**Building Block #2 Impacts on the Emission Rate Goals for Arizona Under EPA's Clean Power Plan Proposal**

## Executive Summary

On June 2, 2014, the U.S. Environmental Protection Agency (EPA) issued its proposed Clean Power Plan, which included interim and final carbon dioxide ($CO_2$) emission rate goals for each state. EPA developed these goals using a prescribed formula in which they applied four "building blocks" that each reflect measures a state can take to reduce $CO_2$ emissions. EPA states these four building blocks comprise EPA's determination of the "Best System of Emissions Reduction" (BSER) for existing power plants under the provisions of Section 111(d) of the Clean Air Act.

In Arizona, EPA's application of Building Block #2 (BB2), which re-dispatches coal and oil/gas (OG) steam generation to natural gas combined cycle (NGCC) generation, accounts for more than 80% of the total reductions associated with the proposed rule. The fact that EPA established the interim goal assuming that BB2 is fully implemented by 2020 means these reductions must take place by 2020 in order to meet the interim $CO_2$ emission rate goal, which is simply not possible.

Furthermore, the level of reduction assumed by the application of BB2 cannot be made up with Building Blocks 3 and 4. If the state were to increase implementation of renewable energy and energy efficiency measures in an attempt to retain a portion of the existing coal generation, it would be impossible to meet the interim target proposed by EPA.

In fully considering the assumptions and application of BB2, there are three primary issues that need to be addressed in the development of a final rule:

- *Existing NGCC generation cannot replace coal capacity over peak demand hours.*
    - EPA bases the re-dispatch potential on the average annual capacity factor, rather than accounting for peak capacity needs. During peak periods, all existing NGCC resources within Arizona are in use, leaving no available existing NGCC generation capacity to replace the existing coal and OG steam generation during these periods. Moreover, a neighboring state could purchase the output of the NGCC units, thereby reducing capacity available for Arizona redispatch while increasing the state's carbon emissions.

      Arizona is home to more than 5,000 megawatts of merchant gas generation. This generation currently helps to meet peak summer demand not only in Arizona, but in neighboring states as well. The BB2 formula does not address the realities of the wholesale power market

and inappropriately assumes that all of this merchant gas generation would only be sold to in-state entities over peak demand hours.

  - To replace lost coal and OG steam generation, Arizona would need to construct new NGCC plants to ensure adequate system reliability during peak demand periods, which is not possible within the tight compliance timeline proposed by EPA. Partial shutdown of coal units is not an option for meeting Arizona goals as the state's coal plants cannot be run for a few hours a day to meet peak load, and running them as baseload units in only the summer months to meet peak demand does not allow the state to meet its interim goal.

  - There is also strong evidence from recent modeling work done in the region that retirement of all existing Arizona coal generation by 2020 would have significant adverse affects on the reliability and load serving capability of the state's transmission system. Arizona is further investigating this issue and plans to address it in future comments to EPA.

- *Application of an inappropriate emission factor for NGCC generation.* In calculating the emission rate targets for Arizona, EPA assumed that NGCC units would operate in future years at a $CO_2$ emission rate of 900 pounds per Megawatt-hour (lb/MWh). This value is the combined average annual emissions rate for the NGCC units in Arizona during 2012. However, this emission factor is not consistent with EPA's analysis regarding emission rate capabilities for new, highly efficient units under Section 111(b).[1]

- *Failure to properly account for remaining useful life for coal-fired units.* EPA contends that states were provided with flexibility to deploy the identified building blocks to address key issues such as remaining useful life. However, if Arizona increases implementation of Building Blocks 3 and 4, Arizona is still not able to retain coal generation and meet the proposed EPA targets. This is a clear demonstration that the state does not have the flexibility assumed by EPA to factor remaining useful life into the state's compliance plan. In the absence of state flexibility, EPA should incorporate remaining useful life into the goal-setting analysis for Arizona to ensure the state is able to retain important baseload generation resources.

[1] In EPA's January 2014 proposal, $CO_2$ emission rates for new units were proposed at 1,000 lb/MWh for NGCC units with a capacity greater than 850 MMBtu/hour and 1,100 lb/MWh for NGCC units with a capacity of 850 MMBtu/hour or less. Refer to 79 Fed Reg. at 1,433.

Given that BB2 accounts for more than 80% of the emission reductions required for Arizona,[2] these issues must be addressed to ensure Arizona is not disproportionately and unfairly impacted by the proposed rule.

## 1.0 Introduction

On June 2, 2014, EPA issued its proposed Clean Power Plan, which includes mandatory $CO_2$ emission rate goals for each state. The proposed rule does not require uniform reductions across the country; rather each state has different emission rate goals. Some state goals, such as those for Arizona, establish greater emissions reduction burdens than others.

EPA developed these goals using a prescribed formula in which they applied four "building blocks" that each reflect measures a state can take to reduce $CO_2$ emissions. The building blocks EPA adopted include:

- **Building Block #1**: Heat rate improvements at coal-fired units;
- **Building Block #2**: Re-dispatch of coal and OG steam generation to NGCC generation;
- **Building Block #3**: Retention of at-risk nuclear generation and addition of new renewable generation; and
- **Building Block #4**: Implementation of end-use efficiency measures.

EPA states these four building blocks comprise EPA's determination of BSER for existing power plants under the provisions of Section 111(d) of the Clean Air Act.

EPA applied the building blocks to calculate two emission rate goals for each state: 1) an "interim" 10-year average goal that must be met from 2020 through 2029; and 2) a final goal in 2030. For Arizona, the proposed interim emission rate goal is 735 lb $CO_2$/MWh and the 2030 emission rate goal is 702 lb $CO_2$/MWh.

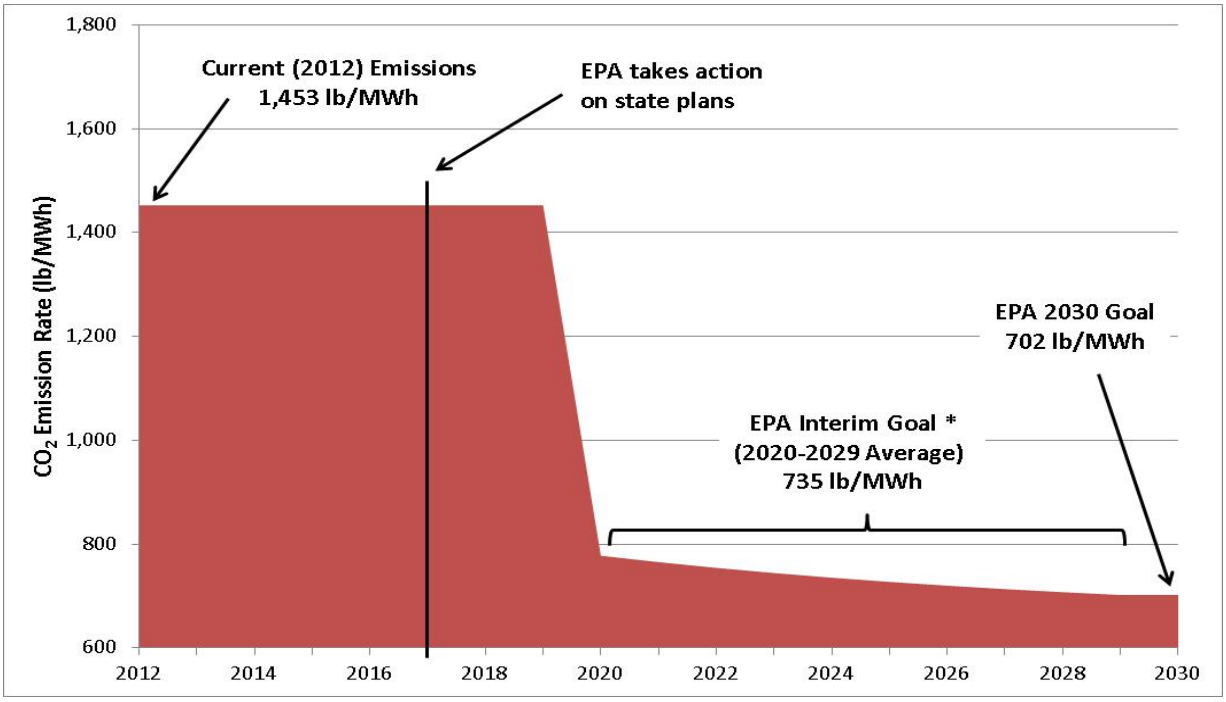
Of the four building blocks, the application of BB2 results in the most significant projected reduction in $CO_2$ emissions for Arizona. Specifically, the application of BB2, accounts for more than 80% of the total reductions associated with the proposed rule for Arizona.

EPA's reliance on BB2 to achieve dramatic emissions reductions in Arizona by 2020 has significant implications for reliability and economics. In establishing the emissions target for Arizona, EPA assumed that all coal and OG steam generation in the state

[2] This reduction is calculated considering the change in emissions from the 2012 baseline emissions rate to the emissions rate after BB2 is applied. This value includes the assumed reductions from Building Block 1 since there is no real reduction from Building Block 1 with all coal eliminated under BB2.

would be replaced with NGCC generation by 2020. Figure 1 demonstrates the dramatic impact that BB2 has on the compliance glide path for Arizona.

**Figure 1. Impact of EPA's Interim and Final Goals in Arizona**




This impact is further amplified when considering the schedule that has been established for approval of state plans. At best, the state will have 2 ½ years to implement its compliance plan for the Clean Power Plan. If the state requests an extension for plan submittal, it is possible that Arizona will have only 6 months to implement its plan. Given that EPA assumes the state must focus on BB2 to achieve compliance, Arizona could have as little as 6 months to shift the entirety of coal generation to NGCC generation to supply electric power to the state's residents and businesses.[3] EPA simply does not provide the state enough time to complete such a dramatic shift in Arizona's energy supply.

[3] Within the Presidential Memorandum regarding Power Sector Carbon Pollution Standards issued on June 25, 2013, the President outlines expected targets for completion of major milestones under the rule including issuing final standards no later than June 1, 2015 and state plan submittal no later than June 30, 2016. Within the rule proposal, EPA indicates they will take one year to review those plans so that states have a final determination by June 2017; hence, 2 ½ years to implement in accordance with the 2020-2029 interim goal. This timeframe does not contemplate the potential for an additional 1-2 year extension to submit compliance plans if requested by the state per the extension options provided in the proposed rule. While the extension gives more time to complete the plan, it does not delay the rule's compliance obligations, which begin in 2020.

Unfortunately, EPA's calculation methodology for BB2 is based on a number of underlying assumptions that are inaccurate for Arizona, which are outlined in the following sections.

## 2.0 EPA's Calculation Methodology for BB2

In its application of BB2, EPA re-dispatches a state's existing NGCC generation to replace coal-fired and OG steam generation.

In applying BB2 to Arizona, EPA first calculated Arizona's annual generation rate from coal and OG steam plants using data from 2012. Next, EPA determined the amount of existing NGCC capacity in use in the state in 2012 (27%), and determined the total annual generation that the NGCC plants could produce at a 70% capacity factor. If the annual generation at 70% capacity factor was sufficient to equal or exceed the generation from coal and OG steam plants, EPA's calculation assumed that NGCC generation would replace coal and OG steam generation beginning in 2020. The emission rate that EPA applied to the NGCC generation used in this calculation was the combined average annual emission rate from those resources in 2012 (900 lb $CO_2$/MWh).

