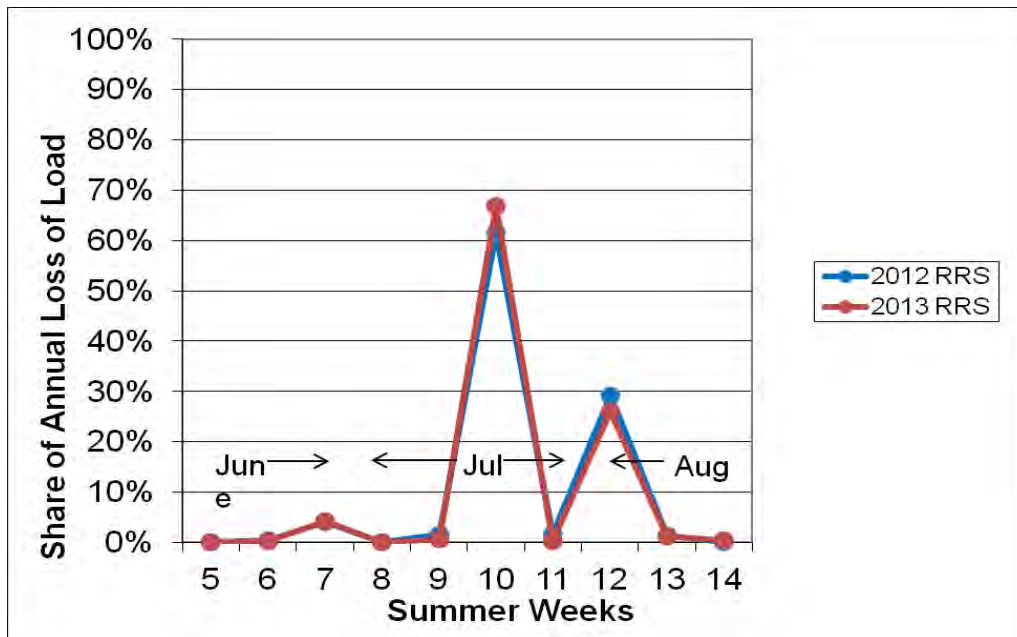


**Limited and Extended Summer Demand Response Targets**  
**Additional analysis requested as part of the “Clearing of Limited DR” issue investigation**  
**Capacity Senior Task Force**  
**October 16, 2014**

**Item #1: When Extended Summer DR (ESDR) is at its target, there is a significant portion of the annual LOLE risk in the six months outside the Extended Summer period.**

As pointed out by Jim Wilson in his presentation at the October 9 CSTF meeting, virtually all of the LOLE risk in the computation of the Installed Reserve Margin (IRM) is concentrated in the summer. This is because the IRM Study assumes all resources are committed for the full Delivery Year.

