BEFORE THE STATE OF WASHINGTON

ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 2006-01:

ENERGY NORTHWEST;

PACIFIC MOUNTAIN ENERGY CENTER

EXHIBIT __ (TJB-T)

APPLICANT'S PREFILED TESTIMONY

WITNESS: THEODORE J. BEATTY

Introduction

Q. Please state your name, title and business address.

A. Theodore J. Beatty, Project Manager Generation Development

Energy Northwest
Mail drop 1035
PO Box 968
Richland, WA 99352-0968.

Q. Please summarize your education and job experience.

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A. Over the last 15 years I have gained experience in a variety of areas throughout the energy industry, with the majority of time spent in the power industry. Most recently I have been focused on managing the development of renewable and thermal resource projects to meet the growing load requirements for northwest public utilities along with efforts in power supply planning and strategy. My educational background education is a BS in Mechanical Engineering from Carnegie Mellon University and a MBA in Energy Finance from the University of Texas at Austin. In addition, I am a registered Professional Engineer in the State of Washington. A copy of my resume is Exhibit ___ (TJB-1).

Q. Please state the purpose of your testimony.

A. My testimony will describe the elements of the Greenhouse Gas Reduction Plan (the "Plan") for the Pacific Mountain Energy Center ("PMEC"). A copy of the Plan is Exhibit ___ (TJB-2). I will explain why we designed it as we did. I will also review the research that we conducted in order to prepare the Plan.

Summary

Q. Please summarize your testimony.

A. Overall, Energy Northwest has found that carbon capture and storage ("CCS") for PMEC is not likely to be technically or economically feasible for a number of years after PMEC becomes operational. However, Energy Northwest has developed a flexible Plan for PMEC to preserve the opportunity for CCS in the future while building a power plant necessary to serve Washington's growing demand in a financially responsible manner today. PMEC will meet the requirements of ESSB 6001 and RCW 80.70 through verifiable greenhouse gas ("GHG") reductions.

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Plan Overview

Q. Please describe your role in preparing the Plan.

A. I had the lead role directing the compilation and coordination of the Plan. Energy Northwest worked with the Big Sky Carbon Sequestration Partnership ("Big Sky") and The Climate Trust for the review of the Plan. Input was also received from the Natural Resources Defense Council ("NRDC") in drafting portions of the Plan. In addition, Energy Northwest staff attended global warming and GHG conferences, organized a sequestration workshop, and consulted with industry experts to strengthen and reinforce our environmental knowledge base.

A good portion of the public body of knowledge concerning GHG sequestration and power plants was used in the development of the Plan. Primary references used in the Plan include:

- The Intergovernmental Panel on Climate Change ("IPCC") publications such as the Special Report on Carbon Dioxide Capture and Storage (See Exhibit ___ (TJB-3) for chapter 8 of that report, which provide information regarding costs and economic potential) and the IPCC Third Assessment Report: Climate Change 2001.
- The United States Department of Energy ("DOE") National Energy Technology Laboratory ("NETL") testimony and publications such as the 2007 Carbon Sequestration Technology Roadmap. See Exhibit ___ (TJB-4)
- Electric Power Research Institute (EPRI) documents, presentations and testimony. See Exhibit ____ (TJB-5) and Exhibit ____ (TJB-6)
- Big Sky and West Coast Regional Carbon Sequestration Partnership ("WESTCARB") publications and presentations.
- Massachusetts Institute of Technology's 2007 study, "The Future of Coal".

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- US Environmental Protection Agency's final report "Environmental Footprints and Costs of Coal Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies".

Q. Please provide an overview of the Plan GHG reduction methods.

A. The flexibility of the Plan is intended to adapt to today's early stages of GHG sequestration technologies and will grow with the technologies as they advance. PMEC will ensure GHG emissions are below 1,100 pounds per megawatt hour and will mitigate GHG emissions as required by RCW 80.70. PMEC will work with government agencies and stakeholders to achieve its GHG reduction obligations.

