NUCLEAR RESOURCES FOR BASELOAD

1.0 INTRODUCTION

The purpose of this exhibit is to set out the OPA's approach to planning for nuclear capacity in order to meet baseload electricity requirements.

2.0 SUMMARY

Q. What is the Supply Mix Directive (the "Directive") with respect to baseload resources?

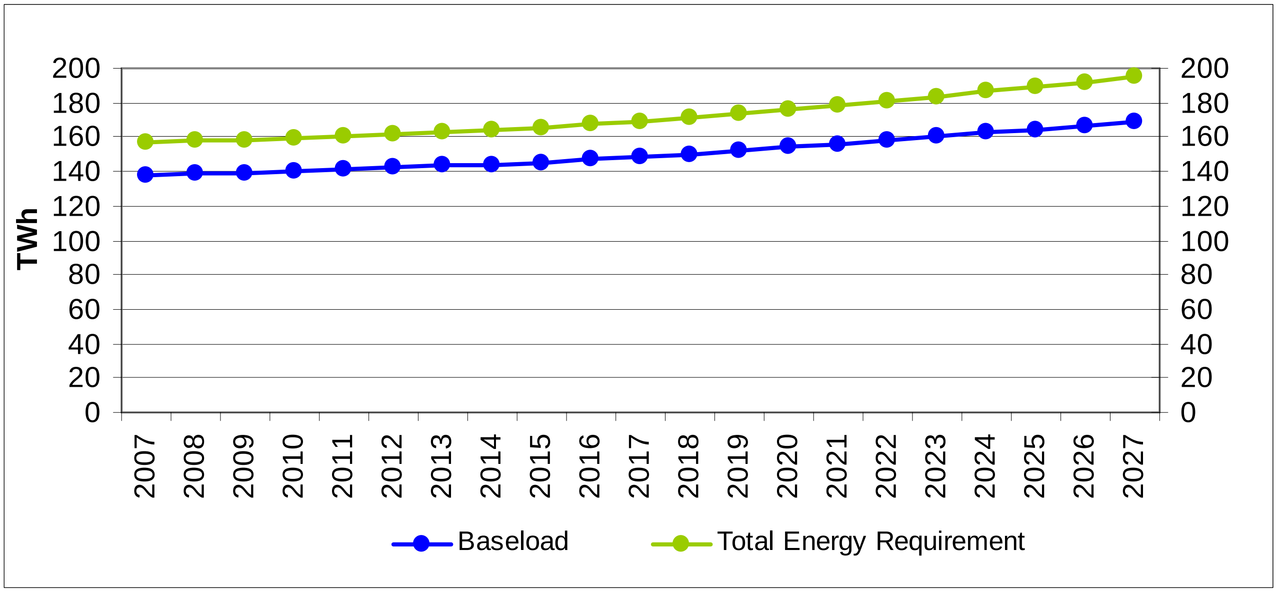
A. The Directive requires the OPA "to plan for nuclear capacity to meet baseload electricity requirements but limit the installed in-service capacity of nuclear power over the life of the plan to 14,000 MW".

Q. What are Ontario's baseload electricity requirements for the term of the Integrated Power System Plan (the "IPSP" or the "Plan") and how will they be met?

A. Baseload capacity and energy requirements are discussed in Exhibit D-3-1. While the Directive deals with nuclear capacity to meet baseload electricity requirements, an understanding of the associated energy requirements and the specific contributions and roles played by nuclear and other baseload resources is important in order to gain a better perspective on baseload requirements. Specifically, considering baseload resources with regard to their expected energy contribution takes into account their associated availability and utilization. For the purposes of this Plan, the focus is on Ontario's electricity needs and does not address potential market demand involving interconnected jurisdictions.

The baseload energy requirements are illustrated in Figure 1 and Table 1, while the associated capacity requirements are shown in Figure 2 and Table 2.

Figure 1: Total System and Baseload Energy Requirements (TWh)



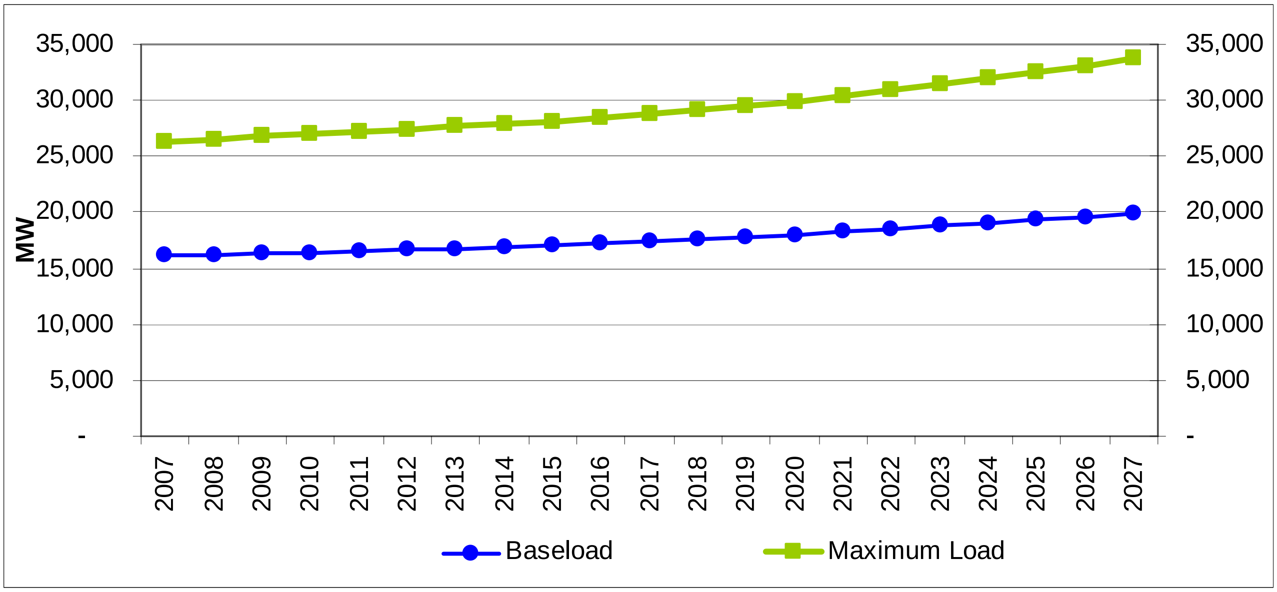
Source: OPA

Table 1: Total System and Baseload Energy Requirements (TWh)

	2007 (TWh)	2010 (TWh)	2027 (TWh)	Change 2007 – 2027	
				(TWh)	(%)
Baseload	138	140	169	31	23
Total System	157	159	195	38	25

Source: OPA

Figure 2: Maximum Load and Baseload (MW)



Source: OPA

Table 2: Maximum Load and Baseload (MW)

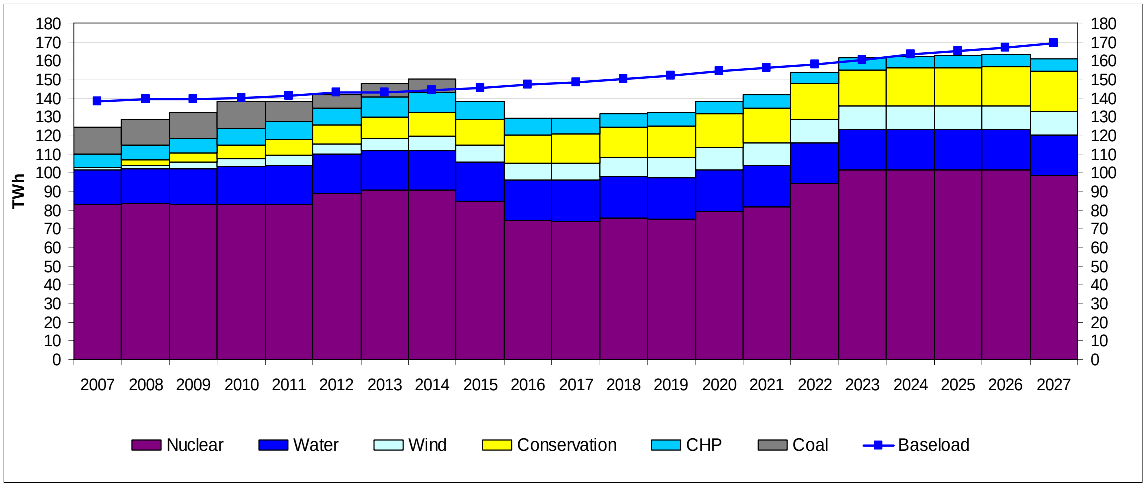
	2007 (MW)	2010 (MW)	2027 (MW)	Change 2007 – 2027 (MW)	
				(MW)	(%)
Baseload	16,156	16,433	19,844	3,688	23
Maximum Load	26,282	26,985	33,678	7,395	28

Source: OPA

Two planning scenarios were considered in determining how the baseload requirements will be met: in Case 1A, Pickering B is assumed to be refurbished over the 2013 to 2016 Plan period, while in Case 1B it is not.

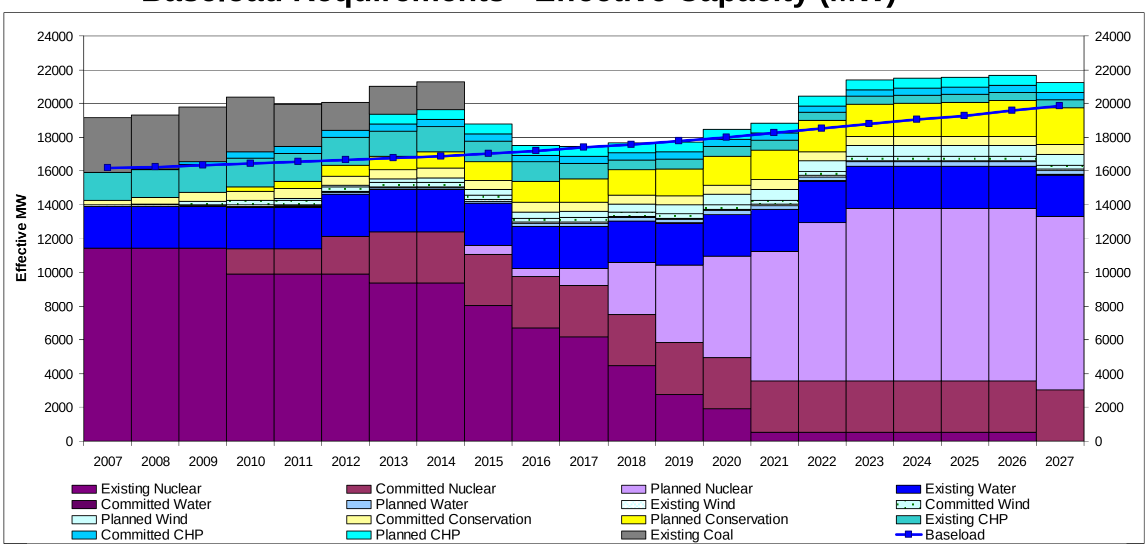
The resources planned to meet baseload energy requirements under Case 1A are illustrated in Figure 3. The associated capacity requirements are illustrated in Figure 4. These are stated in terms of effective capacity which reflects the load-meeting capability of supply resources. The effective capacity is different from the installed capacity for resources with intermittent or variable fuel sources, e.g., wind and hydroelectric resources. The significant contribution by nuclear resources in meeting baseload electricity requirements over the term of the Plan is illustrated in Figure 3 and Figure 4.