For Arizona, EPA's calculation results in the total displacement of coal and OG steam generation by increasing the annual average capacity factor of existing NGCC plants from 27% to 53% by 2020, as shown in Figure 2. When this building block is applied to Arizona's 2012 adjusted baseline emissions rate of 1,453 lb $CO_2$/MWh, it drops the state emission rate to 843 lb $CO_2$/MWh.[4]

**Figure 2: Snapshot of EPA's Re-Dispatching Approach**

| | Step 1 (2012 Data for Fossil Sources) | | | | Step 3a & 3b (Redispatch) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| State | Hist Coal Gen (MWh) | Hist NGCC Gen. (MWh) | Historic OG steam Gen. (MWh) | NGCC Capacity (MW ) | Redispatched Coal Gen. (MWh) | Redispatch O/G steam Gen. (MWh) | Redispatched NGCC Gen. (MWh) | 2012 NGCC Capacity Factor* | Post Redispatch Assumed NGCC Capacity Factor for Existing Fleet |
| Alabama | 46,045,176 | 53,492,096 | 0 | 10,333 | 36,001,107 | 0 | 63,536,165 | 59% | 70% |
| Alaska | 215,407 | 2,204,942 | 0 | 589 | 0 | 0 | 2,420,349 | 43% | 47% |
| Arizona | 24,335,930 | 26,782,325 | 1,033,871 | 11,202 | 0 | 0 | 52,152,127 | 27% | 53% |

It is important to note that the level of reduction assumed by the application of BB2 cannot be made up with Building Blocks 3 and 4. The level of additional renewable generation and energy efficiency measures required to avoid significant coal plant shutdowns in 2020 is not achievable.

[4] Although EPA assumes Building Block #1 will contribute reductions to achievement of emissions rate goals, if all coal units are displaced by natural gas generation by 2020, there is no coal generation remaining and no emissions reductions would be achieved through this building block.

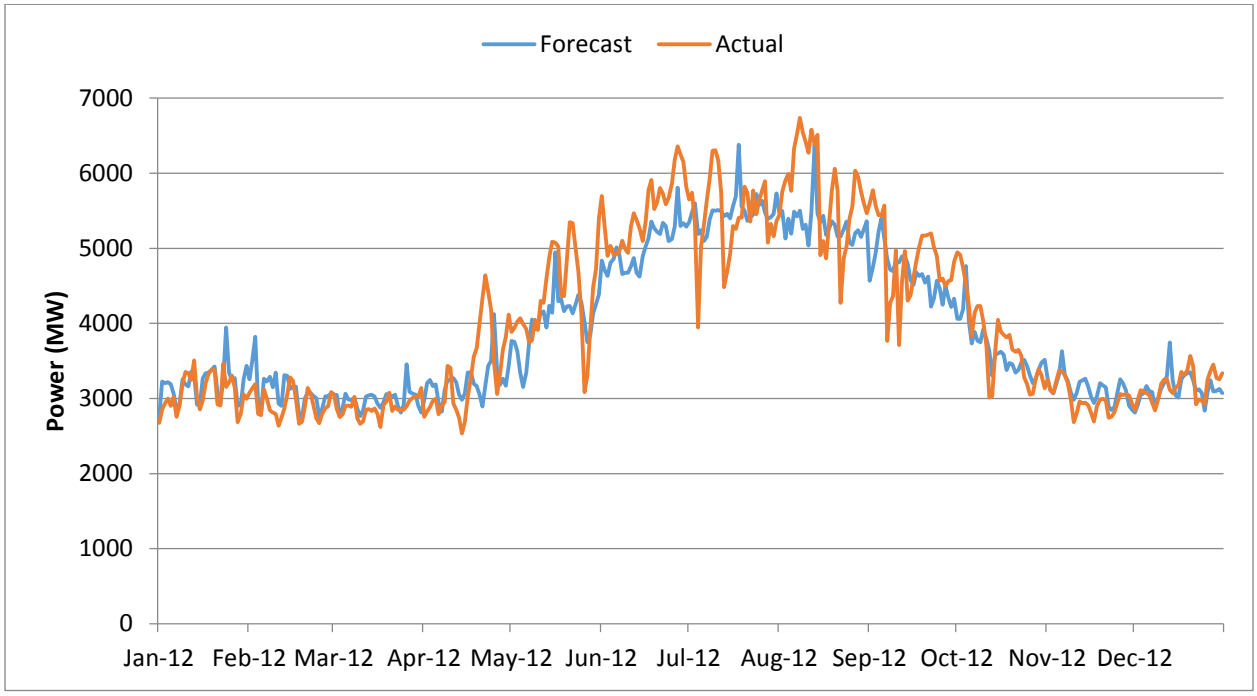
## 3.0 Issues with EPA Assumptions Under BB2 Related to NGCC Capacity

EPA's application of BB2 to establish Arizona's emissions rate goals suggests the agency has a fundamental misunderstanding of how utilities plan and operate to meet electricity demand. There are many factors that must be considered when assessing a unit's capacity factor.

Utilities must ensure that sufficient resources are available to meet peak demand, not just annual average demand. Peak demand occurs when consumer demand for electricity is at its highest level, which for Arizona corresponds with the high temperatures in the summer months. During these months, temperatures regularly exceed 110 °F. EPA's calculation does not account for the fact that demand for electricity in Arizona is much higher in the summer than in the winter. NGCC generation in the state is used heavily in the summer months and much less in the winter months when demand is very low. An NGCC resource could easily run at a 90% capacity factor during the peak summer hours, but have an annual capacity factor around 30%.

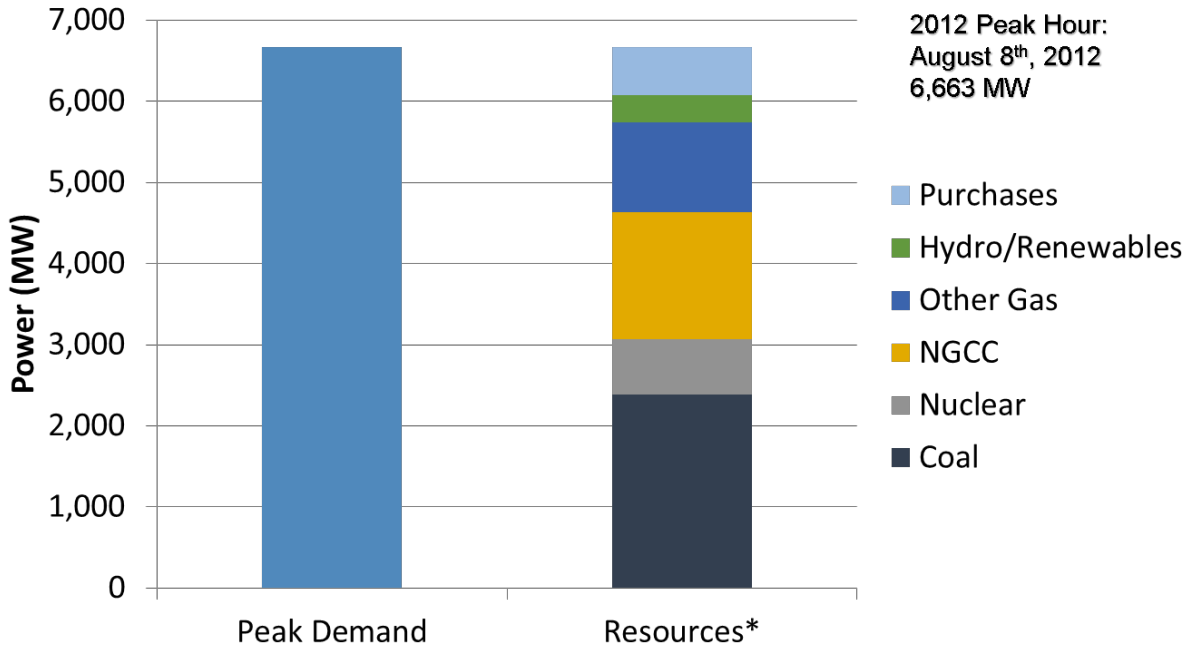
For example, Figure 3 illustrates peak demand for electricity ("retail firm load") from SRP's system in 2012. Peak electricity demand can be more than twice as high as base demand in the off-peak months. Furthermore, while forecasted values trend well with actual values, utilities still cannot predict exactly when the highest peak will occur and how high that peak will be.

**Figure 3: 2012 SRP Retail Firm Load Profile**



In 2012, SRP reached its highest peak hourly load value of 6,663 megawatts on August 8. Figure 4 shows a breakdown of the generating resources that were operating during that peak hour to meet customer demand. During this hour, all available generation resources, including coal and OG steam plants, were being utilized at full capacity to meet that peak demand. Even with all SRP system resources being utilized at full capacity, SRP was still forced to purchase electricity on the open market to meet peak demand and Federally-required reserve requirements.

**Figure 4: Resources Needed by SRP to Meet Peak Demand on August 8, 2012**



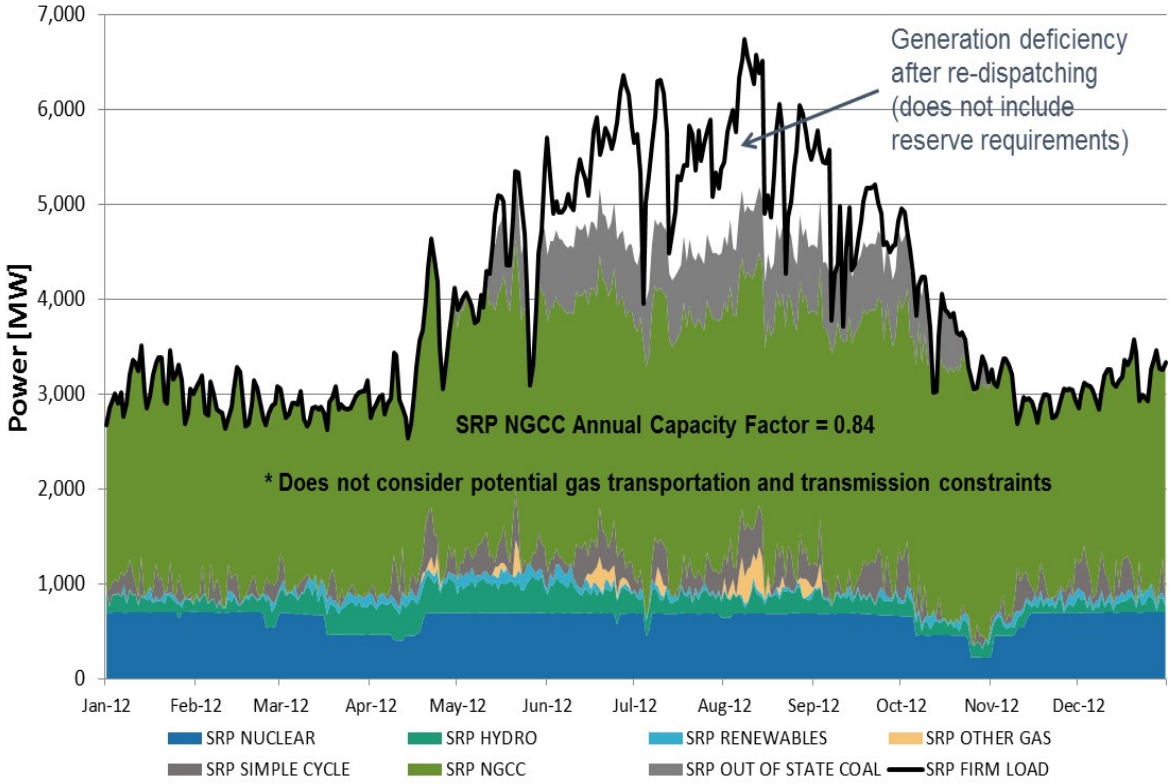

* All available generation resources were operating at full capacity, except for a small portion held to meet reserve requirements.