PMEC will be designed and operated with a focus to minimize the baseline GHG emission rate. Increasing efficiency and selecting optimum fuels will reduce PMEC GHG emissions. To ensure PMEC GHG emissions compliance, additional GHG reductions may be required beyond design and operating considerations. These reductions will be achieved by sequestration or purchased emissions reductions. At this time sequestration is not commercially feasible for a number of technical and economic reasons. Similarly when looking forward, it is difficult to determine if GHG sequestration will be technically and economically feasible for PMEC within five years of operation. The Plan proposes to follow two simultaneous efforts to yield the required GHG emission reductions for PMEC. The first is to develop actual and verifiable GHG reductions by purchasing them from power facilities in the western interconnection. This method can be implemented immediately through contracts with other power plant owners. The second is to move the science of sequestration forward by investing in its development. The economic and technical feasibility of sequestration options for PMEC will be re-evaluated before commercial operation and a

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decision will be made then as to whether to pursue on-site geologic sequestration. Regardless of which equally effective option is selected, GHG emissions reductions will meet or exceed the requirements of ESSB 6001 and RCW 80.70.

Q. How much carbon dioxide will need to be reduced for PMEC to comply with ESSB 6001 and RCW 80.70?

A. At this time, we have made a conservatively high estimate that 1.6 to 1.8 million tonnes of GHG emissions will be reduced annually to comply with both ESSB 6001 and RCW 80.70. The actual amount to be reduced is likely to be lower due to variety of factors such as PMEC's exact capacity factor and potential PMEC efficiency improvements.

Q. Please identify the commitments that Energy Northwest has made to implement this plan.

A. PMEC's design has long contained a selexol or equivalent system to allow for the capture of carbon dioxide ("CO_2") from the synthetic gas stream before it enters the combustion turbines. The capital cost of this equipment is approximately $50 million. In addition, up to $10 million will be spent to evaluate geological sequestration opportunities near the PMEC site along with potential terrestrial sequestration options. To ensure funds are available for achieving PMEC GHG reductions, a $200 million reserve will be established prior to commercial operation. Prior to financial close of the PMEC development and before construction commences, sufficient cost certainty for PMEC participants must be well defined. The GHG reduction costs must be understood well enough to ensure costs don't escalate in an uncontrolled manner. PMEC participant utilities will want to know all the financial risk factors, especially costs associated with GHG measures, in order to determine whether the resource will be cost-effective for their ratepayers.

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On Site Carbon Capture And Sequestration

Q. What has Energy Northwest done so far to provide for the capture of carbon from PMEC operations?

A. As I mentioned above, by including in our design a selexol or equivalent system from the outset, we have provided for carbon capture. We expect this system to be able to capture approximately 20% of total facility GHG emissions by providing for the capture of carbon dioxide from the synthetic gas stream before entering the combustion turbines. Thus from the beginning and well before the passage of ESSB 6001, the PMEC design has incorporated the ability to capture carbon. Because we have committed to invest $50 million in this equipment, PMEC will be able to capture CO_2 once the development is ready to operate on syngas.

Q. What has Energy Northwest done so far regarding on-site carbon sequestration?

A. Naturally, with equipment that can capture carbon, we hope to be able to sequester the carbon on or near our site at some point in time. Energy Northwest staff have attended a variety of GHG workshops, presentations and seminars to understand the current states of sequestration science, technology development and commercialization. One of the factors evaluated during the site selection process was a high level review of each site's potential for geological sequestration. The review determined that three nearby, potential geological storage formations along with the proximity of proven underground natural gas storage reservoirs gave the Kalama area site a preference above most other sites that met our criteria. Two years ago Energy Northwest entered into an agreement with Big Sky to jointly further the development of carbon sequestration. More recently, Energy Northwest has commissioned a high level characterization of the PMEC site and will make the results

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available once we receive them. We have also conducted a review of publicly available technical and economic data for sequestration. At this point in time, cost estimates vary by orders of magnitude due to the many uncertainties I discuss below involved with commercial-scale geologic sequestration. I have seen cost projections range from around $15/metric ton to over $50/metric ton for geologic sequestration. Costs are expected to come down as the technology becomes commercially available.