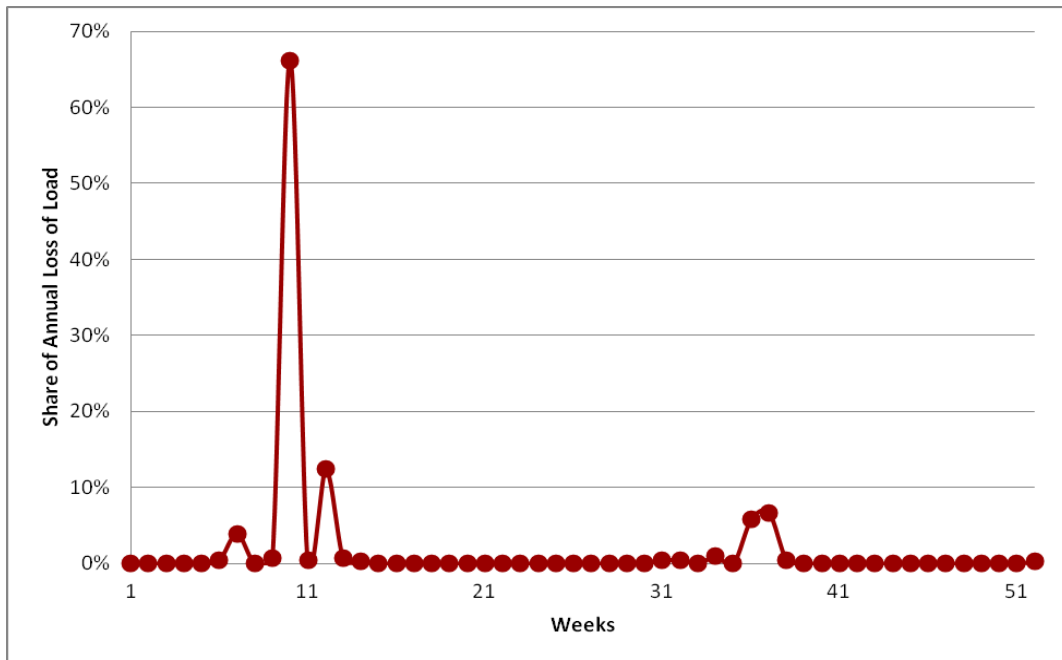


Weeks 10, 12, and 7 contain 66.87%, 26.03%, and 4.24% of the annual LOLE risk, respectively (approximately 97% of the total risk). The full breakdown of the annual LOLE risk by PRISM week in the 2013 RRS for delivery year 2017/18 is as follows (IRM is 15.69%). Week 1 is mid-May.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>
0.00%	0.00%	0.00%	0.00%	0.00%	0.33%	4.24%	0.00%	0.55%	66.87%	0.32%	26.03%	1.17%
<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>
0.49%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>	<b>51</b>	<b>52</b>
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

By design, the current Extended Summer Reliability Target for the RTO is computed by taking the IRM base case and adding Extended Summer DR, replacing an equivalent amount of generation, until the RTO LOLE risk is increased by 10%. This increase in risk occurs because the IRM base case is constructed using annual resources only; when a resource of restricted availability, such as Extended Summer DR, is added to the system, displacing annual resources, there will be a certain amount of Extended Summer DR that will trigger LOLE risk during the weeks in which the restricted resources are not available.

The LOLE risk distribution depicted in the figure above, takes the shape in the figure below once the Extended Summer DR reaches the 2017/2018 BRA target (LOLE risk is increased to 0.11 days/year).



From this figure, it is clear that when the target Extended Summer DR (~10.5 %) is added to the system, most of the LOLE risk still remains in the summer. However, a non-negligible portion of the LOLE risk is shifted to weeks 36-37 (second half of January). The full breakdown of the LOLE risk by PRISM week (week 1 is mid-May) in the case above is as follows:

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>
0.00%	0.00%	0.00%	0.00%	0.04%	0.42%	3.88%	0.00%	0.67%	66.21%	0.37%	12.45%	0.63%
<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>
0.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>
0.00%	0.00%	0.00%	0.00%	0.41%	0.43%	0.00%	0.92%	0.02%	5.76%	6.69%	0.45%	0.05%
<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>	<b>51</b>	<b>52</b>
0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.23%

The weeks in which Extended Summer DR is not available are highlighted in pink in the table above. The total LOLE risk in these weeks represents 14.76% of the annual LOLE risk.

**Item #2: Annual Resources provide more reliability value than Extended Summer Resources when RPM clears above the IRM.**

Consider the previous IRM case (Extended Summer DR is at its target; total LOLE=0.11 days/year) and the following scenarios:

Scenario 1: RPM clears 1% above the IRM.

Scenario 1.A: The additional 1% are Annual Resources

Scenario 1.B: The additional 1% are Extended Summer Resources

Under Scenario 1.A, the LOLE decreases from 0.11 to 0.075 days/year (a 32% decrease). This is due to a reserve margin above the IRM (16.69%) and to the year-long availability of the additional resources.

Under Scenario 1.B, the LOLE decreases from 0.11 to 0.082 days/year (a 25% decrease). The decrease in LOLE is less than in Scenario 1.A due to the 26 week unavailability of the additional resources cleared.

