FGRs vs. FTRs: Round N+1
Larry E. Ruff
September 23, 2000

1. INTRODUCTION
This note responds to the September 22, 2000, note by Professor Shmuel Oren (Oren 9/22) that allegedly “illustrate[s] the advantage of FGRs over FTRs in providing hedge cover for congestion costs associated with efficient transactions.” (Oren 9/22, p. 1) Oren 9/22 was apparently written to respond to the five “RUFF” propositions that, in a widely distributed e-mail exchange, Professor Oren has called “deceptions” that are “misleading, demagogical and obscuring the truth.” In fact, Oren 9/22 does not directly respond to the RUFF propositions, although it implicitly concedes all five of them. Instead, Oren 9/22 changes the subject and tries – unsuccessfully – to “prove” that FGRs are better than FTRs essentially in the absence of the counterflows that have been the principal issue. This note shows that Oren 9/22 does not prove what it claims and that it implicitly concedes the points it supposedly set out to refute.

2. THE ISSUES AND ARGUMENTS IN OREN 9/22
The discussion in Oren 9/22 continues to use the simple 3-node network example originally introduced by CPOW and illustrated in Figure 1. The principal issues in the Ruff-Oren exchange until now have concerned the relative advantages of FTRs and FGRs for hedging transactions involving counterflows on the line between nodes 1 and 2. Such transactions are illustrated by point Y on the nomogram in Figure 2, where the 350 MW of 1→3 transactions cannot be fully hedged unless some market participant takes on an obligation to deliver or pay for a 50 MW 2→3 counterflow transaction. Oren 9/22 does not address the principal issues raised by
the counterflow and the possibility of negative-value FTRs and FGRs, but changes the subject to discuss what happens when the optimal dispatch is near point X in Figure 2.

The implications of the change in subject are discussed later in this note. This section discusses the assertion in Oren 9/22, that the “analysis [there] provides definitive proof that FGRs whether issued as two sided contracts or as options have superior hedging characteristics over their FTR counterparts (i.e., two sided or options).” (Oren 9/22, p. 8) The cases of options and obligations are discussed separately in Oren 9/22 and (in reverse order) here as well.

2.1 THE “PROOF” THAT FGR/OPTIONS ARE BETTER THAN FTR/OPTIONS

Oren 9/22 tries to prove logically that FGR/options are better than FTR/options (which, according to CPOW, cannot even exist) for hedging purposes. But the alleged proof is logically flawed and proves nothing – except that Professor Oren has been unable to find any real difference between the two despite intensive efforts to do so.

Taking FTR/options first, Oren 9/22 says that (in the example) “the RTO cannot issue more than 300 MW of either [1→3 or 2→3 FTR/options because] he cannot count on counterflow or obligation payment.” (Oren 9/22, p. 7) This implies – according to Oren 9/22 – that the only combinations of 1→3 and 2→3 FTR/options the RTO can sell are those corresponding to the darker shaded area in Figure 2, for which the only interesting points are those on the long face (where only the 2→3 constraint is binding\(^1\)), such as point W. In particular, according to Oren 9/22, the RTO could not safely sell the combination of FTRs corresponding to point X, because there are 350 MW of 1→3 transactions at this point, more

---

\(^1\) Oren 9/22 labels the long face of the nomogram “1→3,” implying that the 1→3 constraint is binding on this constraint, when in fact it is the 2→3 constraint that is binding here. This repeats a mistake first made in Ruff 8/26 but has no effect on the argument.
than the maximum number of $1\rightarrow3$ FTR/options the RTO can safely sell without also selling $2\rightarrow3$ counterflow obligations.

