LRMC – Tariff Model Options

Gas TCMWG - Gas Transmission Charging Methodologies Working Group

9th March 2006

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Introduction

- This presentation covers
  - Options for potential enhancements to the LRMC Methodology Tariff model
  - Initial Option Assessment

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LRMC Methodology Enhancement Options

Potential Enhancements

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Potential Enhancements

- **Transport Model**
  - Investigating potential enhancements to “Transcost” and alternative “simpler” models
  - If Transcost is to be retained, considering ways in which model could be made easier to use by industry

- **Tariff Model (post processing)**
  - Assessing whether there are any better alternatives to the way in which the outputs from the Transport Model are used to derive tariffs

Today we will consider the Tariff Model Options

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Key Questions for the Review

1. S&D Scenarios: 1 Year or multiple Year?
2. How should incremental costs be modelled?
3. How should spare network capacity be treated?
4. Should decrement (back flow) costs be considered?
5. **How should entry and exit costs be disaggregated?**
6. **How should negative costs be treated?**
7. **Should capacity charges be adjusted to 50:50 entry:exit and if so how?**
8. **Are zones required?**
9. **Should capacity charges be adjusted to recover allowed revenue and if so how?**
10. **Should year on year price changes be capped?**

Transport Model

Tariff Model

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Key Questions for the Review

1. S&D Scenarios: 1 Year or multiple Year?
2. How should incremental costs be modelled?
3. How should spare network capacity be treated?
4. Should decrement (back flow) costs be considered?
5. **How should entry and exit costs be disaggregated?**
   - *A) Reference node?*
   - *B) Solver with*
     - *Non-negative constraint?*
     - *50:50 constraint?*
6. How sh
7. Should … 50:50 entry:ex
8. Are zon
9. Should … recover allowed revenue and if so how?
10. Should year on year price changes be capped?

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LRMC Methodology Enhancement Options

Entry Exit Cost Disaggregation

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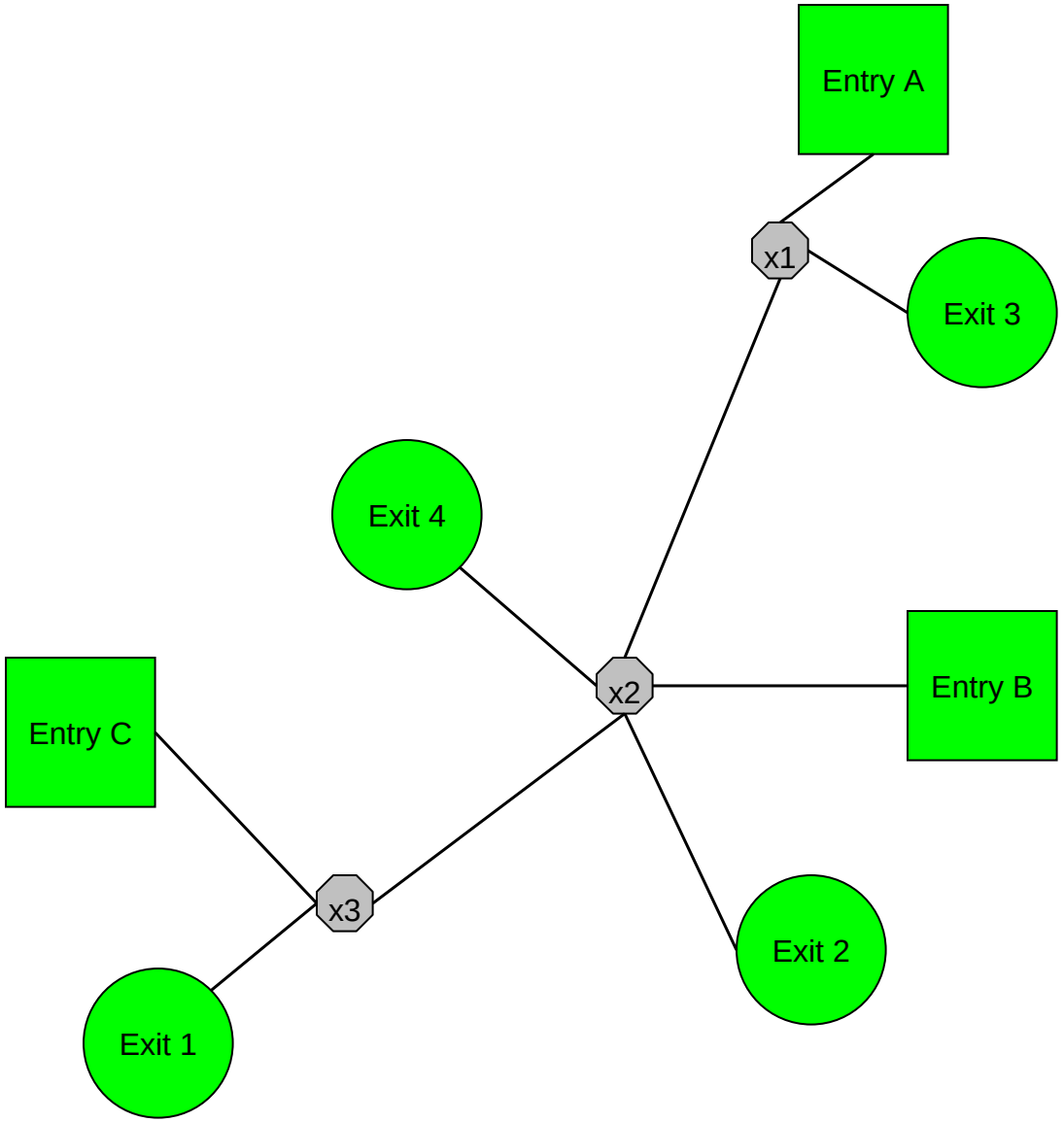
Example Network