Annual resources, therefore, provide an LOLE decrease that is 7 percentage points greater than the LOLE decrease provided by Extended Summer resources. If the same comparison is made for scenarios in which RPM clears more than 1% above the IRM, the difference in the LOLE decrease between the two types of resources is even greater.

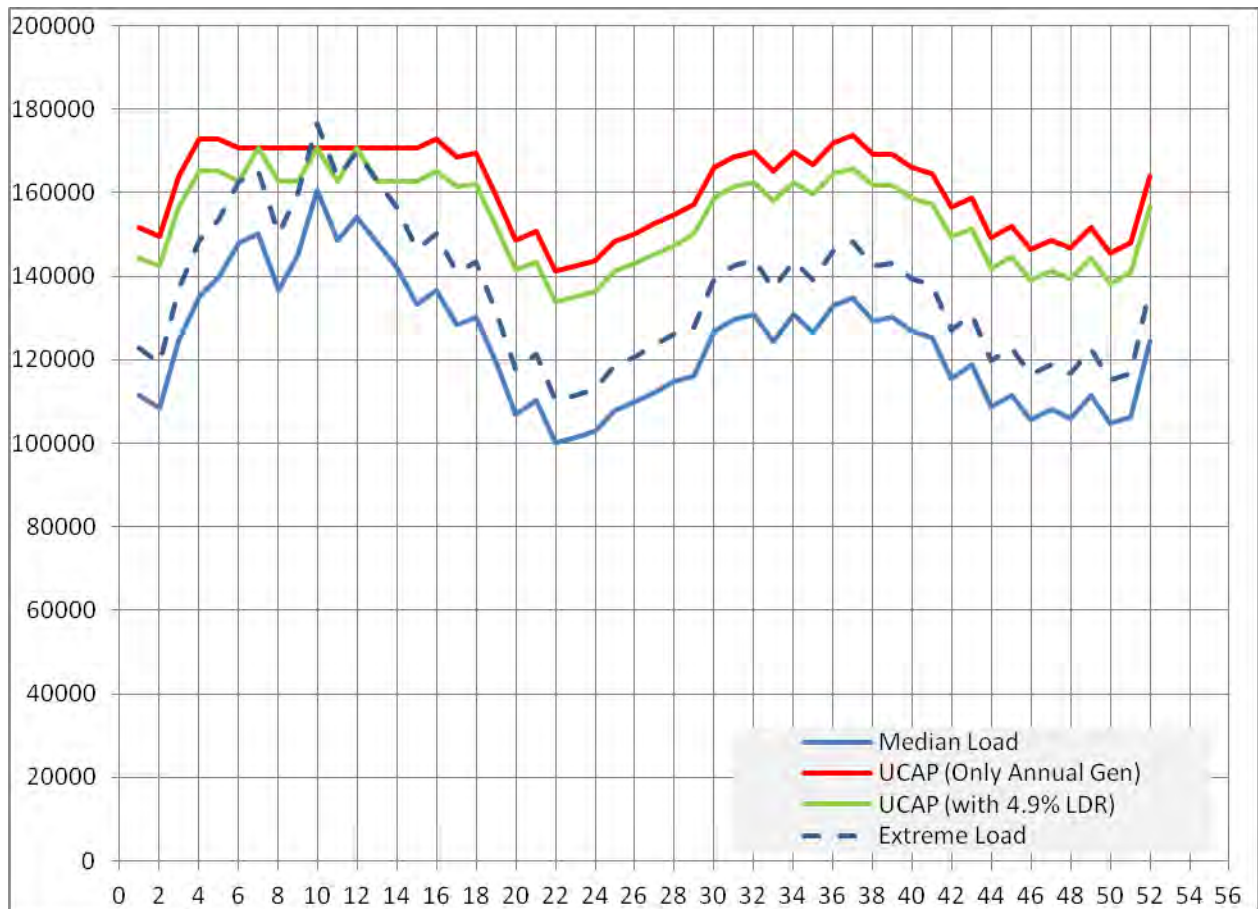
**Item #3: The current RTO Limited DR Target (~5%) already accounts for an LOLE increase of 10% with respect to the RTO IRM base case.**