Figure 3: Case 1A (with Pickering B Refurbishment): Resources to meet Baseload Energy Requirements (TWh)



Source: OPA

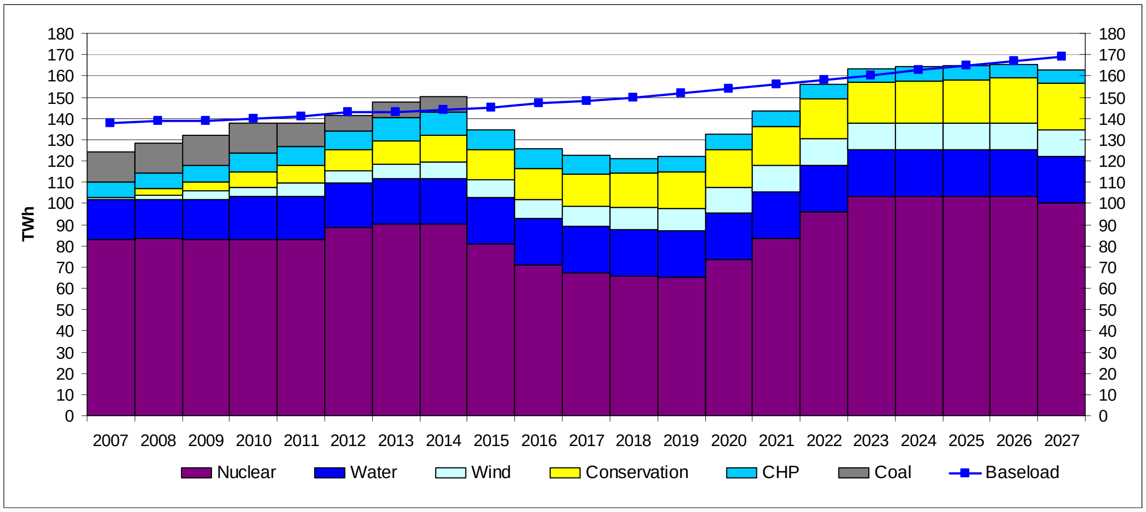
Figure 4: Case 1A (with Pickering B Refurbishment): Resources to meet Baseload Requirements - Effective Capacity (MW)



Source: OPA

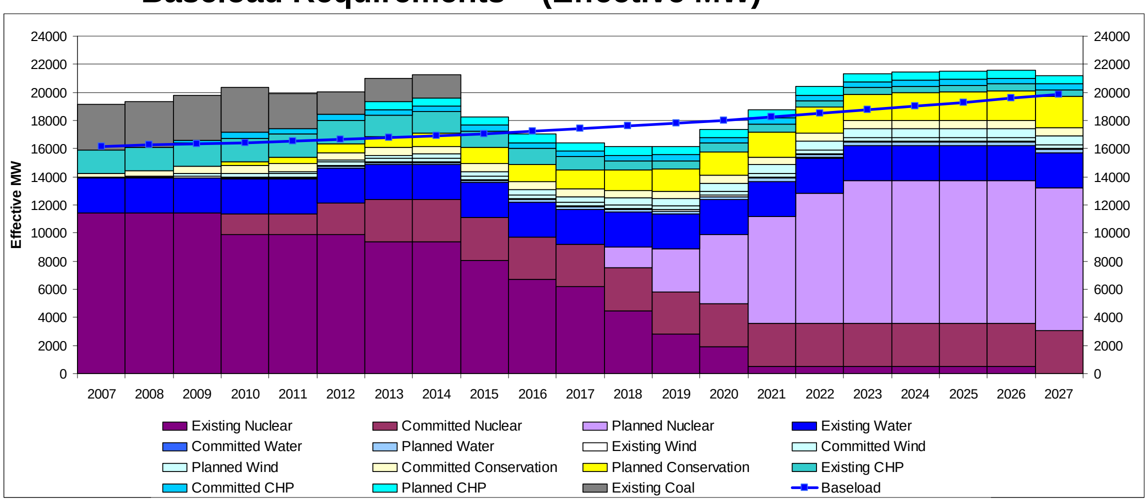
Figure 5 and Figure 6 illustrate the resources to meet baseload electricity requirements under Case 1B.

Figure 5: Case 1B (No Pickering B Refurbishment): Resources to meet Baseload Energy Requirements (TWh)



Source: OPA

Figure 6: Case 1B (No Pickering B Refurbishment): Resources to meet Baseload Requirements – (Effective MW)



Source: OPA

Table 3 summarizes the nuclear contributions to meet baseload energy requirements over the term of the Plan under the two planning scenarios. Table 4 identifies the associated installed in-service nuclear capacity corresponding to these scenarios.

Table 3: Nuclear Baseload Energy Production under Case 1A and Case 1B (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A (Pickering B Refurbished)	83	83	83	83	83	89	90	90	84	74	74	76	75	79	82	94	101	101	101	101	98
Case 1B (Pickering B Not Refurbished)	83	83	83	83	83	89	90	90	81	71	67	66	65	73	84	96	103	103	103	103	100

Source: OPA

Table 4: Installed In-service Nuclear Capacity under Case 1A and Case 1B (MW)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A (Pickering B Refurbished)	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,606	10,242	10,242	10,572	10,425	10,941	11,228	12,923	13,804	13,804	13,804	13,804	13,289
Case 1B (Pickering B Not Refurbished)	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,090	9,726	9,210	9,024	8,877	9,877	11,164	12,859	13,740	13,740	13,740	13,740	13,225

Source: OPA

As illustrated above in Figure 4 and Figure 6**,** and in Table 4, the requirement in the Directive “to plan for nuclear capacity to meet baseload electricity requirements but limit the installed in-service capacity of nuclear power over the life of the plan to 14,000 MW” is met under both Case 1A and Case 1B.

3.0 DEFINITIONS

Q. What are the different terms that the OPA uses to describe and analyze baseload requirements for the purpose of meeting the Directive?

A. The OPA uses the following terms for this purpose:

Capacity	The maximum power output for which a generating unit, generating station or electricity producing apparatus is rated. Common units include kilowatts (“kW”), megawatts (“MW”) or gigawatts (“GW”). Also used to refer to the maximum potential output for the entire electricity system.
Installed In-service Capacity	The capacity of installed supply resources that are capable of being operated.
Capacity Factor	The ratio of the electrical energy produced by a generating unit for a period of time to the electrical energy that could have been produced at continuous full power operation during the same period. It is usually expressed as a percentage.
Annual Capacity Factor	The capacity factor for a generating unit for a period of one year.
Capability Factor	Capability factor is the percentage of maximum energy generation that a plant is capable of supplying to the electrical grid, limited only by factors within control of plant management such as planned maintenance outages. A high capability factor indicates effective plant programs and practices to minimize unplanned energy losses and to optimize planned outages.

Levelized Unit Energy Cost ("LUEC")	The discounted average cost of producing electricity from a power plant over its anticipated operating life expressed in terms of cents per kWh or dollars per MWh. It takes into account the total discounted cost of producing the energy (capital, operating and maintenance, and fuel costs) and the total amount of energy produced over the life of the plant, and distributes these costs over the anticipated operating life of the station.
Baseload Electricity Requirement	The amount of electricity demand that is present on the system on a near-continuous basis. Also known as Baseload Demand.
Baseload Capacity	The capacity of supply resources that are normally operated to meet baseload electricity requirements.
Run-of-the-river plants	Hydroelectric generating plants which use little, if any, stored water to provide water flow through the turbines to generate electric power. Weather changes, especially seasonal changes, can cause run-of-river plants to experience significant fluctuations in power output.
Planned Nuclear	Planned nuclear includes nuclear refurbishment and new build nuclear resources

4.0 DETERMINATION OF REQUIRED BASELOAD RESOURCES

Q. How did the OPA determine baseload electricity requirements?

A. As discussed in Exhibit D-3-1, Attachment 1, the OPA has determined baseload capacity requirements to be equivalent to the load demand in any given year that exists 72% or more of the time. This is derived from corresponding annual load duration curves over the Plan period and is the basis of the baseload electricity requirements over the term of the Plan. The specific baseload electricity requirements over the term of the Plan are discussed in more detail in Exhibit D-3-1.

Q. How did the OPA determine which resources are best capable of meeting baseload requirements?

A. In order to meet the specific baseload electricity requirements, there is a need to determine which resources are best capable of baseload operation. The following five-step approach was used by the OPA to determine the resources to meet baseload electricity requirements and their associated contributions:

Step 1: Determine the contribution to meeting baseload requirements from existing and committed baseload resources;

Step 2: Determine the contribution from planned Conservation, renewable and CHP resources;

Step 3: Determine the remaining baseload requirements;

Step 4: Determine the preferred option for meeting the remaining baseload requirements; and

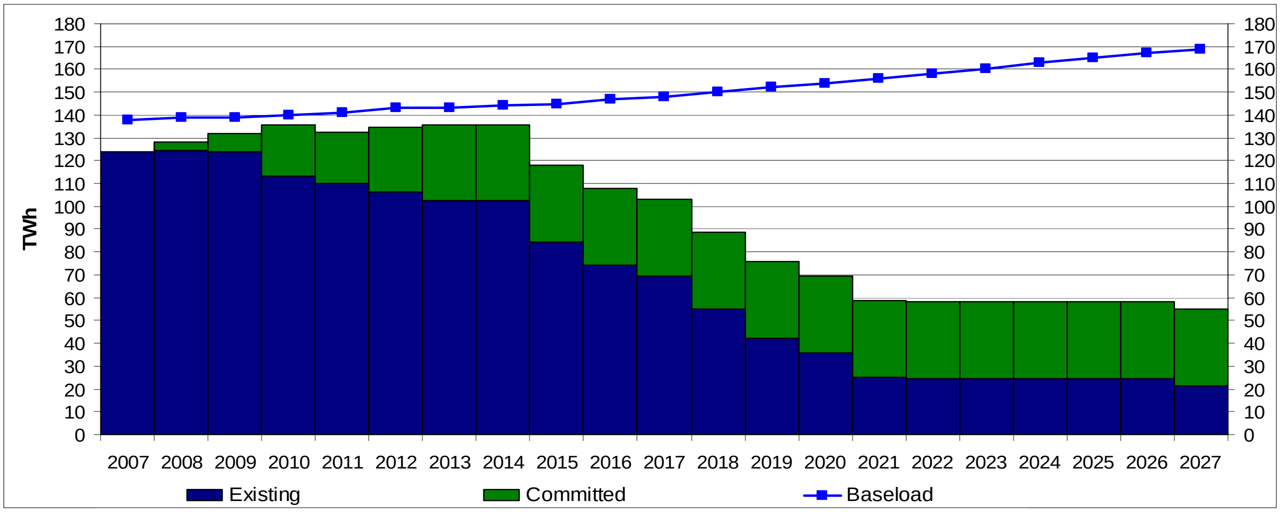
Step 5: Determine the feasible amount of, and contributions from, the preferred option to meet the remaining baseload requirements.

Q. The first step in the OPA's analysis was to determine the contribution from existing and committed baseload resources. What is their contribution?

A. Figure 7 illustrates the energy contribution from existing and committed baseload resources over the term of the Plan relative to the baseload energy requirements. Table 5 summarizes the associated annual energy contributions by resource type. The reduction in the energy contribution from existing baseload resources is associated with two factors. One is the replacement of the coal-fired resources by 2014. The second factor is the declining nuclear capacity, as existing nuclear units reach the end of their service life during the Plan period.

These factors result in significant baseload energy shortfalls starting in 2015 and increasing to nearly 120 TWh by 2027.

Figure 7: Existing and Committed Baseload Resources (TWh)



Source: OPA

Table 5: Existing and Committed Baseload Resources (TWh)

TWh	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing Nuclear	83	83	83	72	72	72	69	69	60	50	46	33	20	14	3	3	3	3	3	3	0
Existing Water	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Existing Wind	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Existing Coal	14	14	14	14	11	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Gas	7	7	7	7	7	7	7	7	5	5	4	3	3	3	3	2	2	2	2	2	2
Committed Conservation	0	3	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Committed Nuclear	0	0	0	11	11	16	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Committed Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Committed Wind	0	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Committed CHP	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TOTAL	124	128	132	136	133	135	136	136	118	108	103	89	76	69	59	58	58	58	58	58	55

Source: OPA

Table 6 identifies the capacity associated with the existing and committed baseload resources.