Q. Does Energy Northwest know whether the Kalama site is suitable for sequestration?

A. We know it might be suitable, and that is one of the reasons we chose the site, but there is no way to quickly determine now whether it is really suitable. With the many potential issues relating to underground storage of CO_2, it is very difficult to determine if any site has the proper geological characteristics for successful injection and long-term storage. To my knowledge, no power plant site in the world has completed the rigorous process of full site characterization for large scale injections of CO_2 into geologic formations. Determining the suitability of the PMEC site for geological sequestration is a major project in its own right, especially since each site is different and must be evaluated on its own individual merits. Two major factors, time and cost, are the most significant drivers in determining suitability. The time required to determine the suitability of a site is on the order of years, not months. ESSB 6001 was signed into law in May of 2007 so there has not yet been enough time for PMEC to determine suitability of geological sequestration at the Kalama site. The suitability determination would consist of complex geological engineering surveys and test well drilling. The second major factor is cost. It is not inexpensive to obtain and schedule geological experts, engineers, drilling crews, and equipment during times of high world demand for these services. It is clear that this is not an easy project; a thorough evaluation of underground injection suitability will be an expensive and time consuming process.

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However, PMEC is committed to spend the time and money required to verify the site's suitability for underground injection and storage of CO_2, and we expect to make the suitability determination over the next four to five years. Efforts towards this goal have already begun and will increase following financial close.

Q. What are the chief barriers to on-site sequestration?

A. In order for geological sequestration to be technologically feasible at a site a number of issues must be resolved. Important open issues include permanence; monitoring; site suitability; costs; and legal concerns. At this time no large fossil-fueled power plant has done commercial scale injection and storage of CO_2 in the earth. Accordingly, the long-term results of such efforts are unknown and will remain unknown for a number of years.

Q. Can you provide more detail on these barriers to implementation?

A. Certainly.

- **Permanency and monitoring**. Although for years CO_2 has been injected into the ground to enhance productivity of oil and gas wells, in that application there was no need to determine whether and how long the CO_2 remained underground. Accordingly, there is little field-tested information regarding the circumstances under which CO_2 will be permanently sequestered, nor are there any highly reliable methods for measuring permanence. Environmental, safety and health concerns can arise with sequestration's potential to contaminate drinking water. In addition, CO_2 could conceivably accumulate and release in high enough concentrations to be lethal to humans and animals.
- **Legal concerns.** As with any industry in its infancy, the rules that apply to commercial scale carbon sequestration are unclear. Key legal issues to be resolved

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include property rights (What property rights must be acquired for underground injection – a mineral-type of right? Rights to surface lands? Who owns and is responsible for the CO_2 once it has been injected – the landowner?); regulatory issues (What sorts of federal, state and local permits are required? What standards for setbacks, pressure limits, etc. will apply? If new standards are adopted, must they be met if injection has already started?); and liability (Who is liable if CO_2 leakage causes damage? Will Washington follow the examples of states that have assumed potential liability associated with CO_2 injection?).

- **Costs and site suitability.** Costs and site suitability are addressed in other portions of my testimony.

Q. When will these issues be resolved?

A. Industry experts predict that it will be impossible to know until at least 2011 whether as a technical matter large-scale sequestration can be done, or how.

Q. Has Energy Northwest reached a conclusion as to whether it is possible to implement on-site sequestration consistent with your anticipated construction schedule for PMEC and with the timeframe of ESSB 6001?

A. We have determined that on-site sequestration is not viable within the necessary timeframe due to uncertainties in sequestration science, uncertainties in the regulatory framework, uncertainties about our site, and cost uncertainties. All of these uncertainties would make it impossible for us to finance PMEC and to obtain partners for PMEC if we assumed today that sequestration would become viable on the necessary timeframe. If costs came in at the middle or upper end of the cost range I mentioned earlier, that would surely make PMEC uneconomic in the market for plants currently under development to the point where it should

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not be built because it could not afford to operate. As Jerry Bobo explains in his testimony, cost and design certainty are required for closing. No utility wants to buy a plant with a blank check.