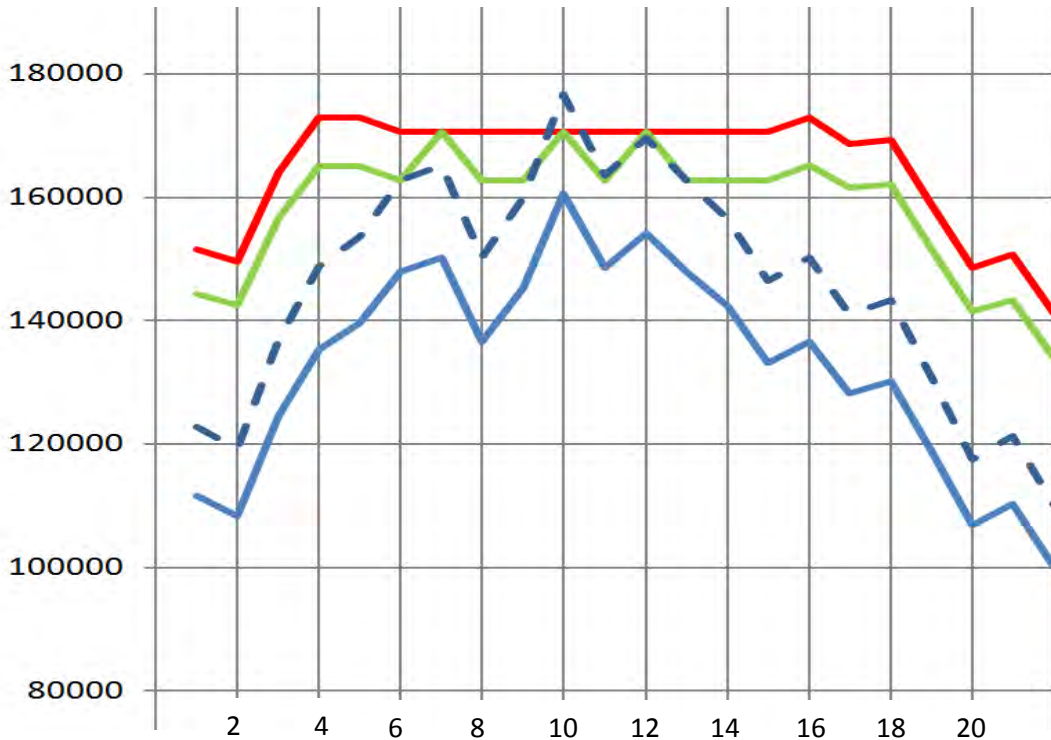
The Extended Summer DR target discussed above is used in RPM to set the Minimum Annual Resource Requirement (MARR = Reliability Requirement – Extended Summer DR Target). In other words, for RPM purposes, the difference between the Reliability Requirement and the MARR can either be Limited DR or Extended Summer DR or a mixture of both products.

The current Limited DR Target tests examine the probability of needing the product when it is not available (an 11<sup>th</sup> time or a 7<sup>th</sup> hour), but these tests do not assess the additional LOLE risk that Limited DR can contribute to the system (by displacing Annual and/or Extended Summer Resources).

In order to assess this risk, a similar test to the Extended Summer DR target test was performed. Limited DR was assumed to be available during 3 weeks in the summer (the 3 weeks with the highest LOLE risk; in the example presented at the beginning of this document, these weeks are 7, 10, and 12). This assumption is rather non-conservative given that Limited DR is only obligated to respond on ten days (which is equivalent to two weeks in PRISM). The same IRM case from the 2013 RRS for delivery year 2017/18 was used as a base case to compute the amount of Limited DR that triggers a 10% LOLE risk increase.