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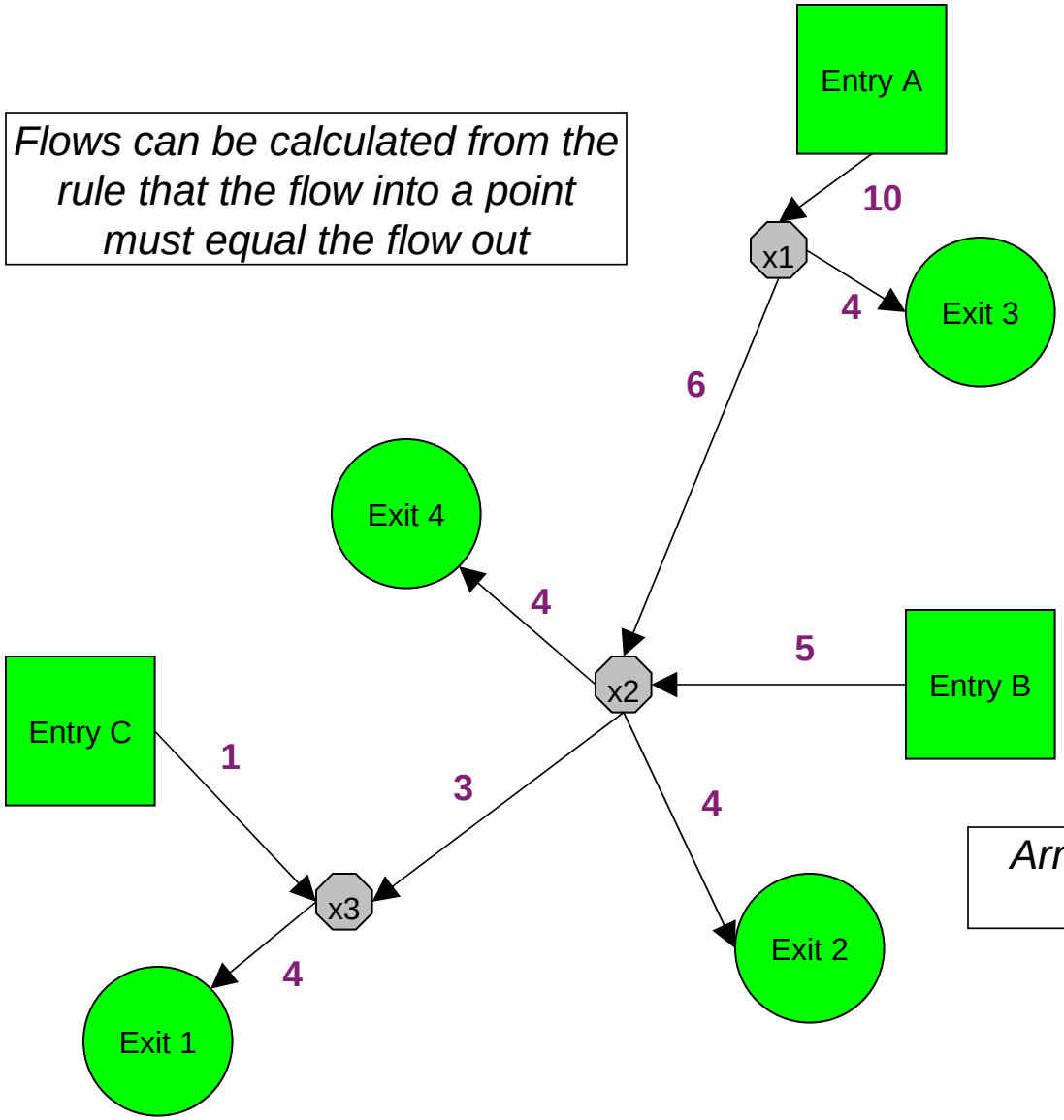
Example Network
Calculate flows from Supply & Demand Data