Q. What else will Energy Northwest do to determine whether it is possible to sequester carbon at the site in the future?

A. We will keep abreast of the industry for advances in sequestration technologies and related issues. We will seek federal and state assistance to the extent it is available to help move the sequestration process forward at PMEC's site. We will participate in Ecology's process and other aspects of rulemaking to implement ESSB 6001 because it is an important source of information, though we believe the rules will not govern PMEC.

Q. What is your schedule and plan for completing site suitability work?

A. We began conducting our phased site characterization approach in mid-2007 and anticipate finishing in 2011. (See discussion of site characterization in Plan and timeline at page 4.)

Q. What assurances is Energy Northwest providing to EFSEC that this work will be completed?

A. As to making PMEC carbon capture-ready, that is already part of the design and we believe no further assurance is required. As to completing the site characterization, at financial closing, we will allocate $10 million of the proceeds to a dedicated sub-account for the sole purpose of completing site characterization. We will submit annual reports to EFSEC summarizing the work we have done, providing a financial accounting, and reporting on industry developments that are significant to PMEC.

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Future Determination of Feasibility

Q. What standards will Energy Northwest apply to determine whether sequestration is feasible?

A. To determine whether geological sequestration is technically feasible, PMEC will spend up to $10 million to evaluate the suitability of the PMEC site area formations and the CCS technology. To determine whether it is economically feasible, a benchmark of $5/tonne of GHG will be applied to sequestration.

Q. How would this $5/tonne benchmark work?

A. This benchmark is not a cap. A better way to view the $5/tonne is as a hurdle. If the costs of sequestration exceed $5/tonne then PMEC may to choose between sequestration and purchasing GHG reductions from another power facility in the western interconnection. Sufficient GHG reductions will still be required regardless of the method chosen to meet the standard. PMEC will achieve the required reductions from either equivalent method (sequestration or purchase) even if they end up costing more than $5/tonne.

Q. Why is $5/tonne an appropriate benchmark?

A. To preserve the opportunity to geologically sequester PMEC's emissions in the future, Energy Northwest used an approach that set a benchmark for economic feasibility based on several factors:

- In the future the DOE expects geological sequestration costs to be approximately 10% of total project costs. For PMEC, which is expect to cost $1.4 billion that would equate to approximately $150 million, which would be less than $5/tonne.
- Current cost for CO_2 credits is around $5/tonne in both European and US trading markets.

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- NETL goal to develop terrestrial sequestration technologies to the point of commercialization by 2015 at a cost not exceeding $5/tonne CO_2 sequestered.
- Recently enacted Washington state law RCW 80.70 uses $1.60/tonne as a proxy for the cost of CO_2 mitigation.
- PMEC's GHG Plan requires PMEC to evaluate the question of economic feasibility every five years and report on its findings to EFSEC.
- As a result, $5/tonne provides a realistic benchmark of economic feasibility and when the costs of CCS for PMEC's carbon dioxide emission drop below the benchmark, PMEC will commence CCS operations.
- The NETL goal for advanced CO_2 capture and sequestration systems applied to an IGCC is achieving 90 percent CO_2 capture with 99 percent storage permanence at less than a 10 percent increase in the cost of energy by 2012.
- Finally, $5/tonne is a benchmark only applicable to the determination of economic feasibility for sequestration and does not apply as a limit for PMEC's costs to mitigate its GHG emissions under ESSB 6001 or RCW 80.70.

Q. Will EFSEC, Ecology or other stakeholders have any input into the determination of the cost per tonne benchmark?

A. In this proceeding, Energy Northwest is open to input and viewpoints from all interested parties, but per ESSB 6001, economic feasibility is determined by Energy Northwest based on the requirements of the utility participants. As I have said, we need to make a determination now of what our maximum cost exposure for on-site geologic sequestration would be.