It is clear that without coal and OG steam resources, SRP would not have been able to meet the peak electricity demand without purchasing a significant amount of electricity from the short-term market in addition to what is already being purchased, which is a costly and risky endeavor, assuming that such power is even available. Arizona is not the only state in the Western U.S. that experiences these high peaks in the summer. As such, other utilities are likely to be competing for that same power, at the same time, on the short-term market.

Electricity market prices are a strong and reliable indicator of available capacity. If the market price greatly exceeds the variable cost of NGCC generation that is evidence that all NGCC generation has been deployed and no available surplus remains. This is not an unusual occurrence in the summer months and is driven by high temperatures, transmission line outages, unplanned generation outages, or any combination of these events.

While Figure 4 shows a single peak hour, Figure 5 provides an annual look at how SRP's generation resources would fall short if SRP were required to replace all existing coal and OG steam generation with NGCC generation. For illustrative purposes, SRP assumed a 100% NGCC capacity factor on an hourly basis, which equates to 84% on an annual average basis. This level of dispatch exceeds EPA's assumption of 70% on an annual average basis.

**Figure 5: Potential Re-Dispatch of SRP Generation Resources**



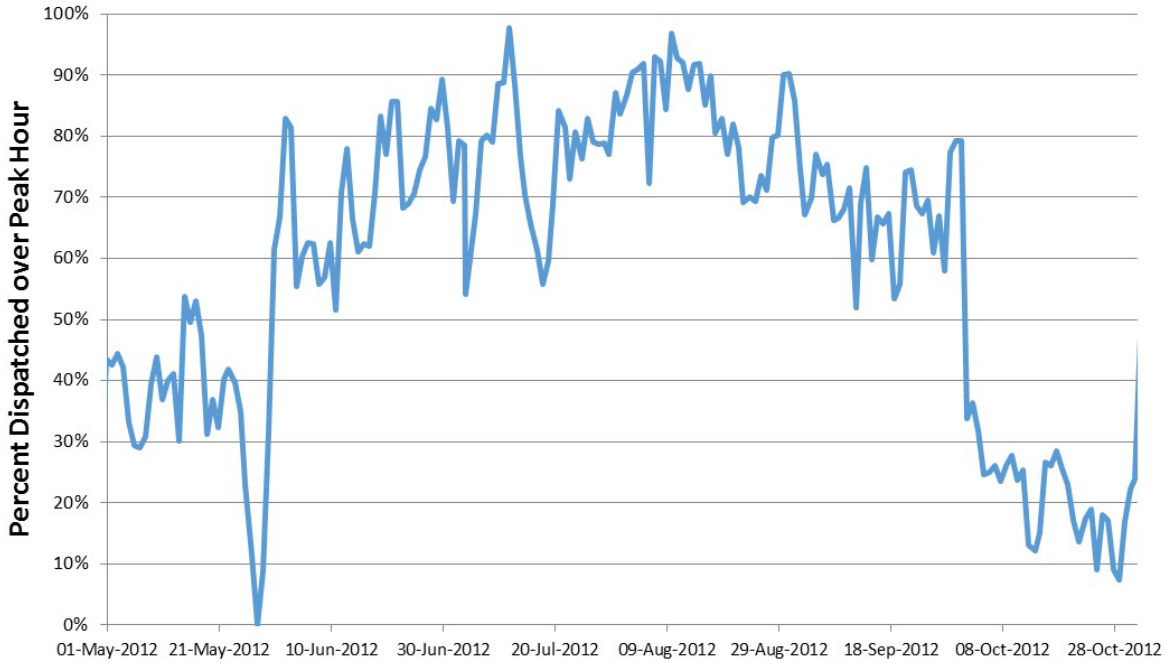

As Figure 5 demonstrates, even with an extremely aggressive NGCC re-dispatch assumption, SRP would still have significant shortages in generation for several months in the summer. This lack of generation would be further aggravated if out-of-state coal resources also are eliminated due to compliance with the Clean Power Plan.

It is important to note that there are a number of merchant NGCC plants in Arizona that EPA included in the total capacity available for re-dispatch. Merchant plants differ from traditional rate-based power plants in (1) how they are financed and (2) where they sell the electricity they generate. A merchant plant is funded by investors and sells electricity in the competitive wholesale power market. Since a merchant plant is not required to serve any specific retail consumers, consumers are not obligated to pay for the construction, operation, or maintenance of the plant.

The nominal capacity available from merchant generators in Arizona is more than 5,000 megawatts, accounting for 53% of the NGCC capacity in the state. Arizona's load serving entities purchase energy from merchant generators through long-term firm purchase agreements or through shorter term transactions. Aside from making such purchases, Arizona's utilities have no control over the dispatch of merchant generation.

Setting aside constraints on merchant use posed by their business structure, SRP still investigated the availability of merchant NGCC plants within Arizona using data obtained from EPA's Clean Air Markets Database, which was used to determine hourly generation loads. Figure 6 shows the level at which merchant NGCC plants were dispatched over the peak hour on each day in the summer of 2012. All of the merchant plants in Arizona often operate at full or nearly full output during peak months to meet demand not only in Arizona, but in neighboring states as well. As such, utilities cannot rely on any significant amount of merchant generation in long-term planning to meet system demand requirements during peak summer demand periods. It should further be recognized regional peak demands have been increasing and are projected to continue to increase. Therefore, even if there was currently a small surplus of regional capacity, it will quickly be absorbed by load growth and already announced coal and nuclear plant retirements, such as Units 1, 2 and 3 at the Four Corners Power Plant and all units at the San Onofre Nuclear Generating Station.

**Figure 6: Merchant NGCC Plant Utilization in Arizona**



SRP's analysis indicates that Arizona cannot solely rely on existing NGCC capacity to meet peak demand because these facilities are already being fully utilized in certain hours of the year to serve regional loads. Coal and OG steam plants provide vital capacity during summer months, and that capacity must remain available to ensure system reliability during periods of peak demand. Coal plants cannot be run for a few hours a day to meet peak load; on the other hand, running them as baseload units in only the summer months to meet peak demand does not allow the state to meet its interim goal.

If Arizona's emissions rate goals can only be met through retirement of all coal and OG steam plants, additional NGCC resources will be needed to cover state electricity demand. EPA did not presume that new resources would be needed to replace coal and OG steam in setting state emission rate goals. For states in such situations, EPA must provide adequate time to site, plan, design, permit, and construct new generation resources and the infrastructure that supports these resources (e.g., new electric and gas transmission).

There are several factors that complicate a utility's ability to construct new generation resources to meet the requirements associated with this rule. One of the biggest issues is the lengthy timelines association with siting and permitting of new energy infrastructure.

The Western U.S. is unique in the amount of land owned by the military, federal government, state governments, and tribal nations. In Arizona, approximately 41% of land is owned by the federal government, almost 13% by the state, and about 27% belongs to tribal nations.[5] Siting and permitting of transmission lines on federal land, for example, can take 10 years or more. In many cases, obtaining the permits necessary to construct a transmission line can take longer than constructing the line itself.

Another issue is added regulatory complexities associated with locating a facility within a nonattainment area. Maricopa County, which serves as the largest load pocket within Arizona, currently does not meet the EPA's National Ambient Air Quality Standards for ozone or particulate matter. The ozone standards are expected to be lowered by EPA in the near future. As EPA is aware, to construct a source in a nonattainment area, the project developer would need to obtain emissions offsets, which are not readily available. Projects are often delayed to allow for development of needed offsets through other air quality control projects.

There is also strong evidence from recent modeling work done in the region that retirement of all existing Arizona coal generation by 2020 would adversely affect the reliability and load serving capability of the state's transmission system. Arizona is further investigating this issue and plans to address it in future comments to EPA.

[5] Natural Resource Council of Maine, Public Land Ownership by State, available at http://www.nrcm.org/documents/publiclandownership.pdf.

## 4.0 Issues with EPA Assumptions Under BB2 Related to NGCC Emission Factors

In calculating the emission rate targets for Arizona, EPA assumed that NGCC units would operate in future years at a $CO_2$ emission rate of 900 lb/MWh. This value is the combined average annual emissions rate of all NGCC units in Arizona during 2012.

However, the emissions rate applied by EPA to existing units is at odds with EPA's proposed rule establishing standards of performance for $CO_2$ emissions for new NGCC units. Specifically, in EPA's January 2014 proposal, $CO_2$ emission rates for new units were proposed at 1,000 lb/MWh for NGCC units with a capacity greater than 850 MMBtu/hour and 1,100 lb/MWh for NGCC units with a capacity of 850 MMBtu/hour or less.[6] EPA asserts that these emission rates can be met over the lifetime of a modern, high efficiency NGCC unit and are representative of the emissions rates of the best performing NGCC units in the country.

Even at these higher limits, EPA still acknowledges in the preamble of the proposed rule that nearly 10% of units today could not achieve the standards they have proposed for new units.

> *"…because over 90 percent of small and large existing NGCC facilities are currently operating below the emissions rates of 1,100 lb $CO_2$/MWh and 1,000 lb $CO_2$/MWh, respectively, these rates are considered BSER for new NGCC facilities in those respective subcategories."*[7]

In calculating state goals under 111(d), EPA has assigned a more stringent $CO_2$ emission rate to existing NGCC units than the agency is proposing to assign to new, higher efficiency NGCC units. The analysis EPA conducted under its 111(b) proposal should hold true under the current 111(d) proposal since EPA evaluated all existing NGCC generation before setting the emissions rate limit for new units.

## 5.0 Issues with EPA Assumptions Under BB2 Related to Remaining Useful Life

EPA does not adequately address "remaining useful life" in its BSER analysis. In the preamble of the proposed rule, EPA discusses how states can address remaining useful life:

> *"Importantly, the proposed BSER, expressed as a numeric goal for each state, provides states with the flexibility to determine how to achieve the reductions (i.e., greater reductions from one building block and less from another) and to adjust the timing in which reductions are achieved, in order to address key issues*

[6] 79 Fed Reg. at 1,433.

[7] See *Id.* at 1,487.

*such as cost to consumers, electricity system reliability and the remaining useful life of existing generation assets."*[8]

EPA contends that states were provided with flexibility to determine how to achieve reductions from other building blocks to address key issues such as remaining useful life. However, if Arizona increases implementation of Building Blocks 3 and 4, Arizona is still not able to retain coal generation and meet the proposed EPA targets. This is a clear demonstration that the state does not have the flexibility assumed by EPA to factor remaining useful life into the state's compliance plan. In the absence of state flexibility, EPA should incorporate remaining useful life into the goal-setting analysis for Arizona to ensure the state is able to retain important baseload generation resources.

For example, SRP owns Unit 4 at the Springerville Generating Station, which commenced operation in December 2009. The bond financing was approximately 30 years with final bond maturity occurring in 2038. SRP also recently completed air pollution control equipment upgrades on Units 1 and 2 at the Coronado Generating Station, which cost approximately $500 million. The bond financing for this project was likewise 30 years with final bond maturity occurring in 2041.[9]

Investments in these units were substantial and are being recovered in the rates of the consumers they serve. Forcing accelerated depreciation of these assets as envisioned by EPA will also accelerate rate recovery, placing an unreasonable burden on electric consumers, who must now cover the cost of prematurely retiring the units and the new NGCC units needed to replace them.

## 6.0 Conclusion

In Arizona, EPA's full application of BB2 accounts for more than 80% of the total reductions associated with the proposed rule. The fact that EPA established the interim goal assuming that BB2 is fully implemented by 2020 means these reductions must take place by 2020 in order to meet that interim target, which is simply not possible.