Table 6: Existing and Committed Baseload Resources (MW)

MW (INSTALLED)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing Nuclear	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
Existing Water	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231	3,231
Existing Wind	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395	395
Existing Coal	3,217	3,217	3,217	3,217	2,485	1,647	1,647	1,647	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Gas	1,658	1,658	1,658	1,658	1,658	1,658	1,493	1,493	1,189	1,142	936	602	602	602	602	471	471	471	471	471	471
Committed Conservation	284	373	508	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
Committed Nuclear	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
Committed Water	0	1	1	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Committed Wind	1	264	1,052	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251
Committed CHP	0	31	178	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414
TOTAL	20,206	20,590	21,659	22,114	21,382	21,314	21,403	21,403	18,139	16,729	16,007	13,989	12,294	11,413	10,017	9,886	9,886	9,886	9,886	9,886	9,371

Source: OPA

Table 7 summarizes the effective capacity of the existing and committed baseload resources identified in Table 6.

Table 7: Existing and Committed Baseload Resources – (Effective MW)

Effective MW	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing Nuclear	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
Existing Water	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478	2,478
Existing Wind	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Committed Nuclear	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
Committed Water	0	1	1	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Committed Wind	0	54	217	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258	258
Existing Gas	1,658	1,658	1,658	1,658	1,658	1,658	1,493	1,493	1,189	1,142	936	602	602	602	602	471	471	471	471	471	471
Committed CHP	0	31	178	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414
Committed Conservation	284	373	508	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
Existing Coal	3,217	3,217	3,217	3,217	2,485	1,647	1,647	1,647	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	19,138	19,313	19,756	20,049	19,317	19,249	19,338	19,338	16,074	14,664	13,942	11,924	10,229	9,348	7,952	7,821	7,821	7,821	7,821	7,821	7,306

Source: OPA

The existing and committed baseload resources are described below:

Nuclear Resources

Existing - The total installed in-service nuclear capacity is 11,419 MW provided by five nuclear generating stations (Pickering A, Pickering B, Darlington, Bruce A and Bruce B) with a total of 16 operating units. This is summarized in Table 8. Nuclear energy production in 2005 and 2006 is also indicated in Table 8.

Table 8: In-service Nuclear Capacity (MW)

Station	Nuclear Units	Installed Capacity (MW)	Energy Production (TWh)	
			2005	2006
Pickering A	P1, P4	1,030	3.8	6.7
Pickering B	P5 – P8	2,064	14.3	14.0
Darlington	D1 – D4	3,524	27.7	27.1
Bruce A	B3, B4	1,540	10.5	10.8
Bruce B	B5 – B8	3,261	22.7	25.9
Total		**11,419**	**79.0**	**84.4**

Source: OPA, IESO
Notes:
1. In 2005, P1 was not in service
2. 2006 energy total does not add up exactly due to rounding

Committed - The Bruce A Refurbishment Project, currently in progress, represents 3,040 MW of committed nuclear resources. Included in this project is the restart of Bruce A, Units 1 and 2, which are currently not in-service. Their return to service, projected by 2009 to 2010, will add 1,500 MW of nuclear baseload capacity in the near term which will be available over the next 25 years.

Hydroelectric Resources

Existing - There is 3,180 MW of in-service baseload hydroelectric capacity. This is provided by run-of-the-river hydroelectric generating facilities owned by OPG and is summarized in Table 9. The associated energy production for 2005 and 2006 from the baseload hydroelectric facilities is also indicated.

Table 9: In-service Hydroelectric Baseload Capacity (MW)

Station	Installed Capacity (MW)	Energy Production (TWh) 2005	Energy Production (TWh) 2006
Sir Adam Beck 1	496	1.8	1.5
Sir Adam Beck 2	1,472	9.8	10.0
Decew Falls 1	23	0.1	0.1
Decew Falls 2	144	1.0	0.8
R.H. Saunders	1,045	5.5	5.6
Total	**3,180**	**18.2**	**18.0**

Source: IESO

Committed – As indicated in Exhibit D-5-1, Renewable Resources, there is a total of 62 MW of committed hydroelectric installed capacity. For planning purposes all run-of-the-river hydroelectric facilities are considered as baseload resources. Hydroelectric facilities with an installed capacity of 10 MW or less that are not run-of-the-river facilities are assumed to contribute to baseload energy with an average capacity factor of 50%.

Gas-fired Resources

Existing – As indicated in Exhibit D-3-1, Determining Resource Requirements, there is a total of 1,658 MW of in-service natural gas-fired baseload resources. The majority of these use Combined Cycle Gas Turbines (“CCGT”), while a few use Simple Cycle Gas Turbines (“SCGT”). Over 1,000 MW of the in-service facilities are under 20 to 25 year

Non-Utility Generation (“NUG”) Power Purchase Agreements (“PPAs”) which were entered into by the former Ontario Hydro during the late 1980s and early 1990s. Many of the NUG contracts will expire over the 2012 to 2018 period. Under the terms of the NUG contracts, the facilities were generally designed for baseload operation. For planning purposes, therefore, these are considered to operate as baseload supply. However, their contribution to future baseload capacity will be re-assessed in light of the Directive’s requirement for the use of gas at peak times and in applications that allow high efficiency and high value use of the fuel. This will include consideration of the extent to which these facilities are operated as cogeneration steam hosts. Based on the re-assessment, some of the NUG facilities may be better suited for peaking and intermediate load applications.

Committed CHP – There is a total of 414 MW of committed CHP facilities expected to be in-service by 2010. These were procured by the OPA under the authority of the June 15, 2005 Directive[1]. They are non-dispatchable resources and are considered to be baseload supply.

Coal-fired Resources

Of the total 6,434 MW of installed in-service coal-fired capacity, about half of this capacity contributes to baseload capacity. This contribution is projected to decline after 2010 to about 1,600 MW in the 2012 to 2014 timeframe after which the coal-fired generation will be replaced. Table 10 summarizes total coal-fired energy production over the last three years. About half of this contributes to meeting baseload energy requirements. The Plan assumes the associated coal-fired baseload energy production contributions to be 14 TWh per annum to 2010 declining thereafter to 7 TWh per annum in the 2012 to 2014 timeframe.

[1] The Directive is titled “Immediate Launch of Procurement Processes to address needs in Downtown Toronto, Western Greater Toronto area, and to develop additional Demand Management, Demand Response and High Efficiency Combined Heat and Power Supply”.

Table 10: Total Coal-fired Energy Production (TWh)

	Total Coal-fired Energy Production (TWh)
2004	26.8
2005	30.0
2006	25.0

Source: OPA

Conservation

Committed – A total of 550 MW of committed baseload Conservation resources, to be in-service by 2010, are included in the Plan. Conservation baseload resources are derived from end-uses that will produce electricity savings year round. These include energy efficiency applications such as lighting, refrigeration and water heating, as well as some fuel switching applications (e.g., space heating, water heating).

Wind Resources

Existing Wind **–** The current installed wind capacity is 395 MW. The associated baseload energy production from wind resources is estimated assuming an average capacity factor of 30%.

Committed Wind –A total of 1,251 MW of committed wind resources are projected for in-service by 2010.

Q. The second step in the OPA's analysis was to identify planned baseload resources. What are the planned baseload resources?

A. The planned baseload resources are as follows:

Conservation Resources

The contribution from Conservation baseload resources will increase over the term of the Plan as current, planned and future Conservation initiatives materialize. As set out in Exhibit D-4-1, the Plan includes a planned Conservation baseload contribution of 280 MW by 2010, increasing to 2,200 MW by 2027.

Renewable Resources

Hydroelectric - The IPSP sets out to acquire all feasible hydroelectric resources (see Exhibit D-5-1). Of these, the proposed Newpost Creek station (25 MW installed capacity) is a run-of-the river facility. It is therefore considered a baseload resource and has a projected in-service date of 2012. As discussed previously, for planning purposes it is also assumed that hydroelectric facilities with an installed capacity of 10 MW or less will contribute to baseload energy assuming an average capacity factor of 50%.

Wind - The OPA projects wind generation resources to increase from the currently installed total of 395 MW as at the end of 2006, to 4,685 MW by 2025. As discussed previously, the baseload energy contribution from wind resources is estimated assuming an average capacity factor of 30%.

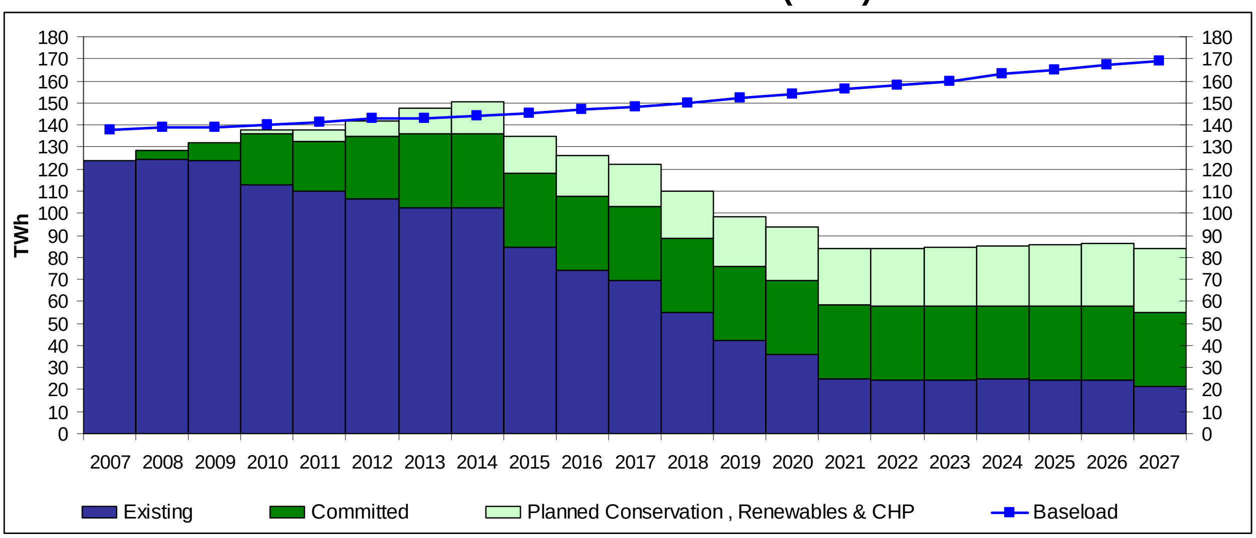
CHP Resources

The OPA has been directed under the June 15, 2005 Directive to procure 1,000 MW of CHP generation. CHP facilities, which will be mostly gas-fired, are considered to be non-dispatchable baseload resources. To date 414 MW of CHP has been procured and is included as committed CHP. The remaining 586 MW of CHP resources will be procured in the future and is included as planned CHP. This does not preclude the acquisition of additional CHP resources that are feasible and economic. This could include some of the existing (NUG) CHP resources when their current contracts expire.

Q. The third step in the OPA's analysis was to determine the remaining baseload requirements that should be met after determining the contributions from existing and committed baseload resources and from planned Conservation, renewable and CHP resources. What are the remaining baseload requirements?

A. The results from Step 1 and from Step 2 in the OPA's analysis are illustrated in the following figures and tables. Figure 8 illustrates the energy contribution from the existing, committed and planned (Conservation, renewables and CHP) baseload resources.

Figure 8: Existing and Committed Baseload Resources + Planned Conservation, Renewable and CHP Baseload Resources (TWh)



Source: OPA

As indicated in Figure 8, the shortfall in meeting baseload energy requirements in 2027 is of the order of 85 TWh. This is after the existing, committed and planned feasible Conservation, renewable and CHP baseload resources are included. Table 11 summarizes the associated annual energy contribution by resource type and category.

