of intersecting exterior walls and excludes:

- any surface not insulated to the final effective thermal resistance for which a rebate is being claimed and
- openings created by skylights, chimneys or other large elements of this type.

**General comments**

Roof components and assemblies whose thermal resistance is to be improved must be designed and built in accordance with good practice to resist or adjust to all environmental loads to which they may be exposed, particularly temperature, water vapor, wind and precipitation levels, differences and fluctuations and accumulations of snow, ice and water.

To minimize the risk of deterioration of materials, particular attention must be paid to the following:

- Measures (with respect to roof components, flashings, junctions and penetrations in particular) to prevent water infiltration as a result of precipitation and accumulation of snow, ice or water
- The structural strength of roof assembly frames, to ensure tolerance of potential snow, ice and water loads
Measure 4E – Insulation upgrade – foundation walls

<table>
<thead>
<tr>
<th>Final effective thermal resistance</th>
<th>Initial effective thermal resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RSI &lt; 1.23 600 mm below ground</td>
</tr>
<tr>
<td>RSI = 2.11–2.63 full surface</td>
<td>$22/m²</td>
</tr>
<tr>
<td>RSI ≥ 2.64 full surface</td>
<td>$27/m²</td>
</tr>
</tbody>
</table>

The table above shows the amount of the rebate for improving the thermal resistance (reducing the thermal conductivity) of foundation wall assemblies separating a habitable heated basement space with a minimum clear height of 6 ft. 4 in. (1.95 m) from exposed ground or outside air.

**Effective thermal resistance**
Initial and final effective thermal resistance (preretrofit and postretrofit) of the assemblies concerned must be determined using the method described in Appendix C of the *Model National Energy Code of Canada for Houses 1997* (MNECH).

**Net surface area**
Net surface area (m²) of a foundation wall assembly whose thermal resistance is to be improved is measured horizontally between the interior faces of adjacent walls in contact with the ground and vertically between the top of the foundation wall and the surface of the intersecting floor in contact with the ground. Net surface area excludes:

- any surface not insulated to the final effective thermal resistance for which a rebate is being claimed and
- openings created by doors, windows or other glazed surfaces, measured from the exterior face of their frames.

**General comments**
Wall assemblies and components whose thermal resistance is to be improved must be designed and built in accordance with good practice to resist or adjust to all environmental loads to which they may be exposed, particularly temperature, water vapor, wind, precipitation and ground moisture levels, differences and fluctuations.

To minimize the risk of deterioration of materials, particular attention must be paid to the following:

- Measures to prevent condensation in the foundation walls, including humidity control in the interior spaces of the building
- Measures to prevent water infiltration as a result of precipitation
- Measures to prevent walls in contact with the ground from absorbing ground moisture
- Measures to promote evaporation of moisture that could accumulate in the walls and cause damage
- Use of low water-vapor permeance and low air permeance materials in walls
Measure 4F – Add heat recovery to mechanical ventilation
(see specific conditions)

<table>
<thead>
<tr>
<th>Type of heat recovery</th>
<th>Initial condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced mechanical ventilation system designed for continuous operation</td>
<td></td>
</tr>
<tr>
<td>Type I</td>
<td>$15 per L/s of reference airflow</td>
</tr>
<tr>
<td>Type II</td>
<td>$20 per L/s of reference airflow</td>
</tr>
</tbody>
</table>

The table above shows the amount of the rebate for adding heat recovery to one or more balanced mechanical ventilation systems in a building in order to recover sensible heat from the exhaust air and transfer it to supply air entering the building, thus reducing the building's electricity consumption. To qualify for a rebate, all heat recovered from the exhaust air must be transferred to a fresh air supply stream of equivalent flow (± 10%) and all spaces involved must be initially heated entirely by electricity.

The building’s balanced mechanical ventilation system, including its exhaust and supply system, must be designed (before or after the retrofit) for continuous operation.

**Type of heat recovery**

For independent systems serving a single dwelling and systems for which test data and results (test method below) are known, the sensible heat recovery efficiency must be between 50% and 70% for type I heat recovery and at least 70% for type II heat recovery. The sensible recovery efficiency of heat recovery ventilator (HRV) systems must be determined at an outdoor temperature of 0°C and a rated airflow equivalent to the operating airflow of the balanced mechanical HRV system. The airflow thus measured is the recovered-heat airflow. Energy efficiency tests must be conducted in accordance with the CAN/CSA C439 standard, *Standard Laboratory Methods of Test for Rating the Performance of Heat/Energy-Recovery Ventilators*.

For other systems, net heat recovery efficiency must be between 50% and 70% for type I heat recovery and more than 70% for type II heat recovery. Net sensible recovery efficiency of these systems must be established in accordance with the ARI 1060 standard, *Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment*, at a rated airflow equivalent to the operating airflow of the balanced mechanical HRV system. The airflow thus measured is the recovered-heat airflow.