Furthermore, the level of reduction assumed by the application of BB2 cannot be made up with Building Blocks 3 and 4. Even if the state were to increase implementation of renewable energy and energy efficiency measures in an attempt to retain a portion of the existing coal generation, it would be impossible to meet the interim target proposed by the EPA.

In fully considering the assumptions and application of BB2, there are three primary issues that need to be addressed in the development of a final rule:

[8] See *Id.* at 34,836.

[9] In fact, EPA acknowledged that Units 1 and 2 had a remaining useful life of 20 years in its regional haze determination.

- Meeting the interim goal would implicitly require the retirement of all or nearly all coal generation in the state. Existing NGCC generation cannot replace coal capacity over peak demand hours for a variety of reasons including lack of NGCC capacity during peak periods and merchant generation complexities, as well as an inability to replace critical coal capacity within the short timeframe provided.

- The NGCC emission factor EPA uses in its analysis under Section 111(d) should be consistent with its analysis of emission rate capabilities for new, highly efficient units under Section 111(b).

- EPA should incorporate remaining useful life into the goal-setting analysis to ensure states do have some level of flexibility in achieving those goals.

Given that BB2 accounts for more than 80% of the emission reductions required for Arizona, these issues must be addressed to ensure Arizona is not disproportionately and unfairly impacted by the proposed rule.

## Problems Associated with Environmental Re-dispatch in Arizona

### Introduction and Background

In the proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Rule), the Environmental Protection Agency (EPA) applied its newly developed best system of emission reduction (BSER) for existing fossil fuel electric generating units (EGUs) to determine carbon emission rate reductions for each state. Based on EPA's methodology, the largest carbon emission rate reduction for Arizona is based on the re-dispatch of coal-fired generation to natural gas combined-cycle (NGCC). Arizona Public Service Company (APS) analyzed the re-dispatch of coal-fired generation to NGCC in Arizona, as envisioned by the EPA, and the following provides APS' assessment of re-dispatch in Arizona.

This paper examines the base assumptions and the EPA's application of generation re-dispatch in determining Arizona's carbon emission rate reduction goals. Several real-world operational limitations overlooked by the EPA led to unrealistic policy targets that must be addressed prior to developing intensity targets. A number of these physical limitations relative to the existing electric system in Arizona are discussed in addition to the reliability requirements to serve customers in the State.

On June 18, 2014 the EPA published the proposed Rule under section 111(d) of the federal Clean Air Act (CAA) to regulate carbon dioxide emissions from existing EGUs. The Rule identifies state-specific carbon emission rate goals based on the application of the EPA proposed BSER for existing EGUs. Each state is responsible for developing a compliance plan to achieve the proposed carbon emission rate goals individually or as part of a multi-state assembly. The EPA's proposal and subsequent discussions have been clear that when developing compliance plans, the states may use either the same methodology used by the EPA to develop the state-specific carbon emission rate goals, or other methods that achieve compliance with the proposed goals.

The newly developed BSER for existing EGUs consists of four "building blocks," that include heat rate improvements at existing coal-fired plants, re-dispatch of coal generation to NGCC, and the implementation of renewable energy (RE) and demand-side energy efficiency (EE) standards. Based on the application of these building blocks, the EPA proposed state-specific interim carbon emission rate reduction goals for the 10-year period beginning in 2020 and lasting through 2029 with a final emission rate goal commencing in 2030 and continuing thereafter.

The EPA used 2012 as the baseline year for determining the carbon emission rate goals. Based on the application of the building blocks to the performance of the existing EGUs in Arizona during 2012, the EPA proposed an interim goal of 735 lb/MWh, averaged over the 2020-2029 period, and a final goal of 702 lb/MWh commencing in 2030. The final carbon goal represents a 52% reduction from the adjusted 2012 average carbon emission rate of the affected EGUs in Arizona. A preponderance of the carbon emission rate reduction is based on the re-dispatch of coal-fired generation to NGCC located within the state. In fact, the proposed EPA goals are based on 100% of the coal generation within Arizona being re-

dispatched to NGCC. The analysis below shows that using nameplate capacity along with an annualized re-dispatch assumption, rather than seasonal, monthly, or hourly data, removes resources from service that are necessary for reliability reasons.

**Analysis**

The method the EPA used to determine the NGCC availability for re-dispatch was based on annual capacity factor of 70%. Further, the EPA determined the annual capacity factor for NGCC located in Arizona during 2012 was 27%. Accordingly, the EPA analysis suggested that NGCC could be re-dispatched to replace all of the existing coal fired generation which would result in the NGCC annual capacity factor of approximately 53%. Therefore, the EPA determined NGCC generation re-dispatch was a viable option for setting Arizona's carbon emission rate goals and can be implemented commencing in 2020.

There are a number of challenges created by the assumptions used by the EPA in its re-dispatch analysis that are discussed in more detail below. First, the potential generation capacity of NGCC located within Arizona used the generator nameplate rating of the units rather than the net output. Net available capacity output is influenced by a number of factors, such as turbine rating, site elevation, humidity, and ambient temperatures and can differ a great deal from the nameplate rating. Generator ratings are often higher than the turbine ratings, so the unit is limited by the turbine output. Also, in Arizona, peak electrical demand occurs at the same time as peak ambient temperatures which has a net negative effect on output ratings. For example, when the temperature and electrical demand is at its highest, the units' capacity is most limited due to ambient conditions. Table 1 below shows the difference between the generation capacities of NGCC located within Arizona assumed by the EPA compared to the actual available capacities of these units. The EPA's failure to account for this situation reduces net NGCC generation capacity by nearly 2,000 MW relative to the nameplate ratings that are actually available during peak demand periods.

**Table 1**

| | Nameplate | Summer | Winter |
|---|---|---|---|
| | MW | MW | MW |
| West Phoenix CC 1-3 | 396 | 255 | 276 |
| West Phoenix CC 4 | 136 | 107 | 120 |
| West Phoenix CC 5 | 570 | 490 | 506 |
| Redhawk CC 1-2 | 1,140 | 934 | 1,007 |
| Gila River CC 1 | 619 | 515 | 553 |
| Gila River CC 2 | 619 | 515 | 553 |
| Gila River CC 3 | 619 | 515 | 553 |

| | | | |
|---|---|---|---|
| **Gila River CC 4** | **619** | **515** | **553** |
| **Arlington CC** | **713** | **579** | **579** |
| **Santan CC** | **1,326** | **1,227** | **1,339** |
| **Kyrene CC** | **292** | **254** | **277** |
| **Desert Basin CC** | **646** | **577** | **625** |
| **Mesquite CC 1** | **692** | **536** | **594** |
| **Mesquite CC 2** | **692** | **538** | **588** |
| **Apache** | **82** | **72** | **72** |
| **Yuma Cogeneration Associates** | **63** | **52** | **54** |
| **Griffith Energy LLC** | **654** | **570** | **570** |
| **Harquahala CC 1-3** | **1,325** | **1,054** | **1,128** |
| **Total** | **11,202** | **9,305** | **9,947** |
| **Seasonal Net Rating Change** | **-** | **1,897** | **1,255** |

*Source: EIA*

Second, the EPA assumes the use of an annual capacity factor to determine the margin of additional energy output that can be generated by NGCC in Arizona. In doing this, the EPA must have assumed the annual capacity factor for NGCC in Arizona is a rather flat line (i.e. units are operated at a consistent level over all seasons), when in reality there is a significant difference between the electrical demands in the summer and non-summer months. For most years, the average summer demand is more than twice the average demand for the remainder of the year.

In Arizona, the most critical period for utilization of generation capacity is the period from June through September. For illustration purposes, the 16$^{th}$ hour of August 7$^{th}$ was used to show that the dispatch of all Arizona coal and gas steam units as envisioned by the EPA is physically not possible. Using data from EPA's Clean Air Markets Division[1], APS plotted the historical output from the NGCCs located in Arizona.

[1] EPA provides gross hourly generation for generators 25 MW and larger. For this analysis these values were converted to net generation using the following net generation to gross generation ratios: Coal - 0.90, NGCC 0.97, Gas Steam 0.91.

Figure 1 below shows that on August 7th, hour 16, 2012, Arizona NGCCs were generating 8,455 MW (net) and the coal and gas steam units were generating 4,098 MW (net). In order to re-dispatch all coal and gas steam with NGCC generation as assumed by the EPA, the NGCCs would have to be operating at 12,553 MW (8,455 MW + 4,098 MW). The maximum capacity assuming all units are fully available, however, is only 9,305 MW, a difference of 3,248 MW. Thus, only 850 MW of the 4,098MW of required capacity is available for re-dispatched in this hour, leaving 3,248 MW of demand that would still need to be met. This suggests that when calculating Arizona's emission goal, portions of coal and gas steam cannot be re-dispatched to NGCC and must be factored into the carbon rate goal.