Table 11: Existing and Committed Baseload Resources + Planned Conservation, Renewable and CHP Baseload Resources (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing Nuclear	83	83	83	72	72	72	69	69	60	50	46	33	20	14	3	3	3	3	3	3	0
Committed Nuclear	0	0	0	11	11	16	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Existing Renewables	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Existing Gas	7	7	7	7	7	7	7	7	5	5	4	3	3	3	3	2	2	2	2	2	2
Existing Coal	14	14	14	14	11	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0
Committed Renewables	0	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Committed Conservation	0	3	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Committed CHP	0	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Planned Conservation	0	0	0	0	2	3	4	6	7	8	9	9	10	11	12	12	13	13	14	14	15
Planned Renewables	0	0	0	2	4	4	5	6	7	8	8	9	10	11	11	11	11	11	11	11	11
Planned CHP	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Total	124	128	132	138	138	142	148	150	135	126	122	110	98	94	84	84	85	85	86	86	84

Source: OPA

Table 12 identifies the capacity associated with the different types of baseload resources.

Table 12: Existing and Committed Baseload Resources + Planned Conservation, Renewable and CHP Baseload Resources (Effective MW)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing Nuclear	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
Committed Nuclear	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
Existing Renewables	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560	2,560
Existing Gas	1,658	1,658	1,658	1,658	1,658	1,658	1,493	1,493	1,189	1,142	936	602	602	602	602	471	471	471	471	471	471
Existing Coal	3,217	3,217	3,217	3,217	2,485	1,647	1,647	1,647	0	0	0	0	0	0	0	0	0	0	0	0	0
Committed Renewables	0	55	217	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272	272
Committed Conservation	284	373	508	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
Committed CHP	0	31	178	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414
Planned Conservation	0	0	0	284	453	621	790	958	1,126	1,241	1,356	1,471	1,579	1,676	1,755	1,831	1,904	1,980	2,037	2,138	2,233
Planned Renewables	0	3	36	40	170	193	284	379	462	522	548	643	721	849	855	855	855	866	866	866	866
Planned CHP	0	0	0	0	0	0	586	586	586	586	586	586	586	586	586	586	586	586	586	586	586
Total	19,138	19,316	19,792	20,374	19,940	20,062	20,998	21,261	18,249	17,013	16,432	14,624	13,115	12,460	11,148	11,093	11,166	11,253	11,310	11,410	10,990

Source: OPA

Table 13 identifies the remaining energy gap after the existing, committed and planned feasible Conservation, renewable and CHP baseload resources are included.

Table 13: Remaining Gap in Baseload Energy Requirements (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Baseload resources	124	128	132	138	138	142	148	150	135	126	122	110	98	94	84	84	85	85	86	86	84
Baseload requirement	138	139	139	140	141	143	143	144	145	147	148	150	152	154	156	158	160	163	165	167	169
Gap	-14	-11	-7	-2	-3	-1	5	6	-10	-21	-26	-40	-54	-60	-72	-74	-75	-78	-79	-81	-85

Source: OPA

Q. The fourth step in the OPA's analysis was to determine the preferred option for meeting the remaining baseload requirements. What is the preferred option?

A. In Step 4, nuclear and CCGT resources were considered as feasible options. The OPA analysis determined that nuclear was the preferred baseload resource as discussed in Exhibit D-3-1, Attachment 1. This does not preclude the possibility of new feasible resources emerging in the future. Specifically, it is possible that contracts for firm imports of baseload resources may prove to be available, or that Conservation resources in addition to those specified in the Directive may be realized. With respect to Conservation, the OPA will be reviewing the results of its Conservation programs through EM&V. These results may demonstrate that additional Conservation resources could be a feasible baseload alternative to supply.

Q. The fifth step of the OPA's analysis was to determine the feasible amount of, and contributions from, the preferred option to meet the remaining baseload requirements. What is the feasible amount and what are the expected contributions to meeting the baseload requirements?

A. In order to respond to this question, it is necessary to consider the timing of new build nuclear generation and whether or not nuclear units are refurbished.

Q. What is the timing of new nuclear generation?

A. Under both Case 1A and Case 1B, the earliest in-service date for new nuclear generation is 2018, based on the assumption of a 10 year lead time requirement for new nuclear. The OPA understands that the following preliminary assessments are being carried out by OPG and Bruce Power.

- In 2006, Bruce Power and OPG started the federal approvals process for the construction of new nuclear power plants at the Bruce site and at the Darlington site, respectively. As part of this process, applications have been made to the Canadian Nuclear Safety Commission ("CNSC") for Site Preparation licenses as part of an Environmental Assessment ("EA") required under the *Canadian Environmental*

Assessment Act ("CEAA"). This is the first of many licenses required under the federal approvals process for new nuclear units.

- The OPG initiative is in accordance with a June 2006 Ministerial Directive to OPG "to begin the work needed to enter into an approvals process, including an environmental assessment for new units to be built at an existing facility". The proposed OPG project is for up to 4,800 MW of new nuclear capacity from up to four nuclear generating stations. The proposed Bruce Power project is for the construction and operation of up to four new nuclear reactors with a total capacity of approximately 4,000 MW. In the event that either or both of these projects are implemented, Bruce Power and OPG project that site preparation and construction of the nuclear units could start as early as 2010/2011.
- Both Bruce Power and OPG will be considering various nuclear reactor technology options as part of their proposed projects. The technology options include CANDU, Advanced CANDU, Pressurized Water Reactor ("PWR"), and Boiling Water Reactor ("BWR") designs. The respective project EAs will include these technology options.

Separately, the Ontario government has recently commissioned McKinsey and Company to conduct an independent strategic assessment of the nuclear technology options available to the province. This assessment is expected to be completed later in 2007.

The OPA takes no position on the issue of a preferred nuclear reactor technology option for new nuclear generation as this is not relevant for the purpose of this Plan.

Q. How much of this baseload nuclear capacity will be from refurbished nuclear and from new build nuclear?

A. Up to 8,988 MW of nuclear capacity can potentially be acquired from the refurbishment of existing nuclear generating facilities over the term of the Plan. This consists of the units at Pickering B (2,064 MW), Bruce B (3,400 MW) and Darlington (3,524 MW).

- Case 1A includes 3,040 MW of committed refurbished nuclear from the current Bruce A Refurbishment Project and 10,249 MW of planned nuclear. The planned nuclear assumes up to 8,988 MW of refurbished nuclear (Pickering B, Bruce B and Darlington) and 1,400 MW of new build nuclear.

- Case 1B includes 3,040 MW of committed refurbished nuclear from the Bruce A Refurbishment project and 10,185 MW of planned nuclear. The planned nuclear assumes up to 6,785 MW of refurbished nuclear (Bruce B and Darlington) and 3,400 MW of new build nuclear.

The IPSP accommodates both scenarios as demonstrated in Figures 3 to 6. As the Plan evolves, the composition of the planned nuclear resources could change with respect to actual amounts of refurbished nuclear and new build nuclear resources.

Refurbishment decisions will not be made by the OPA, but by nuclear plant owners or operators. The first refurbishment decision, expected in 2008, relates to Pickering B. If OPG decides not to refurbish Pickering B, then the Plan assumes that the associated capacity of 2,064 MW will be replaced at a later time by new nuclear resources. This constitutes Case 1B.

Similar scenarios with respect to the refurbishment of Bruce B and Darlington or replacement with new build nuclear will be considered in future Plans. These considerations do not affect the current IPSP.

The following describes considerations related to refurbished nuclear and new build nuclear assumed in the Plan:

The four units at Bruce A (3,040 MW) are currently being refurbished and are included as committed nuclear in the Plan:

- Bruce Power entered into a $4.25 billion *Bruce Power Refurbishment Implementation Agreement* with the OPA in October 2005 to refurbish and restart Units 1 and 2, refurbish Unit 3 and extend the operating life of Unit 4. The restart of Units 1 and 2, expected to be completed by 2009 to 2010, will add another 1,500 MW of nuclear capacity and extend their service lives by 25 years. This will increase the total Bruce site generating capacity to about 6,200 MW. The work on

Units 3 and 4 is expected to be completed by 2012. This will extend the service life of Bruce Unit 3 by another 25 years and that of Bruce Unit 4 to about 2016 to 2017.

- Since the *Bruce Power Refurbishment Implementation Agreement* was signed, Bruce Power has entered into an amendment (the "First Amending Agreement to the Bruce Power Refurbishment Implementation Agreement") with the OPA which will increase the scope of the original project to also include the full refurbishment of Bruce Unit 4. This is projected to be completed by 2012 and will result in the extension of the service life of Bruce Unit 4 by another 25 years.

Refurbishment is an established option, both from a technical and regulatory standpoint, as demonstrated by many completed nuclear refurbishment projects both in Canada and internationally. Specifically, refurbished nuclear units in Ontario currently in-service include Units 1 and 4 of Pickering A. Currently, Bruce Power is refurbishing all four Bruce A Units with a projected completion date of 2012 for the full project. Other relevant Canadian experience includes the refurbishment, in progress, of the 680 MW Point Lepreau nuclear generating station by New Brunswick Power with a projected completion date of 2009.

Subject to economic viability, refurbishment is an attractive option for the following reasons:

- Compared to the new nuclear build option, refurbishment provides a shorter lead-time advantage as a result of unit refurbishment outages of two years or less;
- Refurbishment utilizes existing generation infrastructure, sites and transmission infrastructure thereby minimizing the associated environmental footprint;
- Local and surrounding community support for the continued operation of the Pickering, Bruce and Darlington generating stations is strong; and
- Experience from past and current refurbishment projects, both domestically and internationally, is leveraged on an on-going basis. This could result in improved project cost and schedules.

The refurbishment of Pickering B, in particular, is an example of the merit of refurbishment in providing system and timing advantages.

Q. What is the feasible amount of nuclear generation to meet the baseload energy requirements?

A. To meet the remaining baseload energy requirements of about 85 TWh by 2027, it will be necessary over the course of the Plan to add over 10,000 MW of planned nuclear resources. This includes the replacement of existing nuclear resources most of which are projected to reach the end of their service lives between 2013 and 2020[2]. The planned nuclear resources are in addition to the committed Bruce Power (Bruce A) Refurbishment project.

Table 14 and Figure 9 identify the nuclear capacity (existing, committed and planned) over the term of the Plan under Case 1A and Case 1B.

