10-MINUTE SETTLEMENT EXAMPLE:
RESIDUAL ENERGY

The ISO manages Imbalance Energy requirements by instructing resources to increase or decrease the amount of energy delivered to the system.   Several factors must be considered in determining how much energy to dispatch to meet a given Imbalance Energy requirement.   One factor is the extent to which resources elect to deviate from ISO instructions.

THE ISSUE

An incentive for deviations from ISO instructions is created by the uncertainty related to how energy associated with ramping back to schedule from an ISO instruction is settled. Such Energy may be delivered in an interval subsequent to the interval in which the resource was instructed to return to schedule, which has two implications:

1) <u>Energy settlement may be at a price less than Bid</u>: Energy delivered in a subsequent interval in the same hour would be settled as instructed energy. Energy delivered in the next hour (e.g., if the instruction extends through the end of the sixth interval of the previous hour) would be settled as uninstructed energy. In either case, the price may be lower than that resource's bid price.[1]

2) <u>"No Pay" may apply</u>: If energy associated with returning to schedule is delivered in the next hour, and the resource is scheduled to provide Spinning Reserve, Non-Spinning Reserve or Replacement Reserve, then the uninstructed deviation would lead to the elimination of Energy and capacity payments.

ISO PROPOSAL

The ISO's proposal for "residual energy" would assure that a resource is never paid less than its bid price for energy associated with ramping back to schedule from an ISO instruction. It would also assure that no energy or capacity payments are eliminated to the extent such a deviation uses capacity obligated to provide an Ancillary Service.   This is accomplished by settling for residual energy at the price that applied in the interval in which the instruction to return to schedule was issued. No new prices are introduced.

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[1] A resource that was called off in the prior interval will not set the price in the current interval.

AN EXAMPLE

Figure 1 illustrates a resource scheduled to generate 120 MWh in two successive hours. No instructions are issued, and any deviations from this schedule would be settled as uninstructed energy.

Figure 1
## Scheduled Energy
No Instructions
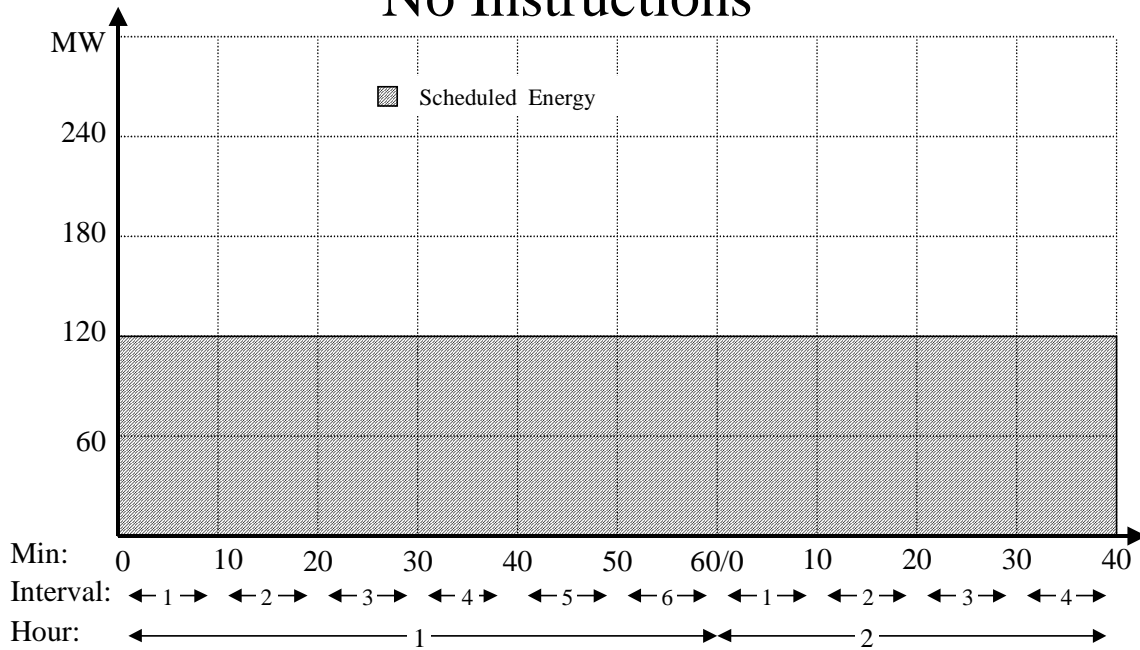
No Residual Energy

Figure 2 shows a 120 MW incremental instruction that is issued at the beginning of the second interval in the first hour, and no further instruction is received. This means that the instruction extends through the end of the sixth interval. For the purpose of this example it is assumed that no instruction is issued in Hour 2.