**Figure 1**

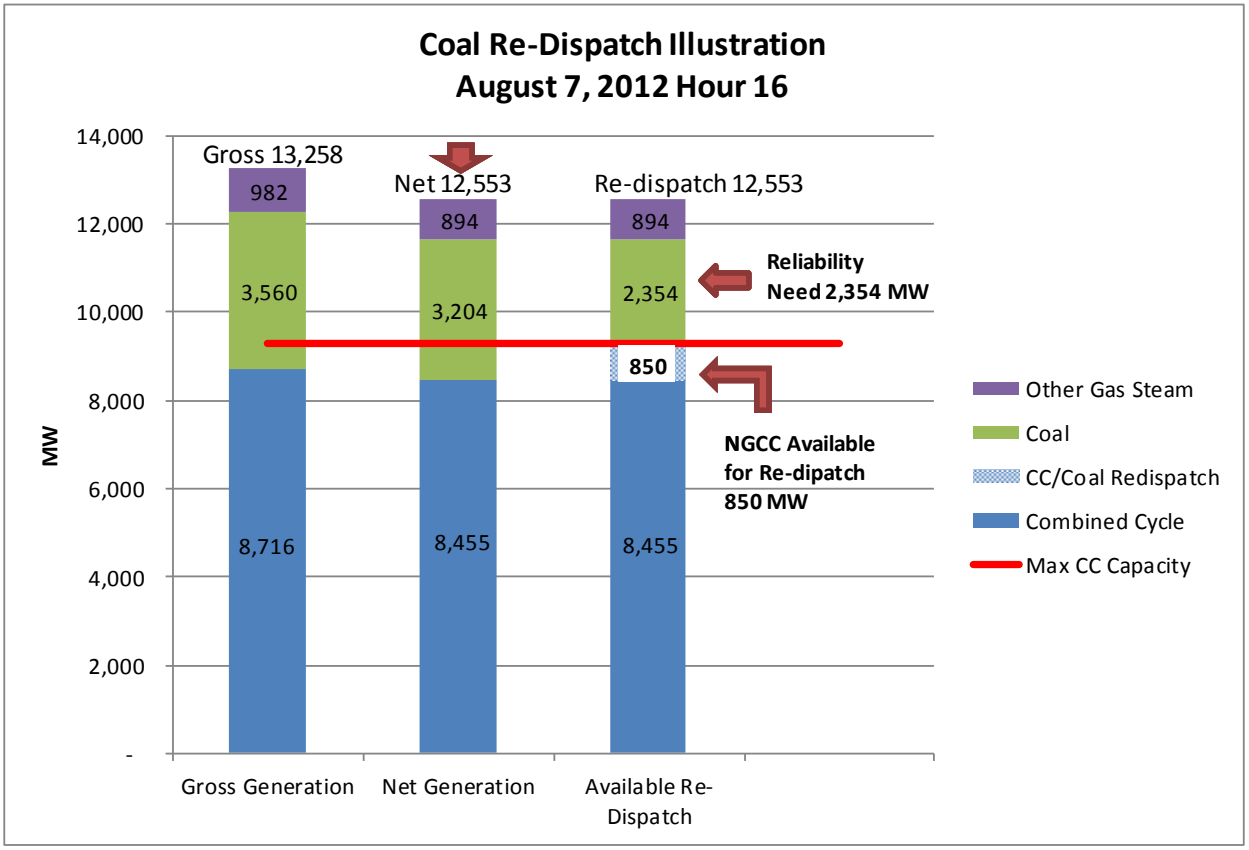
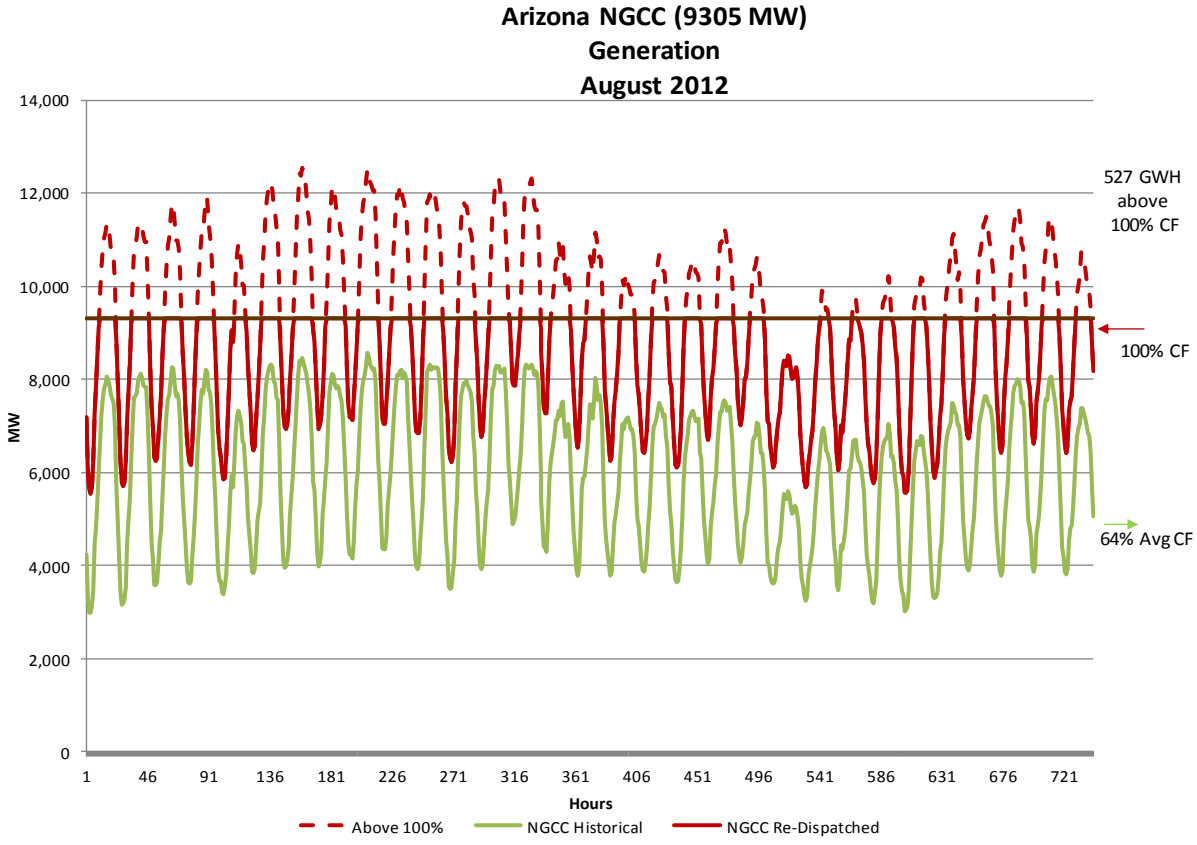


Figure 2 shows the results of this analysis for the month of August (744 hours). Actual hourly generation values for the Arizona NGCCs are indicated by the green line. Additional generation that would be required by NGCCs due to the re-dispatch of coal and natural gas steam-fired generation during the same period was added to the NGCC generation to replicate the re-dispatch as proposed by the EPA. These values are indicated by the red line. The figure also shows the maximum possible generation of the NGCCs during the summer months (100% capacity factor). As indicated by the dashed red line, nearly half of the time during August 2012 the demand that would normally be provided by coal and gas steam-fired generation exceeds the capacity of all NGCC in Arizona. This means that additional capacity is required to serve load beyond the existing NGCCs. August contains the largest number of occurrences when re-dispatch would require additional capacity; however, the same phenomenon occurs during the months of May through October. As a result, if all coal units were retired as modeled by the EPA, Arizona could face serious reliability issues in a significant number of hours throughout the year.

**Figure 2**



The same analysis was performed for all hours of 2012 and is summarized in Table 2. Table 2 shows that nearly 800 hours throughout the year could not meet the NGCC re-dispatch requirement envisioned by the EPA.

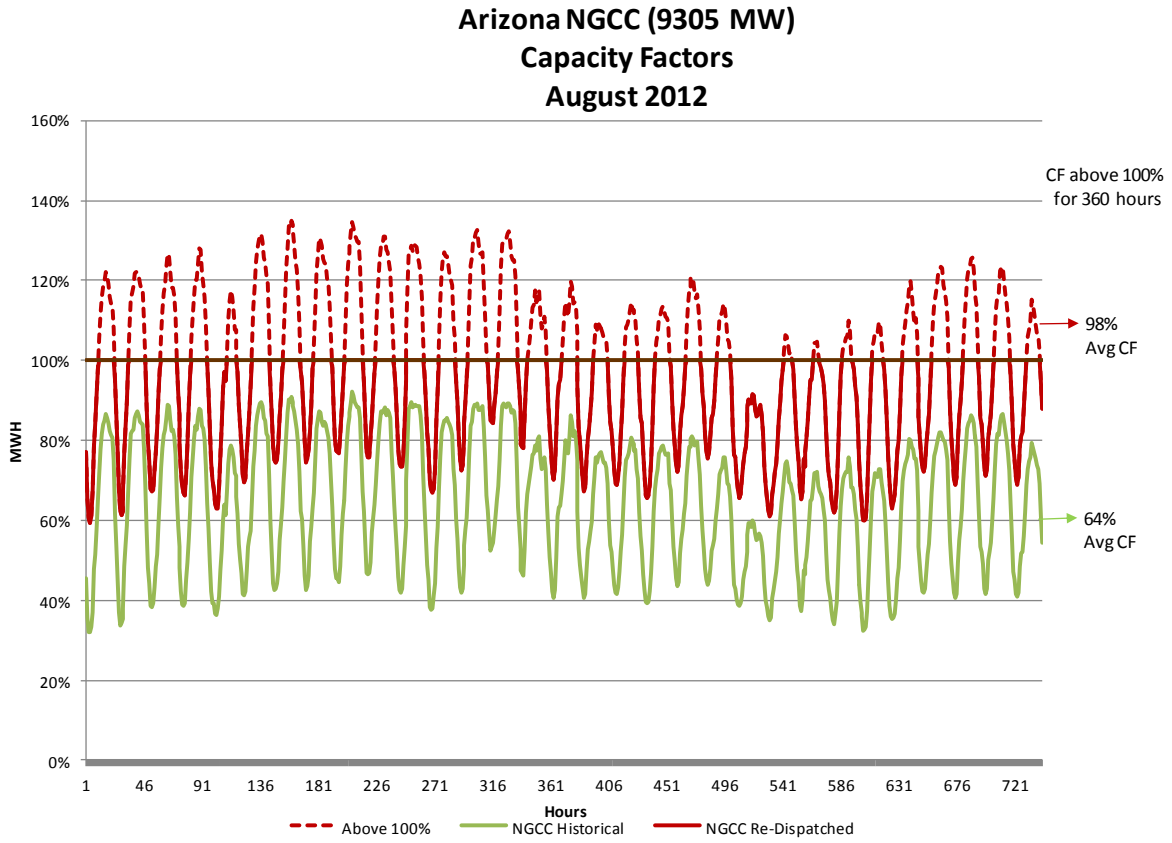
**Table 2**

**Excess Demand**

| Month | GWH | Hours |
|---|---|---|
| January | 0 | 0 |
| February | 0 | 0 |
| March | 0 | 0 |
| April | 0 | 0 |
| May | 3,147 | 6 |
| June | 138,369 | 145 |
| July | 212,637 | 235 |
| August | 526,832 | 361 |
| September | 51,529 | 92 |
| October | 20,313 | 22 |
| November | 0 | 0 |
| December | 0 | 0 |

Figure 3 provides a similar illustration. The green line in Figure 3 represents the actual capacity factor during the month of August 2012 for NGCC located in Arizona. The red line shows the increase in the capacity factor of NGCC with the re-dispatch of the state's coal generation. The re-dispatch capacity factor shows over 360 hours during the month where the demanded generation exceeded the available generation. During this period, the average capacity factor for all NGCC in Arizona would have to increase from 64% to 98%, which far exceeds the 70% cap proposed by the EPA. Because of the substantial increase in electrical demand in Arizona during peak times, the annual average capacity factor of NGCC cannot be used as a basis for determining the additional capacity NGCC can supply during peak demand periods.

**Figure 3**



**Additional Concerns with EPA Plan**

This analysis does not include a myriad of other considerations that must be made by the utilities that have the ultimate responsibility for ensuring that a reliable supply of energy is available to meet customer demands. For example, utilities must maintain a generation capacity reserve margin in order to supply energy in the event existing operating capacity is lost. The policy target envisioned will negatively impact existing capacity and potentially require new dispatchable units to maintain reliability and reserve margin targets.

Also, NGCCs are complex mechanical systems that malfunction even under the best of readiness and preventive maintenance programs. It is naïve and unrealistic to assume there will not be forced outages due to mechanical issues with NGCC from time to time. The EPA must consider both unit availability and the increased potential for outage with additional wear and tear on the existing fleet of NGCCs prior to developing policy targets.

There are other serious technical issues associated with the re-dispatch of coal-fired generation to NGCC. For example, the existing electrical transmission system in Arizona is designed to balance the flow of energy within the state. Because in Arizona coal-fired generation is predominantly in the eastern part of the state and the NGCC fleet is located in the western part of the state, the total re-dispatch of all coal-fired generation to NGCC will create an imbalance in the state's electrical transmission system. This imbalance can cause overloading of transmission lines, overheating of the lines, and failure of the transmission system. Without the coal plants in service, maximum load serving capability (MLSC) of the Phoenix load pocket would be significantly reduced, seriously compromising the reliability of meeting Phoenix area loads. This loss in MLSC could potentially be restored by implementing several transmission upgrade projects. These projects would come at a cost of hundreds of millions of dollars, and may not be able to be completed by 2020, the date at which the EPA assumes re-dispatch of all of Arizona's coal units.

Additionally, the natural gas capacity in Arizona to supply the re-dispatch is also questionable. Arizona has limited natural gas capacity and some of the existing capacity is now being supplied to Mexico. These issues are currently being studied by the state's utilities to determine the specific impacts and potential resolutions. While it is not known at this time what the specific resolutions may be, it most likely will involve adding new generation, transmission, natural gas capacity, or a combination thereof. All of these potential solutions are costly, take many years to implement, and are not consistent with the statutory intent behind BSER.