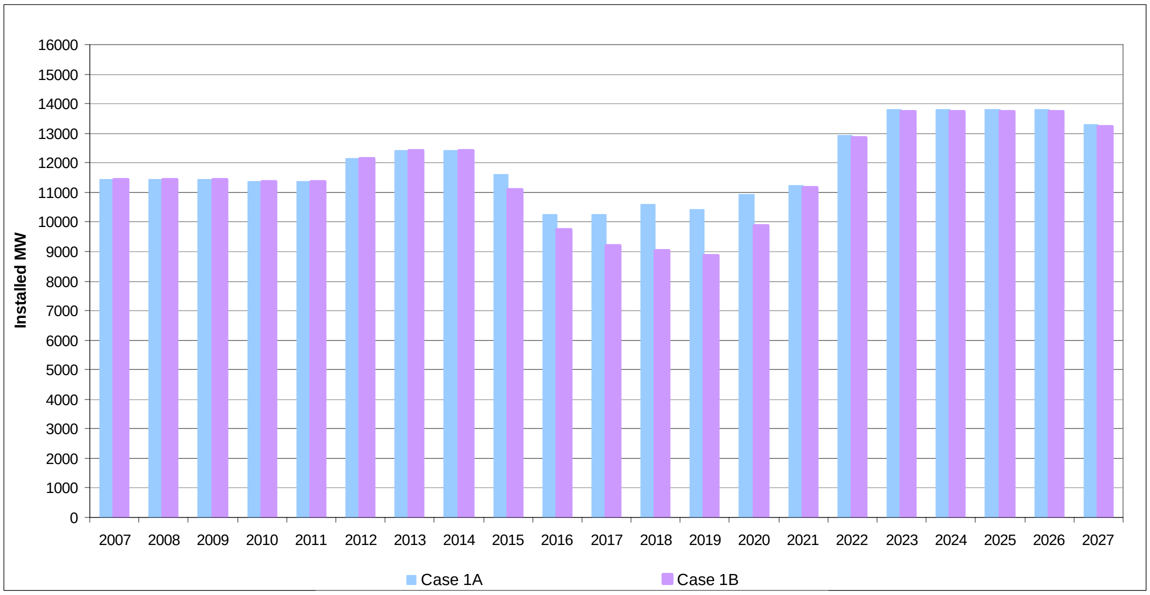
Table 14: Nuclear Capacity under Case 1A and Case 1B (MW)

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A	Existing	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
	Committed	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
	Planned	0	0	0	0	0	0	0	0	516	516	1,032	3,045	4,593	5,990	7,673	9,368	10,249	10,249	10,249	10,249	10,249
	TOTAL	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,606	10,242	10,242	10,572	10,425	10,941	11,228	12,923	13,804	13,804	13,804	13,804	13,289
		2,007	2,008	2,009	2,010	2,011	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019	2,020	2,021	2,022	2,023	2,024	2,025	2,026	2,027
Case 1B	Existing	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
	Committed	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
	Planned	0	0	0	0	0	0	0	0	0	0	0	1,497	3,045	4,926	7,609	9,304	10,185	10,185	10,185	10,185	10,185
	TOTAL	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,090	9,726	9,210	9,024	8,877	9,877	11,164	12,859	13,740	13,740	13,740	13,740	13,225

Source: OPA

[2] Unit service lives are generally determined by the technical or economic end-of-life of major components such as nuclear fuel channels, feeder pipes and/or steam generators.

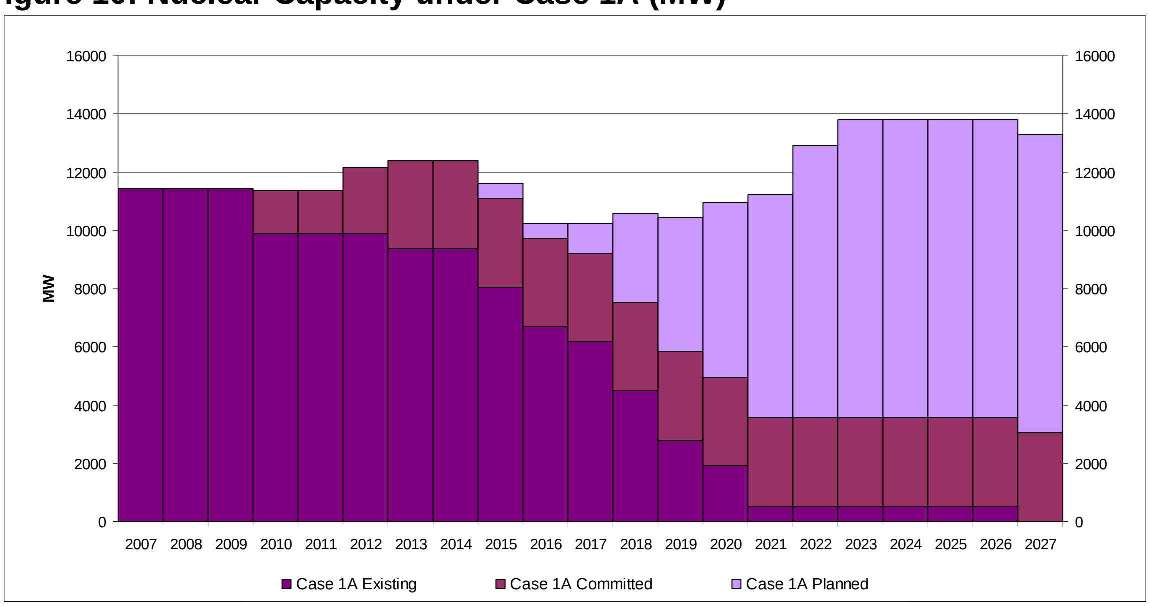
Figure 9: Nuclear Capacity under Case 1A and Case 1B (MW)



Source: OPA

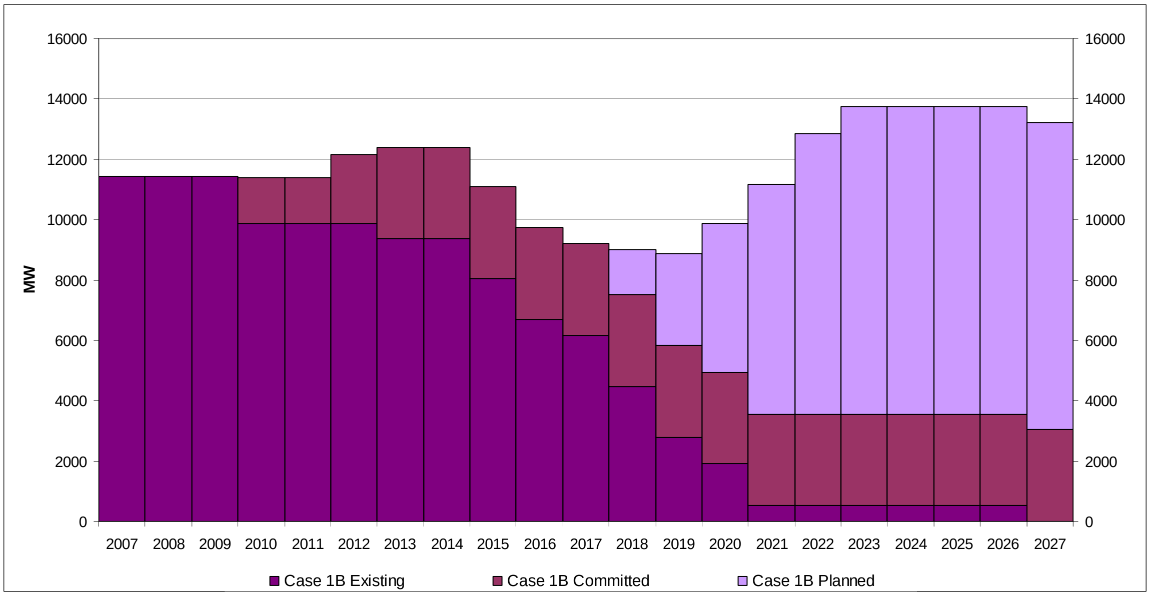
Figure 10 and Figure 11 further illustrate the installed in-service nuclear capacity under the two scenarios.

Figure 10: Nuclear Capacity under Case 1A (MW)



Source: OPA

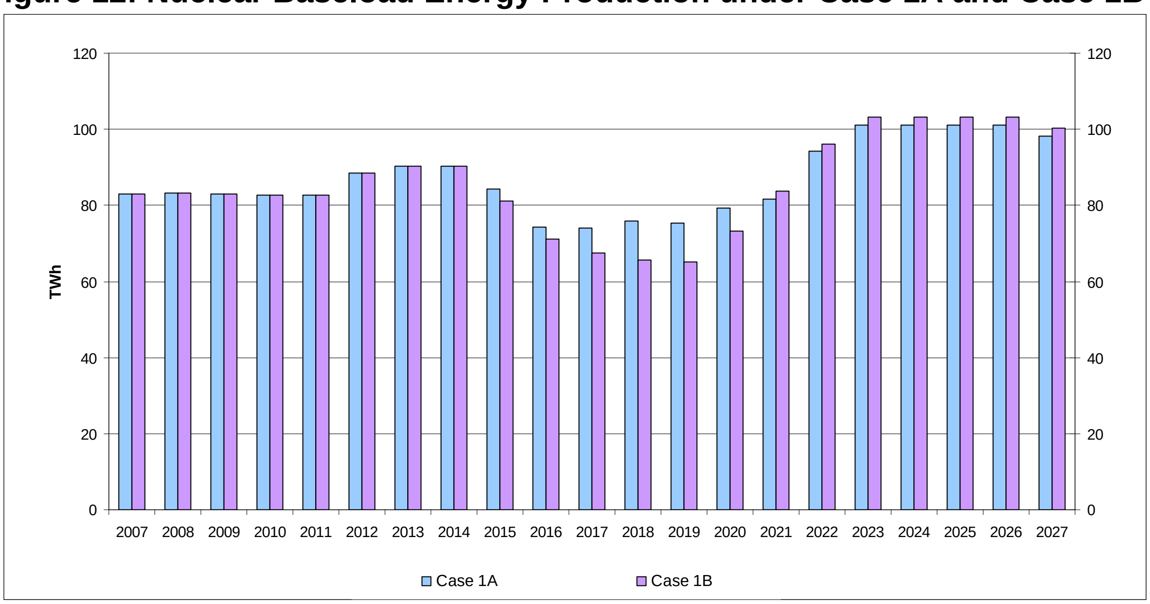
Figure 11: Nuclear Capacity under Case 1B (MW)



Source: OPA

The associated nuclear baseload energy production under Case 1A and Case 1B is illustrated in Figure 12 and Table 15.

Figure 12: Nuclear Baseload Energy Production under Case 1A and Case 1B (TWh)



Source: OPA

Table 15: Nuclear Baseload Energy Production under Case 1A and Case 1B (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A (Pickering B Refurbished)	83	83	83	83	83	89	90	90	84	74	74	76	75	79	82	94	101	101	101	101	98
Case 1B (Pickering B Not Refurbished)	83	83	83	83	83	89	90	90	81	71	67	66	65	73	84	96	103	103	103	103	100

Source: OPA

Q. What are the OPA's assumptions about the conditions necessary to achieve the amount and timing of planned baseload nuclear capacity?

A. The key assumptions and conditions necessary to achieve the amount and timing of planned baseload nuclear capacity are:

For Nuclear Refurbishment:

- Successful completion of the *Bruce A Refurbishment for Life Extension and Continued Operations Project*, initiated in October 2005 and scheduled for completion by 2012;
- Specific to Case 1A, a viable business case, including EA approval, for the refurbishment of the four Pickering B units followed by an affirmative decision by OPG's Board in 2008 to proceed with the project and successful completion of the Pickering B Refurbishment Project over the 2013 to 2016 Plan period;
- Availability of adequate resources, both in terms of skilled resources and material supplies;
- Continued support and acceptance by the public and by host communities surrounding existing nuclear sites (Pickering, Darlington and Bruce) for their continued operation and utilization of existing transmission infrastructure;
- Sustained performance and reliability of operating and refurbished nuclear units; and
- Continued and successful application of refurbishment experience, both domestic and international, to the assessment of future refurbishment options in Ontario.