Consider now the case of FGR/options. The RTO can sell 300 MW of $1\rightarrow3$ FGR/options and 220 MW of $2\rightarrow3$ FGR/options (and 100 MW each of $1\rightarrow2$ and $2\rightarrow1$ FGR/options, if anybody is willing to pay positive prices for these), because these are the physical capacities of the corresponding links. With these FGR/options in circulation, market participants can fully hedge the transactions in any dispatch for which only the $1\rightarrow3$ and/or $2\rightarrow3$ constraints are binding. In particular, the transactions corresponding to point X can be fully hedged with $2\rightarrow3$ FGR/options. Combining this conclusion with the conclusion above that the point X cannot be fully hedged with FTR/options, Oren 9/22 claims to have proved the following Theorem:

**Theorem II:**
**Assuming constant PTDFs and fixed capacity flowgates, then the set of transactions that can be fully hedged for congestion cost with a maximal set of simultaneously feasible FTR options is a strict subset of the set of transactions that can be fully hedged for congestion cost with a maximal feasible set of permanent FGR options. The above holds for any arbitrarily frequent reconfiguration of the FTR options.**

The implied “proof” of this theorem is essentially the following syllogism:

**Premise 1:** If the RTO cannot sell negative-value $2\rightarrow3$ FTR/obligations, it cannot safely sell more than 300 MW of $1\rightarrow3$ FTR/options, so market participants cannot hedge the 350 MW of $1\rightarrow3$ transactions corresponding to point X in Figure 2.

**Premise 2:** Even if the RTO cannot sell negative-value $2\rightarrow1$ FGR/obligations, it can safely sell 300 MW of $1\rightarrow3$ FGR/options and 220 MW of $2\rightarrow3$ FGR/options, and market participants can use these to hedge all efficient transactions including the transactions corresponding to point X in Figure 2.

**Deduction:** Therefore, FGRs allow more complete hedging than do FTRs if the RTO cannot sell negative value obligations.

The deduction/conclusion follows logically enough from these premises. But what is the basis for the premises? Consider Premise 1 first. There is nothing to prevent the RTO from selling more than 300 MW of $1\rightarrow3$ FTR/options without selling $2\rightarrow3$ FTR/obligations.
except the possibility that the optimal dispatch/market-clearing solution will switch from points near $X$ to points near $Y$ in Figure 2, requiring the RTO to pay for $2\rightarrow 3$ counterflow in order to support the additional $1\rightarrow 3$ transactions without compensating payments from holders of $2\rightarrow 3$ FTR/obligations. But if this is unlikely – i.e., if congestion on the $1\rightarrow 2$ flowgate is not “commercially significant” – then the RTO can safely sell up to 400 MW of $1\rightarrow 3$ FTR/options (and the corresponding number of $2\rightarrow 3$ FTR/options) without fear of running a significant deficit. Only if counterflows are commercially significant would it be “unsafe” to sell more than 300 MW of $1\rightarrow 3$ FTR/options. Thus, Premise 1 should be expanded by adding the following introductory clause: “If congestion on the $1\rightarrow 2$ flowgate is commercially significant, and …”

Now consider Premise 2. What happens if the RTO sells 300 MW of $1\rightarrow 3$ FGR/options and 220 MW of $2\rightarrow 3$ FGR/options without selling any negative-value $2\rightarrow 1$ FGR/obligations – and then congestion on the $1\rightarrow 2$ flowgate becomes commercially significant, i.e., the optimal dispatch/market-clearing solution shifts from $X$ to $Y$ in Figure 2? When this happens, the RTO will not pay anything under the FGRs it has sold because none of the corresponding flowgates will be congested. But it will collect a settlement surplus corresponding to the unhedged congestion payments by market participants operating at point $Y$. Thus, if counterflow is commercially significant, the FGR/options will not allow full hedging.