As stated above, APS understands that the EPA has not mandated the total re-dispatch of coal-fired generation to NGCC. APS has heard EPA's comments regarding the "flexibility" provided to the states in developing compliance plans. However, it is impossible to see how Arizona could meet the proposed carbon goals without re-dispatching virtually all coal-fired generation to NGCC, which was EPA's assumption when it calculated the state's "goals." Accordingly, any so-called flexibility touted by the EPA rings hollow.

The EPA has stated that Arizona may use other means of achieving the state goals in lieu of the re-dispatch of coal-fired generation to NGCC. For example the state may employ more renewable energy (RE) and energy efficiency (EE) requirements, EPA explains. However, Arizona analyzed increasing RE and EE standards to allow for the continued operation of a portion of the coal-fired fleet in Arizona and, in fact, these actions would have the opposite effect. By increasing the RE and EE requirements to allow for the continued operation of some coal-fired generation in meeting the final goal, the state actually moves further away from achieving compliance with the state's interim goal proposed by the EPA. On the other hand, if Arizona designs its program to comply with the interim goal, the end result is a rate that is far lower than necessary to comply with the final goal, and a far smaller portion of the state's existing coal-fired fleet is preserved.

The EPA has also suggested that the state's utilities could just operate coal-fired generation during peak demand periods, but this is not a viable option. The coal-fired power plants in Arizona are large, complex units. Typically, such units are not designed and engineered to sit idle for extended periods of time and cycle. Such practices would challenge reliable operation of the units. Moreover, the staffing and maintenance to support such a scenario would not be economically justifiable.

**Ramifications of EPA's Proposal**

Arizona will face a difficult dilemma as a result of the flawed assumptions used by the EPA when it evaluated the re-dispatch of coal-fired generation to NGCC. The most likely outcome of the proposed policy is that the state's utilities will be left with the difficult decision of whether to jeopardize electric reliability in Arizona, risk noncompliance with the proposed carbon reduction goals, or spend exorbitant amounts of money to offset flawed assumptions.

Electric utility companies have a responsibility to reliably supply the energy demanded by customers. In Arizona this responsibility is most critical during peak energy demand periods. Such times are generally associated with elevated temperatures, and ensuring a reliable supply of energy during such period is an important human health issue. To assure utilities can meet this responsibility, they must have reliable sources of energy generation and a reliable electric grid.

**Conclusion**

Complying with Arizona's carbon emission rate goals proposed by the EPA will significantly challenge the reliability of the electrical system or will lead to noncompliance with the proposed goals. Since creating an unreliable electrical system in Arizona is presumably not the EPA's intention or desired outcome, EPA must develop a workable solution for Arizona including a sensible final carbon rate target for the state.

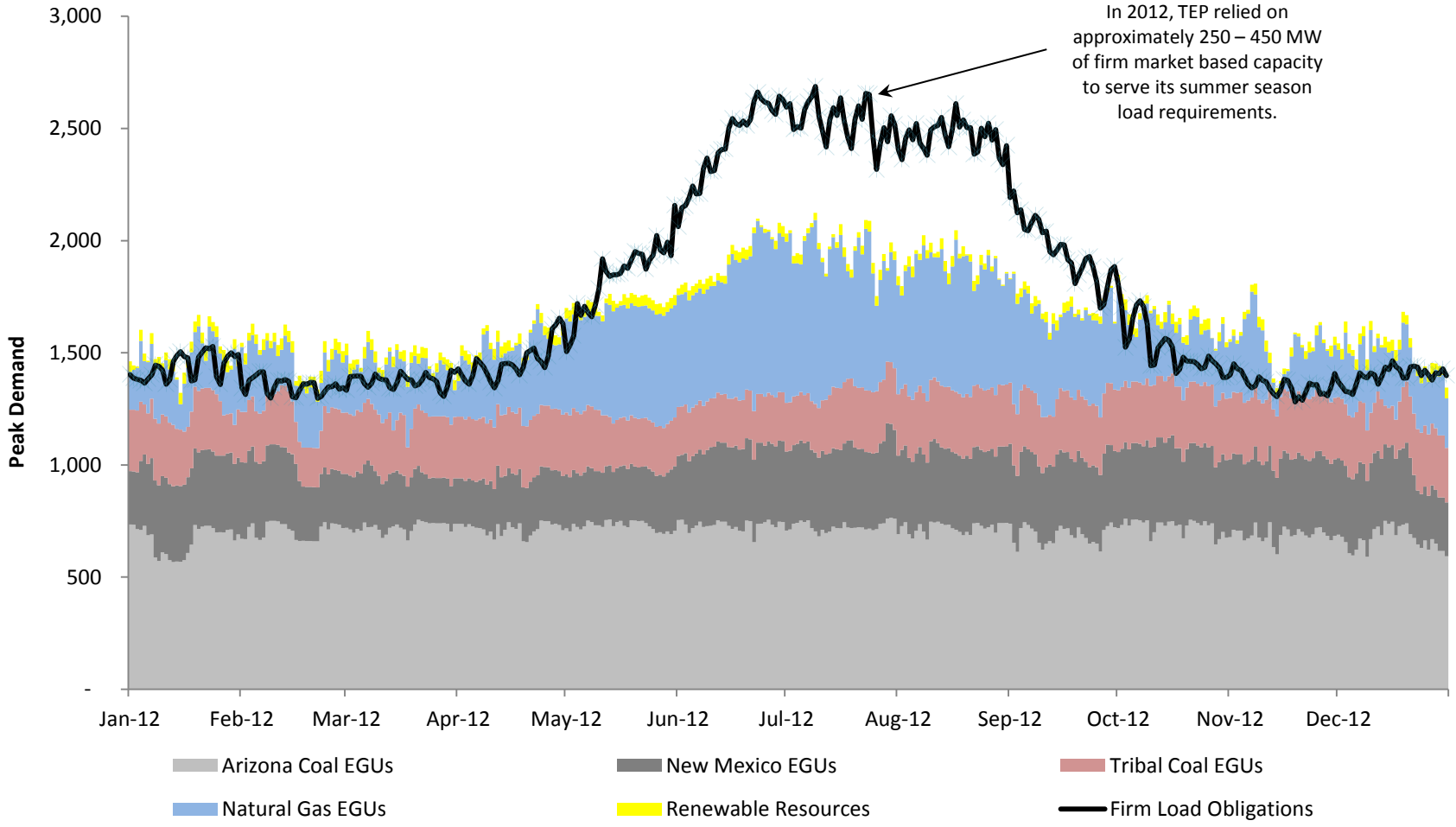
Another method to provide some relief is the elimination of interim goals. The only real purpose for the interim goals is to measure progress towards the final goal. Because the states must submit periodic reports to the EPA, the Agency will have this information and can press the states if reasonable progress

is not being achieved. At the very least, the state should be allowed to set interim goals that provide a logical compliance trajectory for the state.

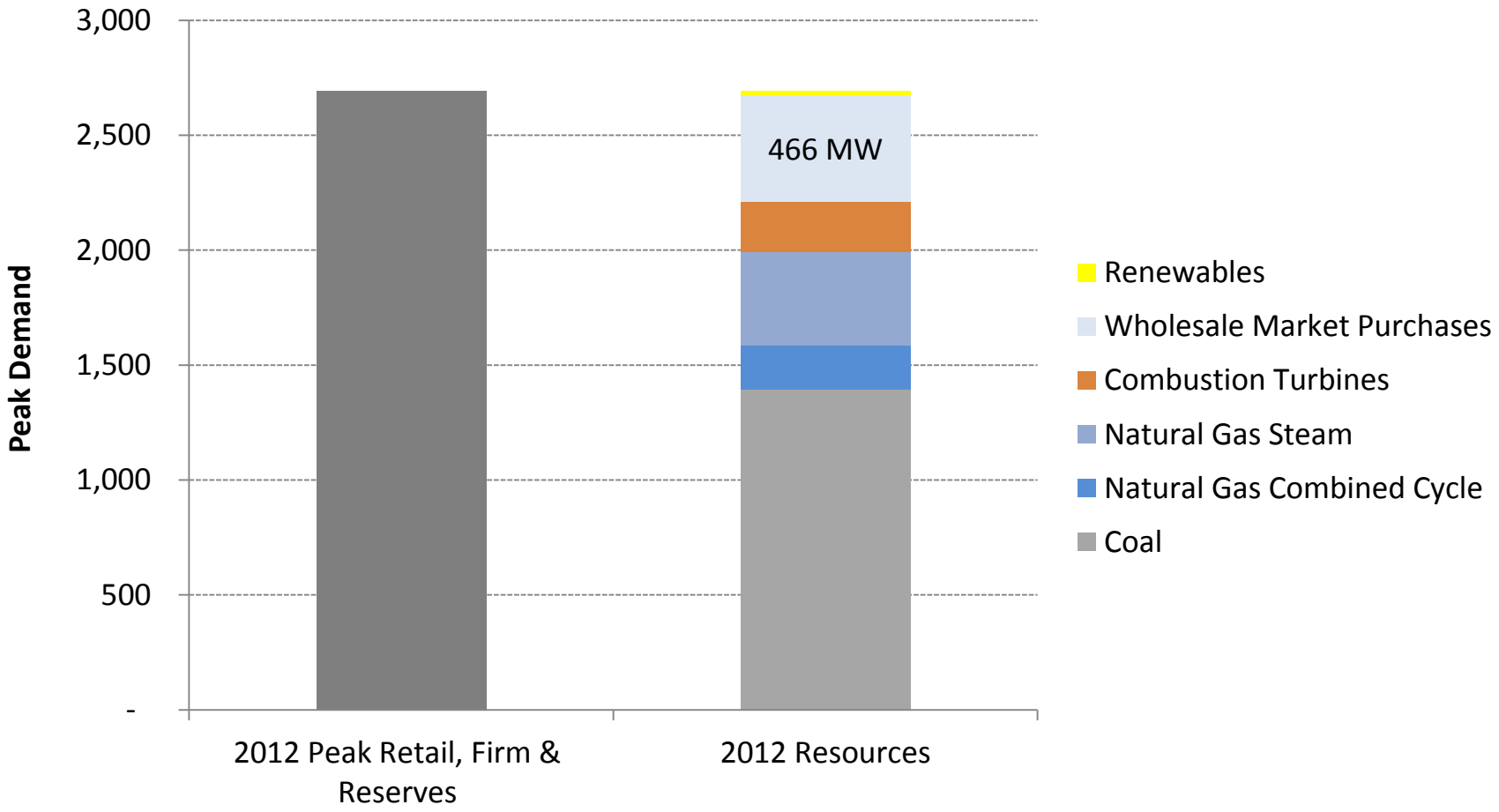
The currently proposed interim goals for Arizona are too heavily weighted toward the early years and cannot be achieved through the re-dispatch of all coal generation in the state to NGCC. Though a specific resolution is not known at this time, Arizona would have to add new generation, transmission, natural gas capacity or combination thereof, which could not be achieved by 2020, the date at which the EPA assumes re-dispatch of all of Arizona's coal units. Arizona's utilities need a more reasonable trajectory that provides additional time to fully understand the implications of the proposed rule and to assist the state to develop and implement an appropriate plan.