Figure 2
120 MW Incremental Instruction
No Residual Energy
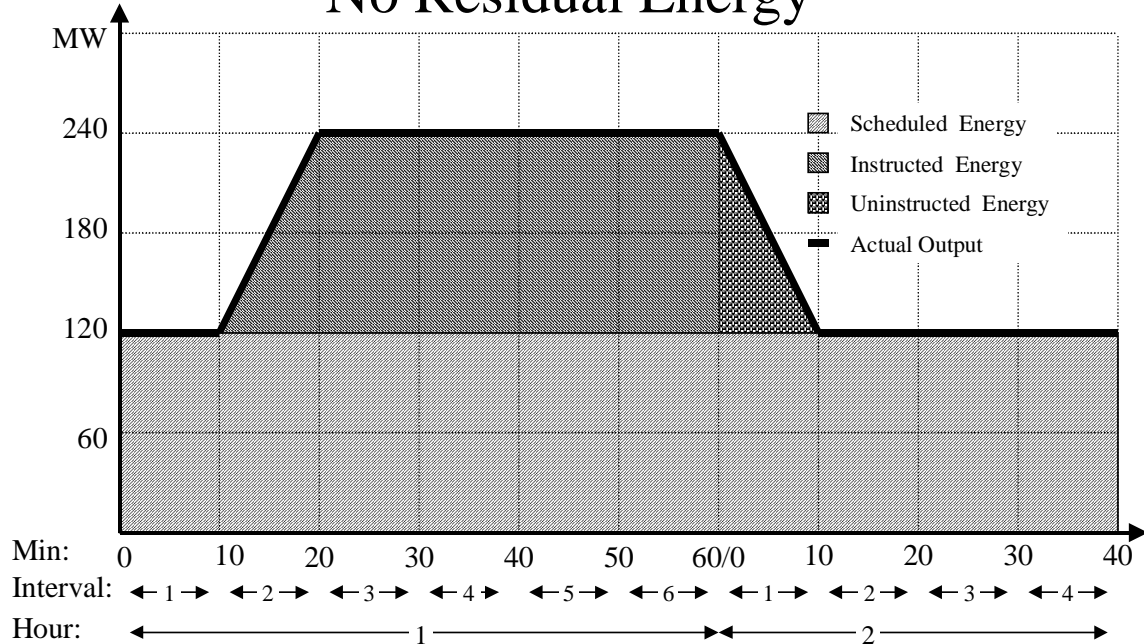
The energy related to the ramp-up in the second interval is settled as Instructed Imbalance Energy, and since it was instructed in that interval, it is assured that the price will be at least equal to its bid price. In contrast, the energy associated with ramping back to schedule in the first interval of Hour 2 would be settled as Uninstructed Imbalance Energy in the absence of the ISO's proposal for "residual energy."[2] The amount of uninstructed deviation in the first interval of Hour 2 is 10 MWh.[3]

To illustrate the risks associated with this settlement, Table 1 provides the assumed market prices and the bid prices submitted on behalf of this resource.

Table 1 Energy Bids and Market Prices $/MWh		
Prices/Bids	Hour 1 Interval 6	Hour 2 Interval 1
Market Prices		
Inc Price	60	35
Dec Price	60	25
Bids*		
Inc Price	55	55
Dec Price	20	20
*Bids in each hour apply to all six intervals.		

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[2] If the instruction had been called off at the end of the fifth interval, then the Energy associated with ramping back to schedule would have been delivered and settled as instructed Energy in the sixth interval. However, the resource would not set the price in the sixth interval, and the price may be less than the bid price. The ISO's proposal for residual energy resolves this problem.

[3] The uninstructed deviation is .5 X 120 MW X 1/6 hr = 10 MWh.

Table 2 shows the settlement results based on these prices. Even though the 10 MWh of energy delivered in the first interval of Hour 2 is directly related to an ISO dispatch instruction, that energy is paid less than its bid price.

Table 2 Settlement Results Without Residual Energy	Hour 2 Interval 1
(1) Uninstructed Deviation (MWh)	10
(2) Bid price ($/MWh)	55
(3) Dec price for Uninstructed Incs ($/MWh)	25
(1) X (2) = (4) Expected Payment based on bid ($)	550
(1) X (3) = (5) Actual Payment as Uninstructed Deviation ($)	250
(4) - (5) = (6) Shortfall ($)	300

The outcome is worse if the capacity that is used for the uninstructed deviation in the first interval of Hour 2 is obligated to provide Spinning Reserve, Non-Spinning Reserve or Replacement Reserve. In this case, then not only will the resource be paid nothing for the 10 MWh of uninstructed energy delivered in the first interval of Hour 1, but capacity payment in Hour 2 associated with that 10 MW will also be eliminated.

With Residual Energy

The ISO's proposal for pricing "residual energy" eliminates this risk. First, the price for Instructed Imbalance Energy that applied in the sixth interval of Hour 1 is applied to the energy associated with that instruction that is delivered in the first interval of Hour 2.[4] Second, since the residual energy is instructed, no uninstructed deviation arises in the first interval of Hour 2. Since there is no uninstructed deviation, there would be no elimination of Energy or Ancillary Service capacity payments as a result of following the ISO's instructions.

This provision for proper pricing of residual energy reduces risk to resources participating in the Imbalance Energy market, and assures that there are no unintended incentives to not follow ISO instructions.

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[4] This pricing assures that residual energy will not be paid less than its bid price. However, residual energy will not set the price for Instructed Imbalance Energy in the first interval of Hour 2, which may be less than the price for Instructed Imbalance Energy in the sixth interval of Hour 1.