Oren 9/22 explicitly dismisses the possibility that points such as $Y$ are relevant in its “proof” of Theorem II, saying such things as: “this hedge cover deficiency only occurs when the flowgates constraints between nodes 1 and 2 is binding” (Oren 9/22, p. 7); “If the constraint is not binding the shortage of FGRs … due to lack of counterflow obligations is moot …” (Oren 9/22, p. 7); “… only dispatches on the positive sloped segments of the nomogram boundary will suffer from a deficiency of congestion hedge cover” (Oren 9/22, p. 8); “… any transaction or dispatch on the [negatively sloped] segment … of the nomogram boundary … can be fully hedged for congestion cost with FGR options (Oren 9/22, p. 8). Given these statements, it is clear that Premise 2 should be expanded by adding the concluding clause: “… provided that congestion on the $1\rightarrow 2$ flowgate is NOT commercially significant.”
Oren 9/22 has even come close to proving Theorem II, because the syllogism contains two logically inconsistent premises – Premise 1 that requires counterflows to be commercially significant and Premise 2 that requires counterflows not to be commercially significant. If counterflows are NOT commercially significant, a system of FGR/options will allow full hedging of all commercially interesting transactions – and an FTR system can safely issue enough FTRs to hedge the same transactions. If counterflows ARE commercially significant, a system of FTR/options cannot safely hedge some transactions that require counterflows – and the same is true for a system of FGR/options. There are no significant differences between FTR/options and FGR/options – or at least Oren 9/22 has not demonstrated any.

2.2 The Case of FGR Obligations and FTR Obligations

Oren 9/22 repeats an earlier argument to try to demonstrate that FGR/obligations (which is virtually an oxymoron in CPOW, which makes much of the fact that FGRs are options, in contrast to the dreaded FTR/obligations) are better than FTR/obligations. Oren 9/22 tries to “prove” a Theorem I, which is based on something like the following syllogism:

**Premise:** The set of FTRs that perfectly hedges one dispatch or market-clearing solution will not perfectly hedge a different dispatch, and the RTO’s unrebated congestion rentals correspond to the extent to which market participants in the aggregate are unhedged.

**Explicit Assumption:** FTRs cannot be reconfigured except in periodic auctions conducted by the RTO.

**Implicit Assumption:** Decentralized trading of FGRs will be fast, low-cost and efficient.

The most important part of Oren 9/22’s Theorem I says (p. 6):

“Assuming constant PTDF, and fixed flowgate capacity, then a maximal feasible set of permanent FGRs (including rights and counterflow obligations) issued by the RTO will provide in the aggregate better or equal hedge cover for real time congestion costs as compared to a maximal set of simultaneously feasible, periodically reconfigured FTRs.”

Again, the deduction follows more-or-less logically from the premise and assumptions. The premise is true enough. The problem is that the assumptions are subject to debate, and the importance of the conclusion even if logically true is a matter of opinion.
As discussed in an earlier reply (Ruff 9/08), it is not clear there is great value added by constantly reconfiguring transmission hedges, particularly for a generator or load trying to hedge a physical position as opposed to a speculator, arbitrager or trader dealing primarily in financial instruments. A physical market participant with a hedged position collects the value of its hedge when dispatch and congestion conditions change, and may have little reason to change its point-to-point hedge unless its own operations or contract arrangements change. Given that hedges are not “use it or lose it” – one of the better parts of the CPOW proposal – there is little value in trading hedges every day, when the price today of a hedge for tomorrow is the expected value of congestion tomorrow.

Be that as it may, the alleged advantages of decentralized trading of FGRs compared to decentralized or centralized trading of FTRs have not been shown. Oren 9/22 asserts that it is “realistic” to assume that FTRs cannot be traded in decentralized markets because there is no visible secondary trading of FTRs in PJM. But this is an unjustified assertion, given that the FTR market is new and there is little need for secondary trading of FTRs given that the ISO conducts frequent auctions, including the day-ahead reconfiguration implicit in the day-ahead LMP market. And there is no evidence whatsoever that decentralized trading of FGRs will work at all, much less that it will be better than the periodic – e.g., daily – reconfiguration of FTRs by an RTO. In short, Theorem I, while it may be reasonable enough as a purely logical proposition if one accepts the premise and assumptions, proves nothing about the real value of FTRs versus FGRs.