# 2012 TEP Hourly System Dispatch

## Historical Dispatch

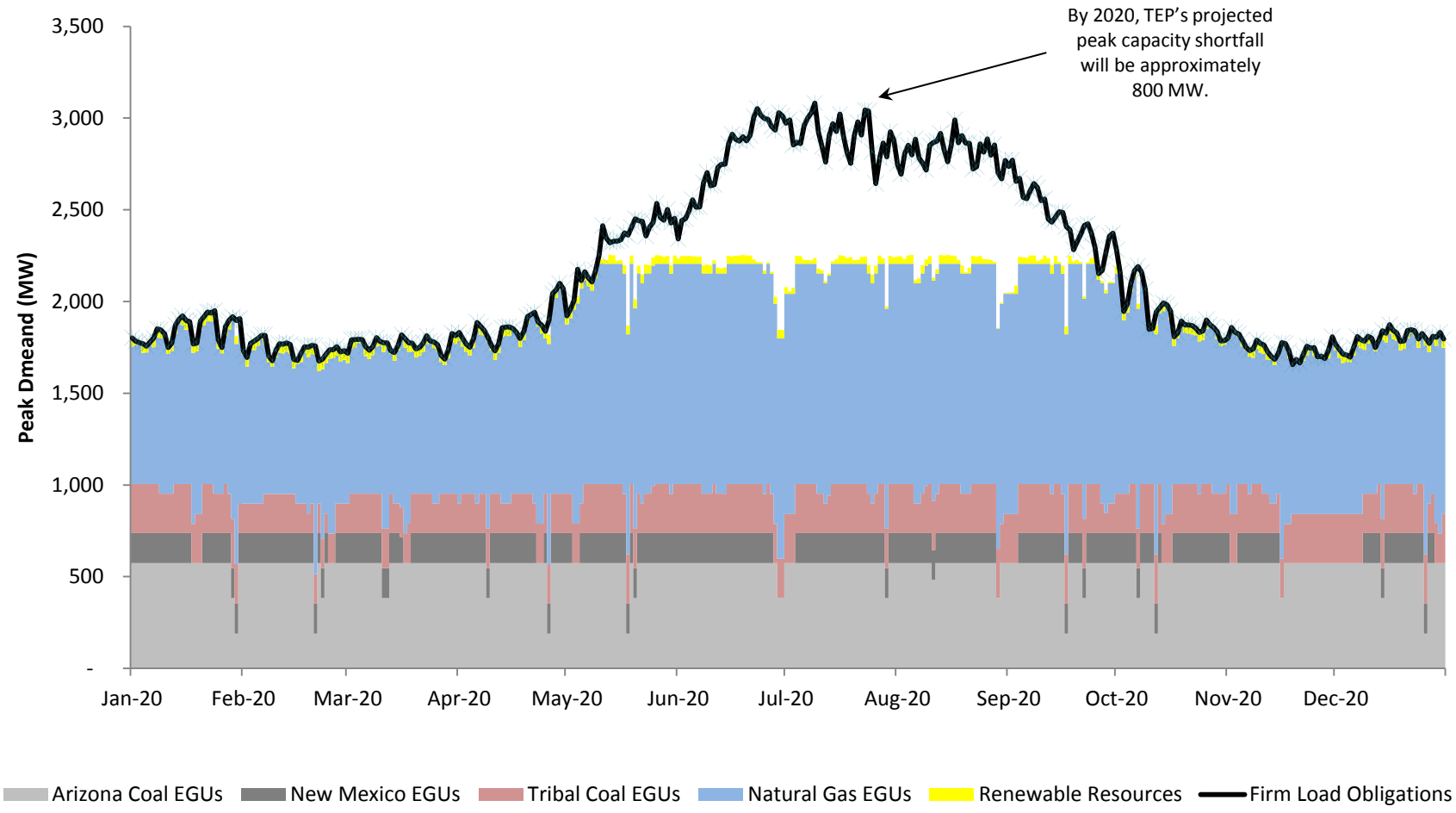


# 2012 TEP Peak Demands



# 2020 TEP Hourly System Dispatch

## Including Arizona Coal EGUs



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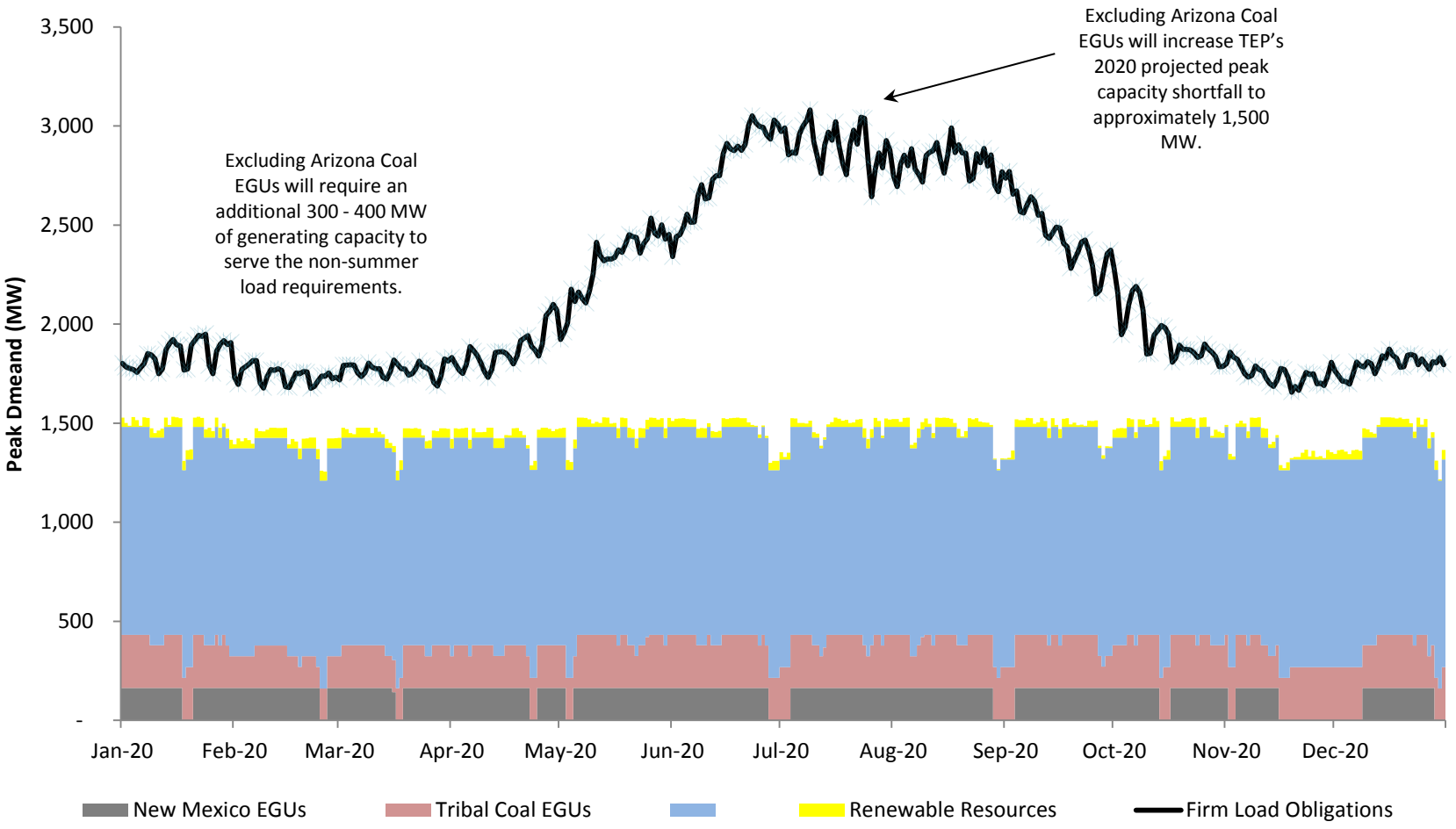
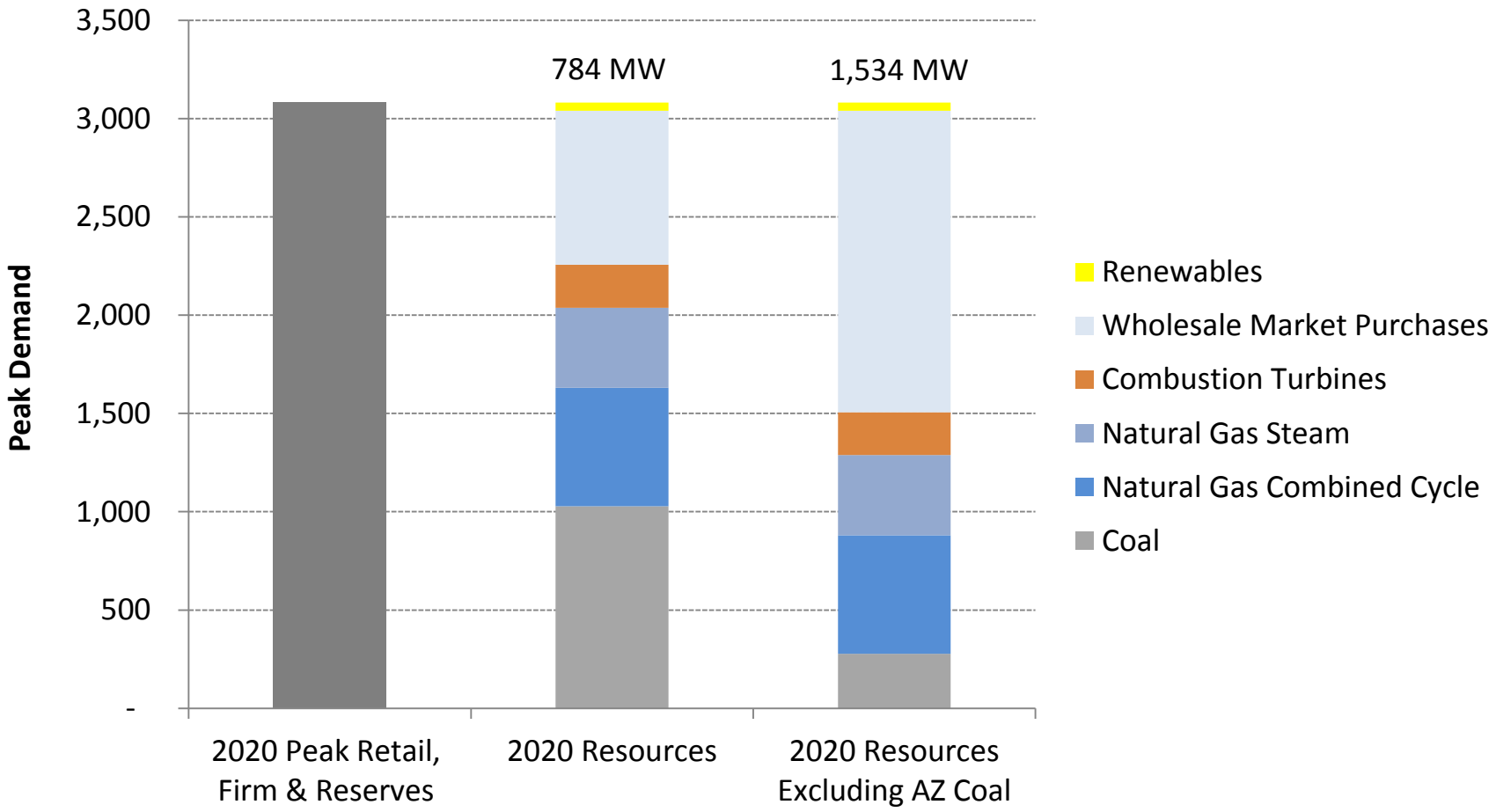
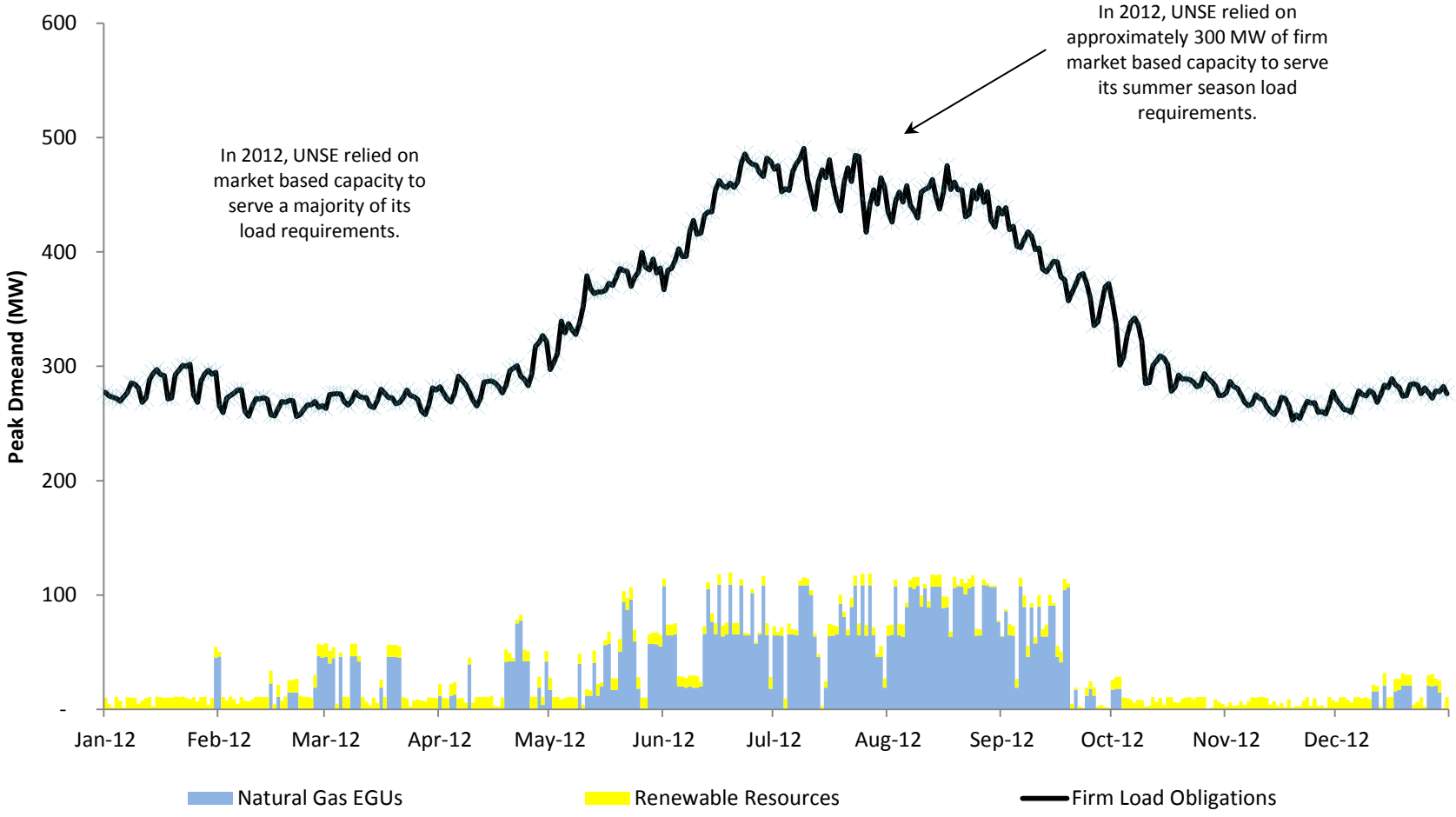