The base case has a starting LOLE of 0.1 days/year with the weekly LOLE distribution and table shown on page 1 of this document. When the Limited DR Target reaches 4.9%, the total LOLE risk is 0.11 days/year (i.e., a 10% increase over the base case LOLE risk). The two figures below are included for illustrative purposes to explain why the annual LOLE increases to 0.11 days/year when 4.9% Limited DR displaces an equal amount of annual resources in the case.





The red line in the figures above represents the average amount of unforced capacity (UCAP) in each week of the year. The solid blue line represents the weekly median load and the dashed blue line represents a weekly extreme load. In the IRM base case, it can be seen that most of the LOLE risk is concentrated during weeks 10 and 12 (dashed blue line crossing solid red line). When a certain amount of Limited DR (4.9% of the Reliability Requirement) is added to the system (displacing an equivalent amount of annual resources), the UCAP is represented now by the solid green line. Note the amount of UCAP is now equivalent to the amount of UCAP in the base case only in weeks 7, 10 and 12 (the three weeks when Limited DR is assumed to be available). For all other weeks, there is less UCAP available than in the base case. This translates into increased LOLE risk during some of those weeks (dashed blue line touches solid green line in weeks 6, 9, 11, 13). A breakdown of the LOLE risk by PRISM week when Limited DR is at 4.9% and the annual LOLE is 0.11 days/year is presented below:

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>
0.00%	0.00%	0.00%	0.00%	0.25%	6.59%	3.25%	0.00%	6.71%	57.81%	6.55%	10.76%	5.80%
<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>
2.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>40</b>	<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>	<b>51</b>	<b>52</b>
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%

The weeks that have more than 2% of the total LOLE risk are highlighted in orange. In the base case, only weeks 7, 10, and 12 had more than 2% each of the total LOLE risk. When 4.9% of Limited DR is

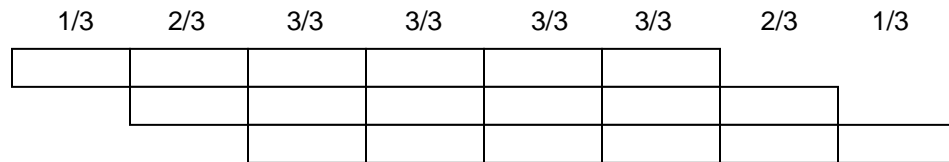
available during 3 summer weeks, a sizable portion of the total LOLE risk is shifted to other summer weeks (weeks 6, 9, 11, 13, and 14 now account for approximately 28% of the LOLE risk). The appearance of LOLE risk outside of the peak three weeks is the reason the total risk in the case is now 0.11 days/year.

As a sensitivity, 180 MW of Extended Summer DR was added to the case on top of the 4.9% Limited DR (an equivalent amount of Annual resources was removed). A minimal but noticeable increase of LOLE risk was observed.

**Item #4: Staggered dispatch does not change what is stated in Item #3.**

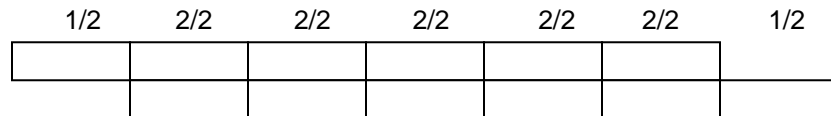
As requested by stakeholders, some sensitivity runs were made assuming that DR is dispatched in a staggered fashion.

Sensitivity 1: DR is dispatched in one third increments throughout 8 hours as follows:



If Test 1 is used, the Limited DR Target is increased to 6.5%

Sensitivity 2: DR is dispatched in half increments throughout 7 hours as follows,



If Test 2 is used, the Limited DR Target is increased to 6.3%

The above results indicate that a staggered dispatch will increase the Limited DR target calculated by Tests 1 and 2. However, the current Limited DR Target value (~5%) already accounts for an increase of 10% in the annual LOLE risk with respect to the IRM base case. A Limited DR Target above this value will increase the total LOLE beyond the 10% threshold.