3. THE ISSUES IN THE RUFF-OREN EXCHANGE

The Ruff-Oren exchange began with a paper from Ruff challenging some assertions in CPOW regarding options versus obligations, counterflows and negative-value FTRs. After multiple rounds in this exchange, in which it appeared that some concessions were being made and some assertions were being softened, the final version of CPOW appeared with the same assertions stated as strongly as ever. The recent state of this exchange can be summarized by excerpts from some recent e-mails:
Sender: Larry Ruff  
To: Shmuel Orens and Hung-Po Chao -

Thank you for sending me the 15 September 2000 version of CPOW, presumably as it will appear in the October Electricity Journal.

I see that this "final" version still contains the following assertions:

CPOW 1. "Another advantage of flowgate rights is that their value is never negative, unlike a point-to-point financial right. [FTR]" [p. 7]

CPOW 2. "By contrast [with FGRs], point-to-point rights [FTRs] entail an obligation to provide the requisite flow, and they can result in a financial liability ." [p. 7]

CPOW 3: "[T]he transfer capability between two points may be greatly diminished unless a point-to-point right with negative value is underwritten. On the other hand, the available number of flowgate rights on a link is determined only by the contingency-adjusted flow constraints on that link ..." [p. 7]

CPOW 4. "This negative price [of FTRs involving counterflow] could increase the cost of implementing a property right system ... [because the holder would be] liable for the cost of more expensive replacement generation at their location [if they could not produce]. ... Hence, the risk premium for undertaking such an obligation would be high, introducing distortion into the allocative efficiency of the property rights." [p. 9, including footnote]

CPOW 5. "On the other hand, if prices must be kept non-negative, the issuance of transmission rights must be limited, and the transmission system will be underutilized. This suggests that unlike the flow-based approach, a point-to-point transmission-rights system is inherently limited in supporting a decentralized market design." [pp. 9-10]

Given all that appeared to have been accomplished in the Ruff-Oren exchange, it is surprising to find these claims in CPOW. There could be and no doubt are different interpretations of the Ruff-Oren exchange, but I think a reasonable reading would support the following conclusions;

RUFF 1. FTRs do not have to be "obligations," but can be options just as well as FGRs can be.

RUFF 2. A flowgate system cannot provide full hedges in counterflow situations unless somebody holds negative-valued FGRs that entail the same perform-or-pay obligations required with a negative-valued FTR.
DRAFT

RUFF 3. Rights with negative values are very common in markets—e.g., a power sales contract is just such a negative-valued right or obligation—and there is nothing about transmission that makes such rights/obligations unusual or particularly risky or that would "introduce distortion into the allocative efficiency of the property rights." In fact, as Andy Ott pointed out, negative value FTRs are commonly bid for and sold in the PJM FTR auctions.

RUFF 4. If the RTO cannot issue negative-value FGRs for some reason (which seems to be the CPOW position), full hedging in the presence of counterflow requires that negative-value rights—obligations—be somehow defined and administered in decentralized markets.

RUFF 5. However hard or easy it may be to use decentralized markets to define and trade negative-value FGRs to deal with counterflows (or anything else), there is no fundamental reason this should be more difficult with FTRs than with FGRs.

The purpose of the Ruff-Oren exchange was presumably to clarify issues such as these. Although everything was not resolved, I and even some more neutral observers thought that at least RUFF 1 thru 5 had been demonstrated. We need not repeat the entire discussion, but it would be useful to know which of the "RUFF" assertions above you disagree with or why the CPOW assertions are still valid despite the RUFF assertions. And it would be useful to know the extent to which you think our remaining disagreements reflect analytical differences and where they reflect factual/quantitative or even philosophical/ideological differences.