Heat recovery systems and related ducts must be located within the heated building envelope whenever possible. If not, or if outdoor exposure is required, the manufacturer’s instructions must cover such usage and particular attention must be paid to airtightness, watertightness, water vapor transfer, thermal insulation and weather protection of the equipment and the air ducts running to it from inside the heated envelope, so that all measures are taken in accordance with good practice to maintain the anticipated efficiency.
**Reference airflow**

The reference airflow (L/s) is the smallest of the following three values:

- \((7.5 \times n1 + 7.5 \times n2) + COM\)

  where  
  
  \[n1 = \text{total number of units in the building}\]
  \[n2 = \text{total number of rooms in the building}\]
  \[COM = (0.25 \times C1) + C2\]

  where  
  
  \[C1 = \text{floor area (m}^2\text{) of common corridors, service rooms and storage areas}\]
  \[(0 \text{ in the case of a building with a single unit})\]
  \[C2 = \text{floor area (m}^2\text{) of common rooms}\]
  \[(0 \text{ in the case of a building with a single unit})\]

- Mean design winter ventilation rate (L/s) of the balanced mechanical ventilation system
- Mean airflow during the heating season of the balanced mechanical HRV system or systems; this is the mean recovered-heat airflow.

**General comments**

- A building's mechanical ventilation needs (rate and distribution) must be established in accordance with good practice.
  Mechanical ventilation systems and any measuring systems required to maintain net overpressure and underpressure within acceptable limits must also be designed and built in accordance with good practice.

- Where real or perceived mechanical ventilation needs are minimal and the mean ventilation rate would be significantly reduced in the heating season, the payback period for adding heat recovery to the mechanical ventilation system may be as long or longer than the service life of the equipment.

  This may be particularly true in two-storey houses where the air leakage rate of the envelope is more than four or five air changes per hour (ACHs) at 50 Pa, which is the average leakage rate of homes built before 1985: with real average mechanical ventilation needs so low, the mean ventilation rate would be significantly reduced during the heating season.

- A maintenance program should be established for mechanical ventilation systems, particularly HRV systems.
Applicable warranties
Warranties on products installed are those offered by manufacturers and installers (such as those covering manufacturing defects that affect safety or performance). Hydro-Québec cannot be held liable for any damage or injury arising from the installation or use of products or from the work performed.

Verifying applications
• You must unconditionally agree to submit the necessary documents or to give a guided tour of your premises within twelve months of the date of completion of the work to ensure compliance with Program conditions.
• Hydro-Québec can reduce payments for any overpayments to the Coopérative under one or more previous payments. If the overpayments to the Coopérative exceed the amount owed by Hydro-Québec, the company can demand repayment of the amounts owed to it within 30 days.
• If you fail to comply with Program conditions, you must pay back any rebates received from Hydro-Québec.
• Rebates apply only to eligible retrofit measures. Eligible measures and rebate amounts are shown in the tables of this guide.

Failure to pay Hydro-Québec
Hydro-Québec may deduct any amount you owe from the rebate to be paid. The rebate will be paid within 30 days of receipt of applications, provided the proofs of purchase and installation meet Hydro-Québec’s requirements.

Link to other programs
Any work for which Hydro-Québec has paid a rebate under the Energy Efficiency Retrofit Program for Low-Income Households – NPO Component is ineligible for any other rebate or financial assistance under any other Hydro-Québec program.

Supporting documents to be submitted
You must submit the detailed information required in Section 4 of the Retrofit Measures form, which must be checked and signed by a member of a competent professional governing body (see Specific Conditions of Participation).

Proofs of purchase and installation to be submitted on request
You must retain all invoices related to the work covered by the rebate application for twelve months after completion of the work and submit them on request. Invoices must include the following information:
• Your name
• Nature of work
• Description of materials used
• Date work was done
• Total price paid
• Corresponding ENERGY STAR data sheets (measure 4A)

Changes to specific conditions
Hydro-Québec reserves the right to change without prior notice the specific conditions of participation in the Energy Efficiency Retrofit Program for Low-Income Households – NPO Component. However, the specific Program conditions will continue to apply to applications approved by a professional prior to the effective date of the changes.

Installation standards
• You are solely responsible for the selection, purchase and installation of materials and for the work performed.
• You are solely responsible for compliance with the requirements herein as well as those decreed by regulatory authorities, recommended by manufacturers or considered to be good practice, particularly those set forth in applicable codes and standards or in applicable directives, guides or manuals published by agencies such as the NRCC or the CMHC.

Environment
It is up to you to recycle or dispose of any products replaced under this Program.
The Energy Efficiency Retrofit Program for Low-Income Households – NPO Component covers other products that can help reduce energy-consumption and save even more money. Inquire about them.

For further details, go to
www.hydroquebec.com/org-osbl/en

or call
514 ÉNERGIE (363-7443) 1 800 ÉNERGIE
Montréal area elsewehere in Québec

Hydro-Québec
Coordinated by Communication avec la clientèle for Direction – Approvisionnement en électricité
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