For New Build Nuclear:

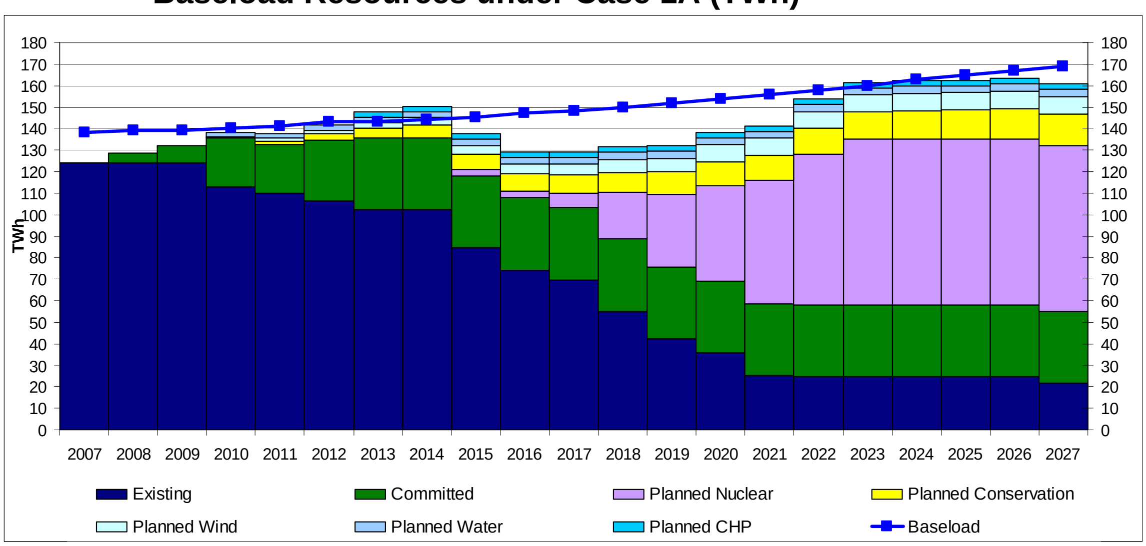
- Support and acceptance by the public and by host communities surrounding the proposed sites for new build nuclear, currently, Bruce and Darlington;
- Successful and timely completion of the federal approvals process, including EA approval, of applications made by Bruce Power and by OPG for the construction and operation of new nuclear generating units at the Bruce and Darlington sites, respectively;

- Continued viability and cost-effectiveness of the new nuclear option, and especially of the preferred nuclear reactor technology option(s) to be selected for Ontario;
- Timely provision of applicable regulatory standards and policies governing the preferred nuclear technology option(s) selected for new build nuclear, to the extent such standards and policies are necessary;
- Adequate infrastructure and resources in support of the financing, design, construction and operation of the preferred nuclear technology option(s) selected for new build nuclear; and
- Sustained performance, safety and reliability of new nuclear units consistent with the best international experience.

Q. In summary, what is the expected contribution of the existing, committed and planned baseload resources to meeting baseload requirements?

A. Figure 13 illustrates the Step 5 results in the OPA's analysis under Case 1A. In addition to the planned nuclear baseload energy contribution, the contributions from other existing, committed and planned resources to baseload energy are also indicated. Table 16 identifies the associated annual contributions to baseload energy from existing, committed and planned resources.

Figure 13: Energy Production from Existing, Committed and Planned Baseload Resources under Case 1A (TWh)



Source: OPA

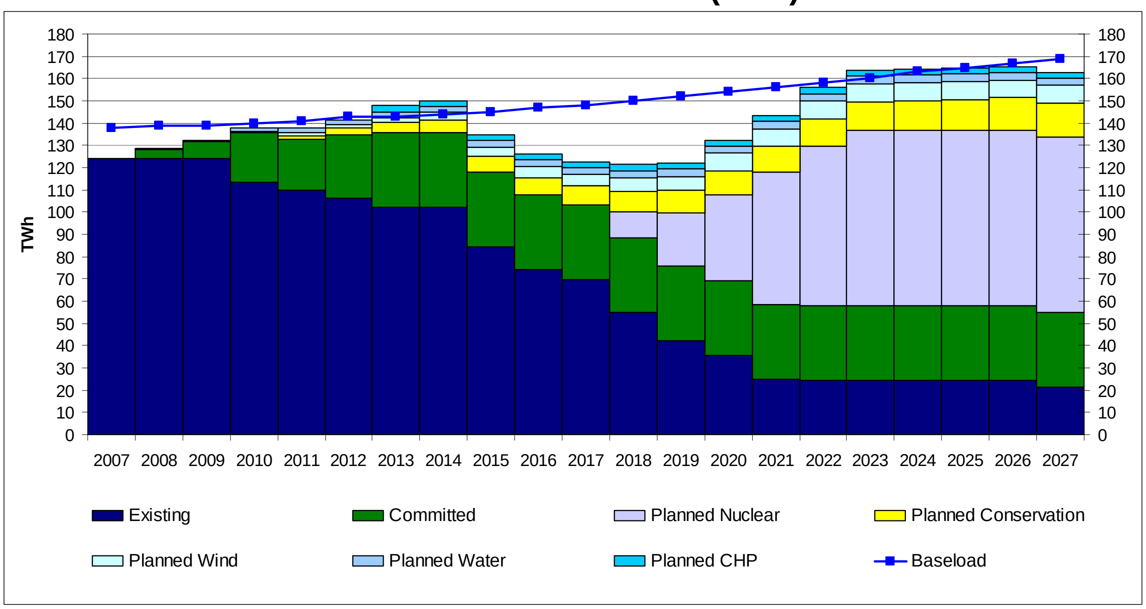
Table 16: Energy Production from Existing, Committed and Planned Baseload Resources under Case 1A (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing	124	124	124	113	110	106	102	102	84	74	70	55	42	36	25	25	25	25	25	25	22
Committed	0	4	8	23	23	28	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Planned Nuclear	0	0	0	0	0	0	0	0	3	3	7	22	34	44	57	70	77	77	77	77	77
Planned Conservation	0	0	0	0	2	3	4	6	7	8	9	9	10	11	12	12	13	13	14	14	15
Planned Wind	0	0	0	0	2	2	2	4	4	5	5	6	7	8	8	8	8	8	8	8	8
Planned Water	0	0	0	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Planned CHP	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
TOTAL	124	128	132	138	138	142	148	150	138	129	129	131	132	138	141	154	161	162	163	163	161

Source: OPA

Figure 14 and Table 17 illustrate the corresponding results under Case 1B.

Figure 14: Energy Production from Existing, Committed and Planned Baseload Resources under Case 1B (TWh)



Source: OPA

Table 17: Energy Production from Existing, Committed and Planned Baseload Resources under Case 1B (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Existing	124	124	124	113	110	106	102	102	84	74	70	55	42	36	25	25	25	25	25	25	22
Committed	0	4	8	23	23	28	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34
Planned Nuclear	0	0	0	0	0	0	0	0	0	0	0	11	24	38	59	72	79	79	79	79	79
Planned Conservation	0	0	0	0	2	3	4	6	7	8	9	9	10	11	12	12	13	13	14	14	15
Planned Wind	0	0	0	0	2	2	2	4	4	5	5	6	7	8	8	8	8	8	8	8	8
Planned Water	0	0	0	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Planned CHP	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
TOTAL	124	128	132	138	138	142	148	150	135	126	122	121	122	132	143	156	164	164	165	165	163

Source: OPA

As illustrated in Figure 13 and Figure 14, baseload requirements under the two scenarios are not fully met with the existing, committed and planned baseload resources during the period 2015 to 2021. During this timeframe the refurbishment of Pickering B units is either under way, or the units are being taken out of service; in addition, Bruce B refurbishment is assumed to start. Under these conditions, nuclear energy production is reduced which accounts for the identified baseload energy shortfalls during the period. The OPA did not consider additional feasible baseload resources to be available to address this shortfall since the planned amounts of Conservation, renewable and CHP resources have been maximized.

To make up for the identified baseload energy shortfalls during the period 2015 to 2021, contributions from other resources are required. While the specific contribution from these resources cannot be determined in detail at this time, there are a number of potential options to increase baseload energy contributions during this period. These include the following:

- contributions from additional Conservation, renewable and CHP resources in excess of planned levels to the extent this is feasible;
- increased energy production from other available baseload resources to the extent this is feasible[3];
- contributions from intermediate load resources, e.g., CCGT;
- potential purchases from interconnections; and
- earlier implementation of new build nuclear generation[4] compared to the IPSP assumption that new build nuclear generation will not be available before 2018.

[3] One such option is IGCC with carbon capture and sequestration which was considered in the OPA Supply Mix report, Volume 3, Section 3.8.1. It concluded that large–scale coal gasification with carbon sequestration is not feasible in Ontario and not economic at this time. When and if it becomes feasible in the future, it will be considered as an option.

[4] Bruce Power and OPG identify possible in-service dates of 2015 -2016 for new build nuclear: www.brucepower.com: Bruce Power New Build Project Environmental Assessment - Project Description (January 2007); www.opg.com/pdf/darlprojdesc.pdf: Project Description for the Site Preparation, Construction and Operation of the Darlington B Nuclear Generating Station - Environmental Assessment (April 12, 2007)

As indicated in Figure 13 and Figure 14, above, in the longer term and for the remainder of the Plan period the identified baseload energy shortfalls disappear as additional resources are implemented.

5.0 ECONOMIC PRUDENCE AND COST-EFFECTIVENESS

Q. How has the economic prudence and cost effectiveness of planned baseload resources to meet baseload requirements been determined?

A. The planning criteria considered by the OPA are: feasibility, cost, reliability, flexibility, environmental performance and societal acceptance.

Feasibility

Feasibility was addressed in Step 2 of the five-step approach used by the OPA in determining the resources to meet baseload electricity requirements and their associated contributions. Specifically, in Step 2 all maximum feasible Conservation, renewable and CHP baseload resources were selected. In Steps 4 and 5 nuclear resources were selected as the preferred option to meet the remaining baseload requirements after all the existing and committed resources and the planned Conservation, renewable and CHP resources were determined. To the extent feasible and, if economic, baseload resources become available earlier to mitigate identified baseload energy shortfalls in the period 2015 to 2021, these options will be considered in successive Plans.

Cost

The cost analysis was primarily carried out in Step 4 where the two candidate marginal baseload resources – nuclear and CCGT - were assessed on an economic basis. The assessment supported the selection of nuclear generation compared to CCGT as detailed in Exhibit D-3-1, Attachment 1.

Flexibility

Baseload requirements by definition are not required to be met by flexible resources. The baseload resources in the Plan do not contribute to flexibility to respond to uncertainties in load demand and supply requirements due to their limited ramping capabilities. They can also be a major source of uncertainty themselves, e.g., as a result of limited water availability for the hydroelectric baseload resources in any given year or operational issues affecting the performance of nuclear resources. The larger unit capacities and relatively long lead times for new build nuclear generation inherently limit its flexibility. However, Plan flexibility exists in that provision is made to accept additional Conservation, renewable and CHP resources to meet baseload requirements should these be feasible. There is also flexibility to accept new build nuclear baseload resources earlier than assumed in the Plan.

Reliability

The reliability of Ontario's nuclear reactors has, on average, improved measurably during the past several years as a result of both Canadian and international experience in the operation and maintenance of reactors. In addition, relevant international experience in the operation and maintenance of reactors has been leveraged for application to Ontario's reactors. Table 18 is a summary of the 2006 performance and the lifetime performance of CANDU nuclear units in Ontario and elsewhere.

Table 18: CANDU Nuclear Unit Performance (December 2006)

Nuclear Unit	In Service	Capacity (MW)	Performance in 2006 (%)	Lifetime Performance (%)
Pickering 1	1971	542	77.3	63.9
Pickering 4	1973	542	66.2	66.9
Pickering 5	1983	540	89.5	74.1
Pickering 6	1984	540	86.5	77.3
Pickering 7	1985	540	59.2	79.2
Pickering 8	1986	540	64.9	76.1
Bruce 3	1978	805	82.7	62.4
Bruce 4	1979	805	80.6	60.8
Bruce 5	1985	845	96.1	82.8
Bruce 6	1984	872	98.8	80.2
Bruce 7	1986	872	94.7	83.0
Bruce 8	1987	840	76.2	81.0
Darlington 1	1992	934	83.3	83.2
Darlington 2	1990	934	98.5	75.2
Darlington 3	1993	934	72.5	84.6
Darlington 4	1993	934	97.1	85.4
Point Lepreau (New Brunswick)	1983	680	79.1	82.4
Gentilly-2 (Quebec)	1983	675	83.2	79.5
Wolsong 1 (Korea)	1983	622	91.4	85.8
Wolsong 2 (Korea)	1997	730	99.7	94.0
Wolsong 3 (Korea)	1998	729	94.0	95.1
Wolsong 4 (Korea)	1999	730	100.4	97.2
Embalse (Argentina)	1984	648	96.2	85.3
Cernavoda 1 (Romania)	1996	706	91.4	87.5
Qinshan 4 (China)	2002	700	98.2	87.7
Qinshan 5 (China)	2003	700	88.7	86.1
Total/Average		**18,944**	**86.4**	**80.6**

Source: Canadian Nuclear Association Nuclear Energy Handbook 2007: COG CANDU/PHWR Performance Indicators, December 2006
Note: Performance factors refer to capacity factors

Table 19 summarizes the performance of the operating Ontario nuclear units including their performance in 2005 and 2006. The average performance of all the operating units in 2004 was 79.4% indicating a steady improvement in 2005 and 2006, respectively. The lifetime performance for Bruce Units 3 and 4 includes those years when these units were shutdown and placed in a laid-up state. Data for Pickering Units 1 and 4 excludes those years when the units were shutdown and placed in a laid-up state.