Q. If on-site sequestration is feasible, how will Energy Northwest implement it?

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A. We will submit a detailed plan for EFSEC approval, we will perform environmental review as needed for any new impacts to the environment, and we will obtain any necessary amendments to our site certification agreement from EFSEC or permits from other agencies with jurisdiction.

Q. If on-site sequestration is not feasible, how will Energy Northwest comply with its obligations under ESSB 6001?

A. We will comply through off-site sequestration, through purchase of emissions reductions, or both. Exhibit ___ (MJB-T), the prefiled testimony of The Climate Trust's Mike Burnett, explains both these approaches in detail. I will discuss them briefly from the Energy Northwest perspective.

Off-Site Sequestration

Q. Do you believe that off-site sequestration is a permissible method of carbon sequestration for Energy Northwest under ESSB 6001?

A. Yes.

Q. Please explain.

A. Off-site sequestration is contemplated in subsection 5(13) of ESSB 6001 with purchasing reductions from other power plants in the western interconnection. ESSB 6001 also mentions terrestrial sequestration as a viable method to reduce GHG emissions. ESSB 6001 allows for other sequestration which is a broad category that could include geologic and other forms of off-site sequestration.

Q. What sorts of off-site sequestration would Energy Northwest consider?

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A. The GHG Plan explains some of these potential options:

- Geological sequestration of CO_2 emitted by a source other than PMEC at a site other than PMEC
- Enhanced oil recovery
- Renewable energy resources
- Terrestrial sequestration

Q. Please describe what Energy Northwest has done to date to evaluate off-site sequestration.

A. We have examined the existing off-site sequestration body of knowledge. We have engaged The Climate Trust to assist us in evaluating off-site sequestration and identifying potential sites.

Q. Please describe the schedule and plan for Energy Northwest's further evaluation of off-site sequestration.

A. Off-site sequestration will be evaluated along with on-site geological sequestration through 2011. At this point in time, off-site geologic sequestration is not feasible due to concerns about leakage, availability, administration and cost, but this can change in the future with continued advancements.

Q. What opportunity will there be for EFSEC, Ecology and other stakeholders to have input to a decision as to whether off-site sequestration should be done?

A. If Energy Northwest determines that it should pursue off-site sequestration, we will submit a detailed plan for it and we will request EFSEC approval, after review by Ecology.

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Q. If Energy Northwest does do off-site sequestration, how will it be implemented?

A. This depends on who the owner and operator of the sequestration site is, what jurisdiction it is in, etc. Energy Northwest would present a detailed proposal to the Council and seek confirmation that through implementation, certain amounts of CO_2 will be counted as having been sequestered.

Purchase Of Emissions Reductions

Q. Describe how the purchase of emissions reductions factors into PMEC's GHG Reduction Plan.

A. Purchases of GHG emissions reductions are allowed if sequestration is not technically or economically feasible. In order to comply with ESSB 6001 within the five years of PMEC commercial operations, it is likely that the purchase of emissions reductions will be required. The purchase of GHG reductions is the only method that is feasible today to meet the standard of ESSB 6001. Therefore, PMEC will purchase emissions reductions to comply with the law. To comply with 80.70 RCW, we expect to have purchases of emissions reductions in place at the time we begin commercial operation.

Q. Aren't you proposing to purchase emissions reductions even before you have determined whether sequestration is feasible?

A. No. We know today that both on-site and off-site geologic sequestration are not currently feasible for PMEC. If efforts to commercialize sequestration go well and it becomes feasible, PMEC will do it, as I described above. But we believe we can purchase emissions reductions – that are clearly viable and equally effective today. For the reasons discussed by Mike Burnett, we believe that properly structured purchases of emissions reductions will be a more reliable and effective way to achieve the performance standard, and the legislative

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intent to reduce CO_2, than any other approach that is currently available. So as of today, that is our compliance plan. It is a plan we can execute.