# 2020 TEP Peak Demands

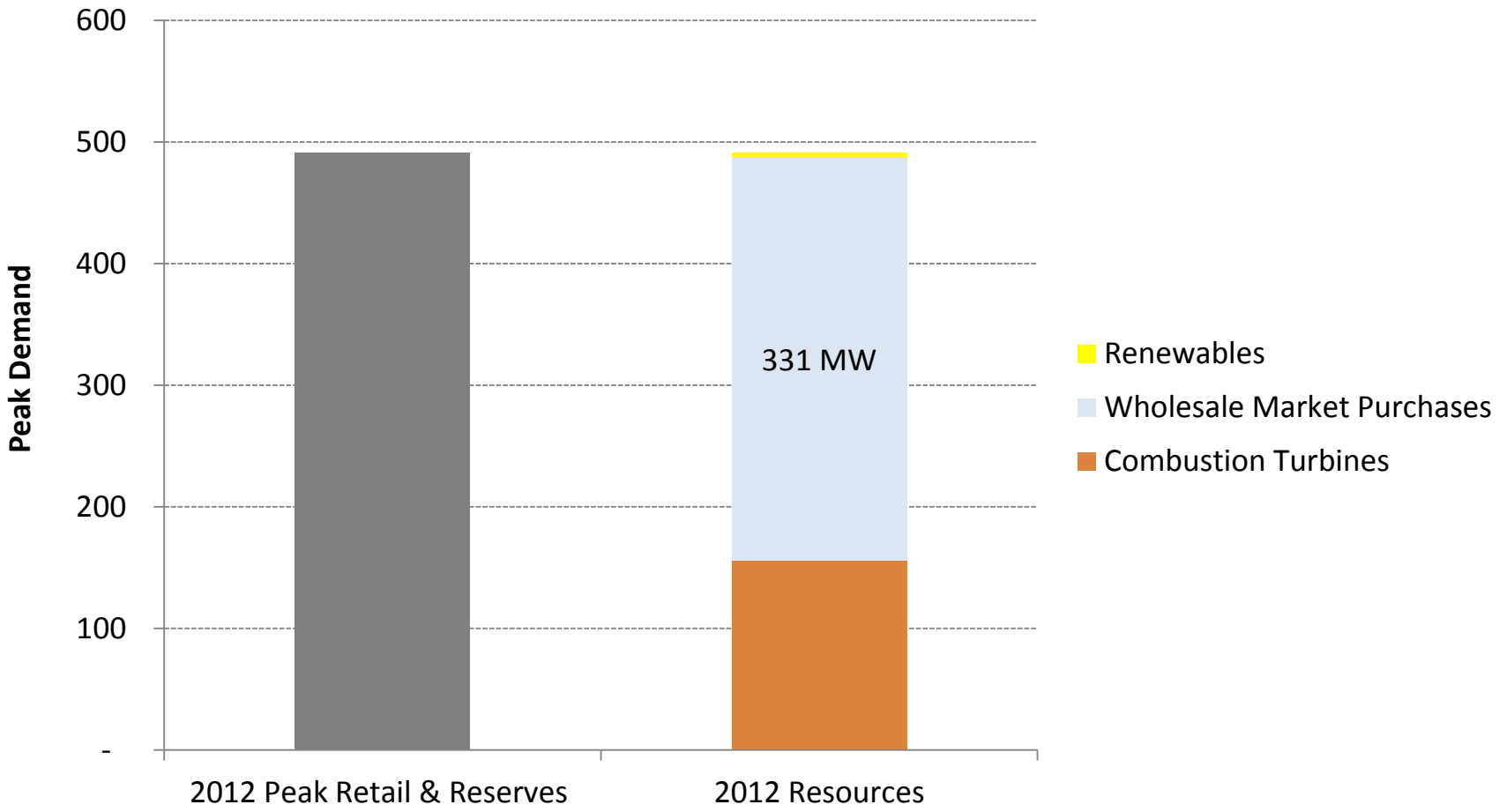


# 2012 UNSE Hourly System Dispatch

## Historical Dispatch

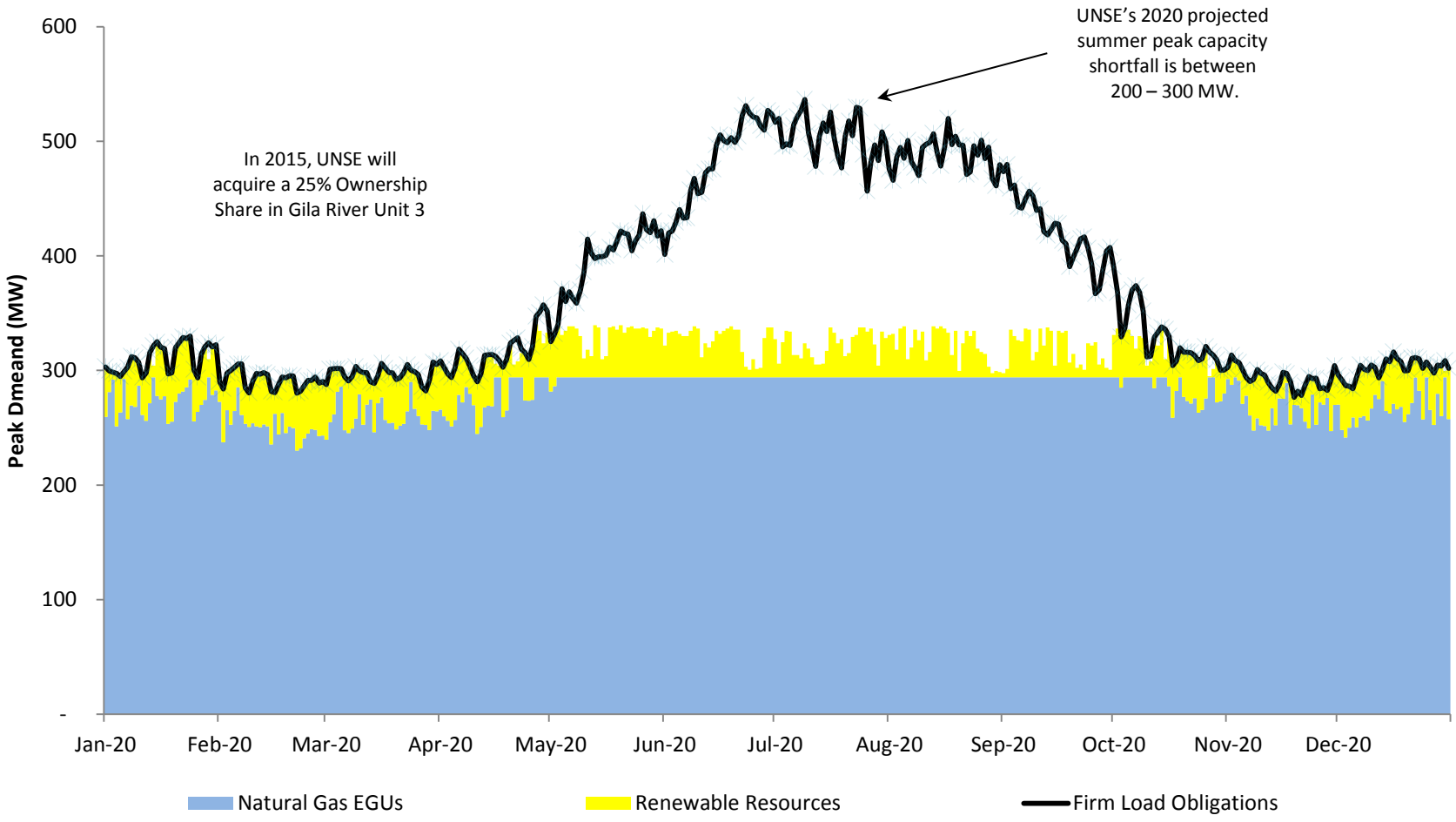


# 2012 UNSE Peak Demands



# 2020 TEP Hourly System Dispatch

## Includes 25% Ownership Share in Gila River Unit 3



# 2020 UNSE Peak Demands