Table 19: Ontario CANDU Nuclear Unit Performance

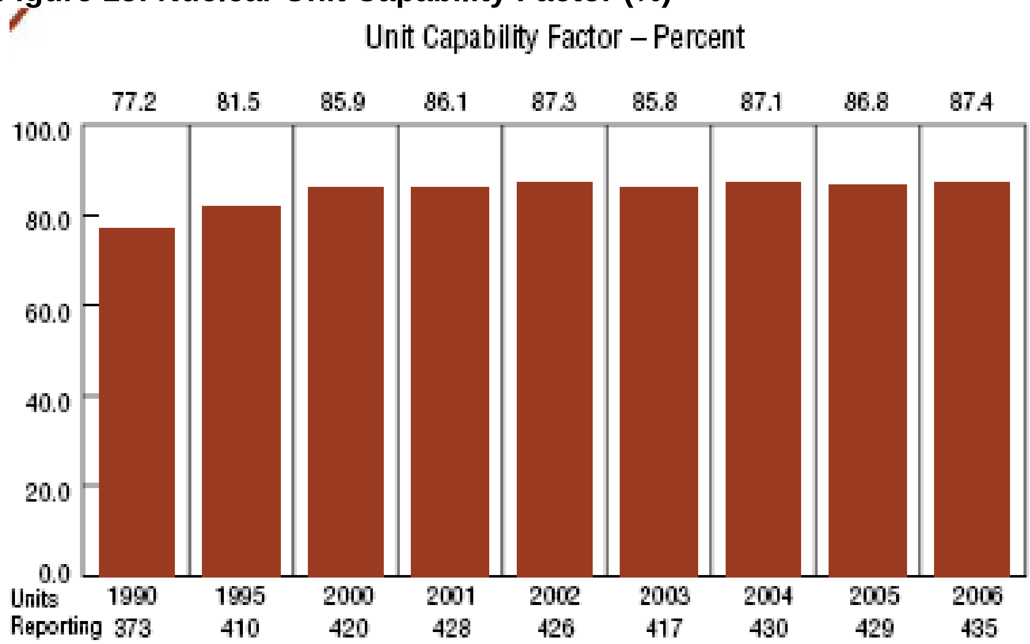
Nuclear Unit	In Service	Capacity (MW)	Performance in 2005 (%)	2006 (%)	Avg. 2005/2006	Lifetime Performance to 2006 (%)
Pickering 1	1971	542	Not I/S	77.3	77.3	63.9
Pickering 4	1973	542	66.4	66.2	66.3	66.9
Pickering 5	1983	540	52.6	89.5	71.1	74.1
Pickering 6	1984	540	63.3	86.5	74.9	77.3
Pickering 7	1985	540	97.8	59.2	78.5	79.2
Pickering 8	1986	540	93.6	64.9	79.3	76.1
Bruce 3	1978	805	74.9	82.7	78.8	62.4
Bruce 4	1979	805	83.3	80.6	82.0	60.8
Bruce 5	1985	845	74.1	96.1	85.1	82.8
Bruce 6	1984	872	79.2	98.8	89.0	80.2
Bruce 7	1986	872	70.2	94.7	82.5	83.0
Bruce 8	1987	840	99.4	76.2	87.8	81.0
Darlington 1	1992	934	96.1	83.3	89.7	83.2
Darlington 2	1990	934	79.0	98.5	88.8	75.2
Darlington 3	1993	934	98.7	72.5	85.6	84.6
Darlington 4	1993	934	85.6	97.1	91.4	85.4
Total/Average		**12,019**	**80.9**	**82.8**	**81.8**	**76.0**

Source: Canadian Nuclear Association Nuclear Energy Handbook 2006 & 2007: COG CANDU/PHWR Performance Indicators, December 2005 and December 2006
Note: Performance factors refer to capacity factor

For planning purposes, the OPA has adopted a conservative approach in the treatment of nuclear unit reliability. Specifically, the OPA has used the average of the actual 2005 and 2006 performance of each unit as representative of the performance of that unit over the Plan period. This is much lower than the corresponding unit performance projections by the nuclear operators.

On a worldwide basis, Figure 15 shows the performance of commercial nuclear units from 1990 to 2006. In 2006, the average unit capability factor of 435 nuclear units was 87.4%.

Figure 15: Nuclear Unit Capability Factor (%)



Source: World Association of Nuclear Operators (WANO), 2006 Performance Indicators

Based on the information presented in Table 18 and Table 19 and in Figure 15, the OPA is satisfied that nuclear generation is a reliable source of baseload supply.

Environmental Performance

Nuclear power plants in Canada fall under federal jurisdiction. They are regulated by CNSC during all stages starting from site selection to decommissioning, including nuclear fuel and waste management. The CNSC's mandate is to protect the health and safety of the public and the environment and to ensure national security arising from risks associated with the use of nuclear energy and nuclear materials. It does so by licensing nuclear facilities and their operations according to prescribed regulations and by monitoring nuclear plant environmental performance and compliance of licensees. In the more than 40 years that nuclear power plants have been operating in Ontario, radiation doses to the public as a result of nuclear power plant operations have been well within prescribed regulatory limits and are significantly lower compared to radiation doses from other, naturally occurring sources or from medical applications.

Environmental impacts associated with the two candidate marginal baseload resources that were assessed, nuclear and CCGT, are discussed more fully in Exhibit G-3-1, Attachment 1, which compares environmental impacts of various supply resources. CCGT have higher greenhouse gas and conventional contaminant (e.g., NO_x, SO_2 and particulate matter) emission factors compared to nuclear, while nuclear has higher radioactivity releases and makes greater use of water compared to CCGT.

Under a Nuclear Funds Agreement with the provincial government, OPG is obligated to contribute to a Decommissioning Fund (to cover future costs for decommissioning nuclear plants) and a Used Fuel Fund (to cover future costs for the disposal of used nuclear fuel bundles). These funds apply to the Bruce A and Bruce B stations as well. As at March 31, 2007, the value of the Decommissioning and Used Fuel Funds was $8.3 billion on a fair value basis, compared to OPG's future liability for fixed asset removal and nuclear waste management of $10.6 billion on a present value basis.[5]

Nuclear energy as an energy source emits virtually no greenhouse gases.

Societal Acceptance

It is well known that public opinion regarding nuclear power issues is generally divided or polarized. Nuclear generating plants have a long operating history in Ontario and their continued operation is generally supported by host and neighbouring communities. Moreover, their significant contributions to meeting Ontario's electricity requirements are recognized. The nuclear industry in Canada falls under federal jurisdiction and is regulated by the CNSC. The regulatory process allows for public input and participation in licensing proceedings.

In June 2007, the government of Canada announced its selection of the Adaptive Phased Management ("APM") option for managing used nuclear fuel in Canada over the long term. This option was recommended by the Nuclear Waste Management Organization ("NWMO") following a three year study involving extensive public and First

Nations consultations. NWMO will now start planning and designing a site-selection process in consultation with the public and other stakeholders for implementing the APM option. APM includes the isolation and containment of used nuclear fuel deep in the earth, with an option for temporary shallow underground storage.

Q. How will the OPA monitor developments to evaluate the progress towards achieving the required amount of baseload capacity?

A. The OPA monitors developments to evaluate the progress towards achieving the required amount of baseload capacity as follows:

- Nuclear - The OPA consults frequently and regularly with both OPG and Bruce Power regarding the status of issues affecting on-going initiatives pertaining to refurbishment and new build nuclear. As these projects proceed, more information will become available through the environmental assessment processes, and additional monitoring of developments will be possible. In addition, the OPA monitors nuclear performance and industry developments, both domestically and internationally.

In addition to the ongoing nuclear-related consultation and monitoring initiatives described above, the OPA will also regularly monitor and assess the contributions and impact from current and planned Conservation and supply resources on baseload requirements over the term of the Plan. These include:

- Hydroelectric – In consultation with hydroelectric generators and the IESO, monitor the continued and projected performance, availability and acquisition of hydroelectric baseload resources;
- NUG-CHP – Monitor and assess the near term and ongoing contribution of NUGs to meeting baseload requirements;
- Conservation – Periodically assess uptake and effective contribution of planned Conservation baseload components;

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[5] OPG 2007 First Quarter Financial Results (May 18, 2007)

- Wind – Periodically assess the uptake and effective contribution, i.e., dependable capacity of wind to meet baseload requirements, as the installed wind capacity increases from the current 395 MW to 4685 MW projected by 2025; and
- CHP – Periodically assess the uptake and effective contribution to baseload capacity from the currently procured 414 MW of CHP (for in-service by 2010) and the additional 586 MW planned in the near term.

Q. What are the economic and financial risks associated with refurbished nuclear and new nuclear options and how have these been factored into the determination of the planned nuclear baseload capacity?

A. The first experience with the refurbishment of nuclear units, Unit 4 of Pickering A by OPG (2001 to 2003), was one of significant project cost overruns and schedule delays. The final refurbishment project cost of $1.25 billion was nearly three times the original cost estimate approved by OPG's Board of Directors and the project was completed two years behind schedule. Following extensive reviews by OPG, the lessons learned from Unit 4 were applied to the refurbishment of Unit 1 of Pickering A. This leveraging of the experience base resulted in the Pickering A, Unit 1 refurbishment to be completed substantially within budget and schedule at a final cost of $1.0 billion.

As at August 2007, the Bruce A Refurbishment project, in particular the work associated with the restart of Units 1 and 2, is within budget and on schedule.

There continue to be financial and other project risks associated with refurbishment projects. To manage these risks, OPA has assumed that some near-term refurbishment projects may not proceed as planned. The OPA has allowed for this contingency in the determination of planned baseload capacity. In particular, two nuclear scenarios have been considered as discussed previously, that is, Case 1A, assuming that Pickering B will be refurbished, and Case 1B, assuming that Pickering B will not be refurbished.

New nuclear technology options represent evolutionary designs. Some of these designs are either operating, under construction, or on order. Many other designs have not been built before. The lack of recent experience in building new nuclear plants in Ontario combined with potentially new licensing and regulatory processes governing the new designs could mean that the initial units to be built will have higher plant costs as a result of new design and engineering features until additional experience is gained.

The risk of cost overruns and project delays has been incorporated into the probabilistic economic analysis carried out to compare the economics of CCGT and nuclear to meet baseload requirements as described in Exhibit D-3-1, Attachment 1. Planning Reserve requirements consider the risk of refurbishment project delays as described in Exhibit D-2-1, Attachment 2.

Q. Are there lower cost alternatives to achieve the target; if so, why were lower cost alternatives not chosen?

A. There are no other viable lower cost alternatives that can achieve the baseload requirements since their contribution to baseload capacity is either already at its maximum potential, such as in the case of hydroelectric resources, or cannot now be determined feasible, such as, in the case of additional Conservation baseload resources. Furthermore, to the extent that some of the planned resources that contribute to meet future baseload requirements (for example, wind and CHP resources) exceed planning projections over the term of the IPSP, their additional contribution towards meeting baseload requirements will be taken into consideration in successive Plans.

5.1 Overview of nuclear baseload resources in the Plan

Q. What capital investments are associated with the committed and planned nuclear baseload resources in the Plan?

A. The annual capital investments associated with the planned nuclear baseload resources (refurbished and new build nuclear) in the Plan are indicated in Table 20. These are discussed more fully in Exhibit G-2-1, Plan Cost.