Q. How will you go about purchasing emissions reductions?

A. Energy Northwest has created a list of approximately 1,000 permitted and operating GHG emitting power facilities in the western interconnection. A number of these plants will be viable for either operating restrictions or efficiency improvements. With the increasing need for power in the West, operational restrictions might not be the best choice because that would require more power plants to be built. So the best opportunities may lie in improving aging facilities by increasing their efficiency. Increases in efficiency will produce more electricity with the same or less emissions footprint. The Climate Trust will assist the PMEC in finding reduction opportunities.

Q. What emissions reductions do you plan to purchase?

A. We have not yet made this decision, but most likely we will implement efficiency improvements at power plants.

Q. What will these emissions reductions cost?

A. There is not a ready market for GHG emissions reductions from power plants, so the cost is currently unknown. The cost of reductions will be negotiated between Energy Northwest and the power plant owners to determine the cost.

Q. When will you purchase these emissions reductions?

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A. PMEC cost risk must be quantified to the maximum extent to be financially acceptable for project participants. Therefore, the purchase costs will be determined and deemed viable to our participant utilities and financial advisors before we proceed with PMEC construction.

Q. At that time, will you purchase reductions sufficient to cover the life of the plant?

A. We will work with our advisors prior to commercial operations to purchase emissions reductions, or at least options for the purchase of such reductions, that are sufficient to cover anticipated minimum operations over the life of the project.

Q. How will you address compliance with RCW 80.70 in your purchase of emissions reductions?

A. The purchase of GHG emissions reductions is one of the permissible compliance methods under RCW 80.70 along with self mitigation or paying $1.60/tonne to a third party. Purchased emissions reductions amounts will meet or more likely exceed the requirements of RCW 80.70.

Q. You testified earlier that you will implement on-site sequestration if it does become economically and technically viable at some point in the future. But you also testified that you will have purchased emissions reductions sufficient for the life of the plant. What will happen with any emissions reductions that are in excess of what you need to comply with ESSB 6001 and RCW 80.70 if you switch to on-site or off-site sequestration?

A. Excess carbon credits or GHG emissions reductions will be sold into a carbon trading market if one exists. Currently there are potential options in the European market and the Chicago

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Climate Exchange. Other potential markets are likely to be developed in the next five to ten years.

Requirements For Verification, Etc.

Q. Even if Energy Northwest uses the compliance path of purchasing emissions reductions under subsection 5(13) of ESSB 6001, your plan must still meet the requirements for monitoring, verification, penalties, etc. under subsection 5(11). Please explain how the Plan satisfies these requirements.

A. Purchased emissions reductions will be verified by a third party such as The Climate Trust. Once the purchase source is determined a monitoring plan will be developed. If the PMEC does not meet the standard then the PMEC's operations will be restricted by the amount needed to comply with the law. For example, if PMEC were able to purchase only half of the required emissions reductions then the PMEC would only be allowed to operate on syngas at full power during half the year or at 50 percent power all year long.

Conclusion

Q. Please summarize the determinations that Energy Northwest is asking the Council to make in connection with the GHG Plan.

A. We are asking the Council to determine that if we implement the Plan, we will achieve compliance with both RCW 80.70 and ESSB 6001. Specifically, we are asking the Council to confirm that it accepts our assumptions (Plan at 7-8) and that implementation of the Plan as stated will satisfy the requirements of RCW 80.70 and ESSB 6001.

Q. Does this complete your testimony?

A. Yes it does.

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EXHIBIT LIST

Ex. No.	Prefiled No.	Description
	TJB-1	Ted Beatty's resume.
	TJB-2	Greenhouse Gas Reduction Plan
	TJB-3	IPCC Report on Carbon Dioxide Capture and Storage, Chapter 8
	TJB-4	2007 Carbon Sequestration Technology Roadmap
	TJB-5	EPRI: Stuart Dalton Testimony May 15, 2007
	TJB-6	EPRI: Bryan Hannegan March 22, 2007

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