Larry

Date: Friday, September 22, 2000 10:30 AM
Sender: Shumel Orens
To: Larry Ruff

Dear Larry

In the email [above] you present five conclusions that you choose to extract from our debate. I find your selection of "proven facts" misleading, demagogical and obscuring the truth. At least in theory, under the assumptions of stable PTDFs and Flowgate capacities, FGRs either as options or as obligations are fundamentally superior to FTRs in providing flexible hedging capability for congestion cost. To be specific, RTO issued feasible FGRs can provide hedge cover for more transactions then simultaneously feasible RTO issued FTRs. This is true when the FGRs and FTRs are defined as options and also true when obligations are allowed. Giving you the benefit of the doubt that the deception is not intentional, I am willing to assume responsibility for not making myself clear enough in our exchange. Therefore, at the
risk of re igniting our debate I will give it another shot trying to make it simple and crisp.

Shmuel

The discussion in earlier sections of this note has dealt with Professor Oren’s “proof” that FGRs are “fundamentally superior to FTRs.” But this still leaves the five RUFF propositions – propositions that Professor Oren calls “deceptions” that are “misleading, demagogical and obscuring the truth.” This characterization of the RUFF propositions is particularly interesting given that Professor Oren implicitly or explicitly concedes all five of these propositions in Oren 9/22. Consider them one at a time.

RUFF 1: FTRs do not have to be "obligations," but can be options just as well as FGRs can be.

Oren 9/22 spends a lot of effort trying – unsuccessfully – to prove that FTR/options are not as good as FGR/options, but no longer claims that FTRs cannot be options. Oren 9/22 also concedes that FGRs can be obligations – indeed, they must be obligations if, as supposedly proven in Theorem I, they are to be as good as or better than FTR/obligations.

RUFF 2: A flowgate system cannot provide full hedges in counterflow situations unless somebody holds negative-valued FGRs that entail the same perform-or-pay obligations required with a negative-valued FTR.

Oren 9/22 explicitly concedes this by making FGRs obligations for the purpose of Theorem I and elsewhere.

RUFF 3: Rights with negative values are very common in markets - e.g., a power sales contract is just such a negative-valued right or obligation - and there is nothing about transmission that makes such rights/obligations unusual or particularly risky or that would "introduce distortion into the allocative efficiency of the property rights." In fact, as Andy Ott pointed out, negative value FTRs are commonly bid for and sold in the PJM FTR auctions.

Oren 9/22 does not address this point explicitly, but clearly allows – indeed, requires – that FGRs be obligations if they are to be as good as FTR/options for hedging purposes, with no suggestion that negative-value FGRs would be unacceptably risky or allocatively inefficient.
RUFF 4: If the RTO cannot issue negative-value FGRs for some reason (which seems to be the CPOW position), full hedging in the presence of counterflows requires that negative-value rights - obligations - be somehow defined and administered in decentralized markets.

Oren 9/22 explicitly concedes this point when it assumes, “for simplicity, that all FTRs or FGRs are issued (or acquired) by the RTO. In other words we will exclude (just for the sake of this discussion) the possibility of privately issued FTRs and FGRs.” (Oren 9/22, p. 2)

RUFF 5: However hard or easy it may be to use decentralized markets to define and trade negative-value FGRs to deal with counterflows (or anything else), there is no fundamental reason this should be more difficult with FTRs than with FGRs.

In Oren 9/22 Professor Oren says: “I personally believe, for reasons given in the CPOW paper and the RUFF-OREN exchange that a secondary FGR market is likely to be more liquid and efficient that a secondary FTR market … However, since that assertion is still debatable …” (Oren 9/22, p. 3) In other words, Professor Oren sees no “fundamental reason” that decentralized trading should be easier with FGRs than with FTRs; he just “personally believes” it would be.

4. CONCLUSIONS

Oren 9/22 fails to prove that FTRs have any advantages over FGRs, and in fact concedes most of the main points that have been at issue in the Ruff-Oren exchange, including the five RUFF propositions that Professor Oren has called “deceptions” that are “misleading, demagogical and obscuring the truth.” It is unfortunate that some of these issues could not have been resolved before CPOW went to press in a widely-read policy journal.