Table 20: Annual Capital Investments for Planned Nuclear Baseload Resources (2007 $B)

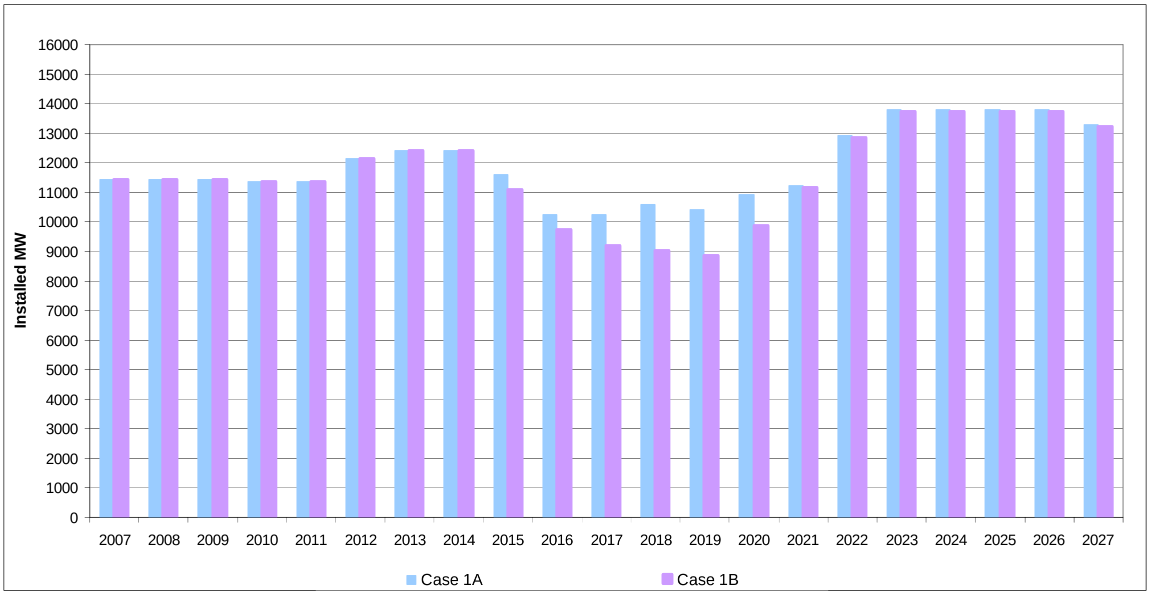
$ (2007) Billions	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A	-	-	-	-	-	1.14	1.52	2.28	3.79	3.79	3.79	4.17	3.03	2.27	0.76	-	-	-	-	-
Case 1B	-	-	-	-	-	0.38	0.76	2.07	3.37	3.37	4.13	4.50	4.12	2.82	0.76	-	-	-	-	-

Source: OPA

Q. What is the nuclear capacity and associated energy production over the term of the Plan?

A. The nuclear capacity over the term of the Plan under the two Scenarios is illustrated in Figure 16, Figure 17 and Figure 18 and in Table 21. The associated nuclear energy production is illustrated in Figure 19 and Table 22.

Figure 16: Nuclear Capacity under Case 1A and Case 1B (MW)



Source: OPA

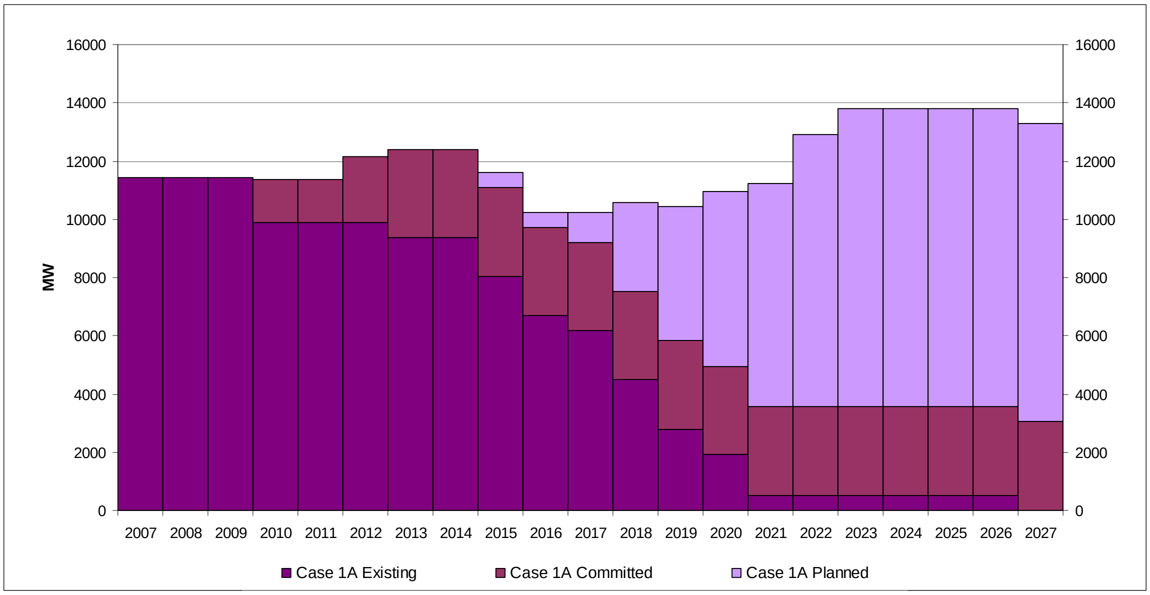
Table 21: Nuclear Capacity under Case 1A and Case 1B (MW)

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A	Existing	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
	Committed	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
	Planned	0	0	0	0	0	0	0	0	516	516	1,032	3,045	4,593	5,990	7,673	9,368	10,249	10,249	10,249	10,249	10,249
	TOTAL	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,606	10,242	10,242	10,572	10,425	10,941	11,228	12,923	13,804	13,804	13,804	13,804	13,289

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1B	Existing	11,419	11,419	11,419	9,879	9,879	9,879	9,363	9,363	8,050	6,686	6,170	4,487	2,792	1,911	515	515	515	515	515	515	0
	Committed	0	0	0	1,500	1,500	2,270	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040	3,040
	Planned	0	0	0	0	0	0	0	0	0	0	0	1,497	3,045	4,926	7,609	9,304	10,185	10,185	10,185	10,185	10,185
	TOTAL	11,419	11,419	11,419	11,379	11,379	12,149	12,403	12,403	11,090	9,726	9,210	9,024	8,877	9,877	11,164	12,859	13,740	13,740	13,740	13,740	13,225

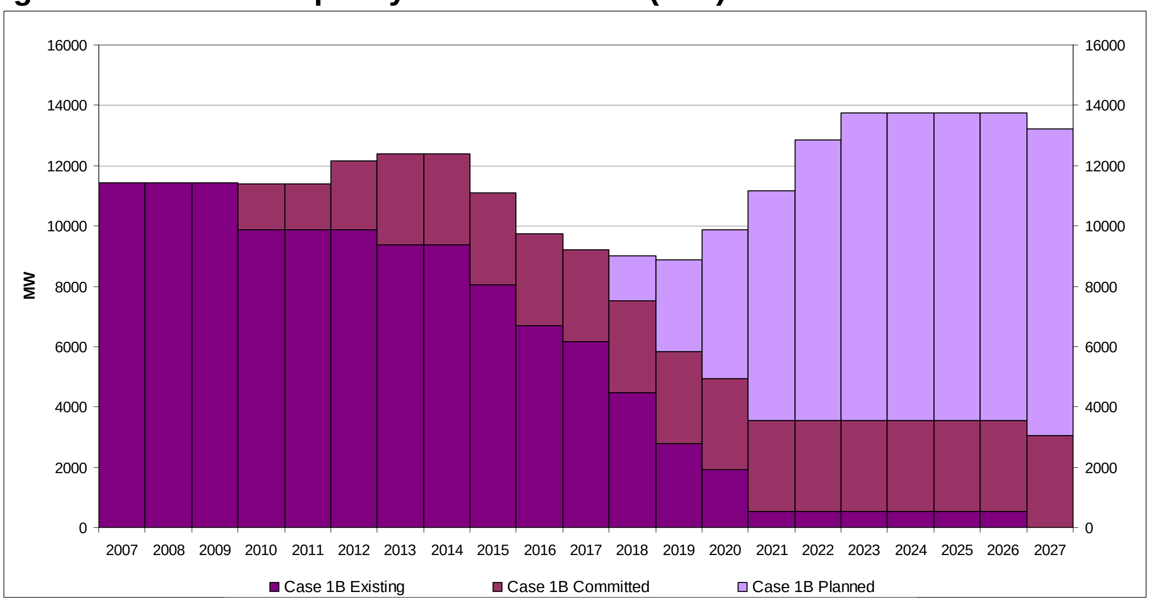
Source: OPA

Figure 17: Nuclear Capacity under Case 1A (MW)



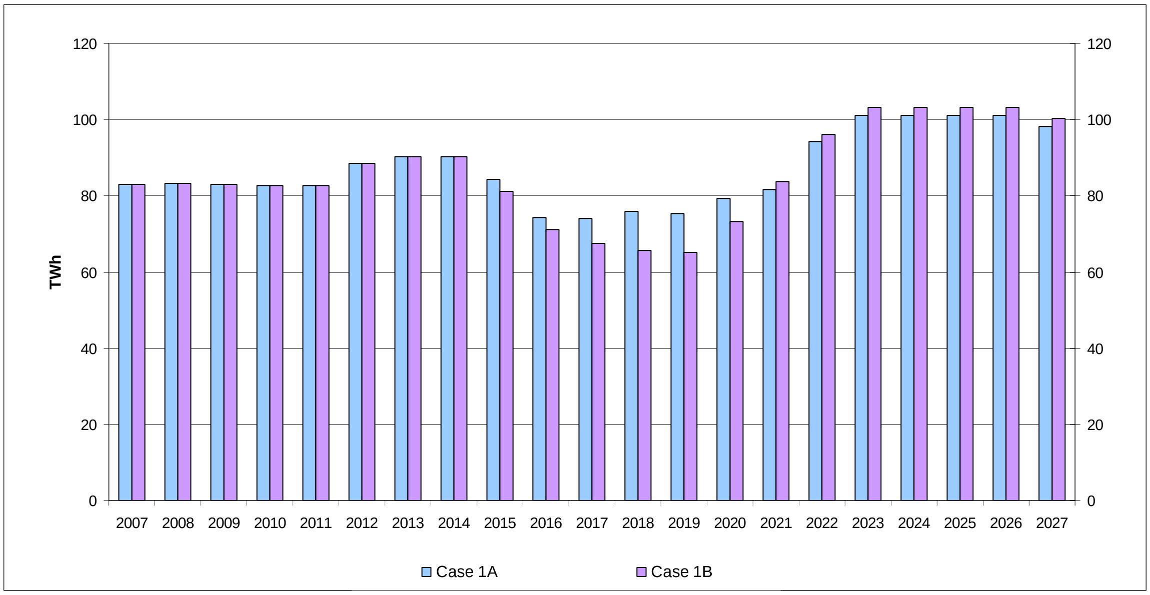
Source: OPA

Figure 18: Nuclear Capacity under Case 1B (MW)



Source: OPA

Figure 19: Nuclear Baseload Energy Production under Case 1A and Case 1B (TWh)



Source: OPA

Table 22: Nuclear Baseload Energy Production under Case 1A and Case 1B (TWh)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Case 1A (Pickering B Refurbished)	83	83	83	83	83	89	90	90	84	74	74	76	75	79	82	94	101	101	101	101	98
Case 1B (Pickering B Not Refurbished)	83	83	83	83	83	89	90	90	81	71	67	66	65	73	84	96	103	103	103	103	100

Source: OPA