Flows can be calculated from the rule that the flow into a point must equal the flow out



Entry Point	Peak Flow	Exit Point	Peak Day Flow (GWh)
A	10	1	4
B	5	2	4
C	1	3	4
		4	4

Arrows show direction of flow based on peak flow

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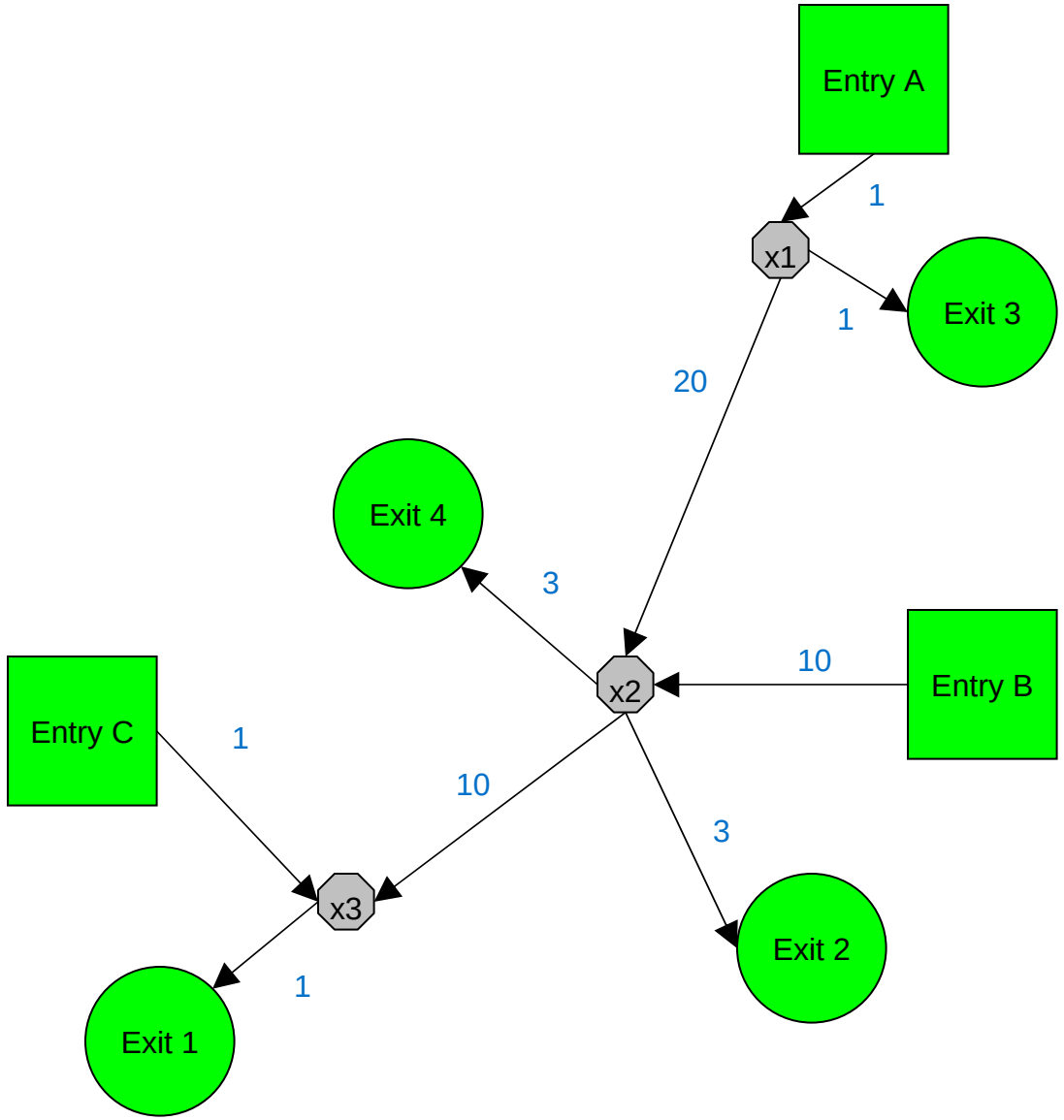
Example Network

(calculate reinforcement cost per GWh/day for each pipe section)



Pipe	Node 1	Node 2	Cost (£/peak day GWh)
1	Entry A	x1	1
2	x1	Exit 3	1
3	x1	x2	20
4	Entry B	x2	10
5	x2	Exit 2	3
6	x2	x3	10
7	X2	Exit 4	3
8	Entry C	x3	1
9	X3	Exit 1	1

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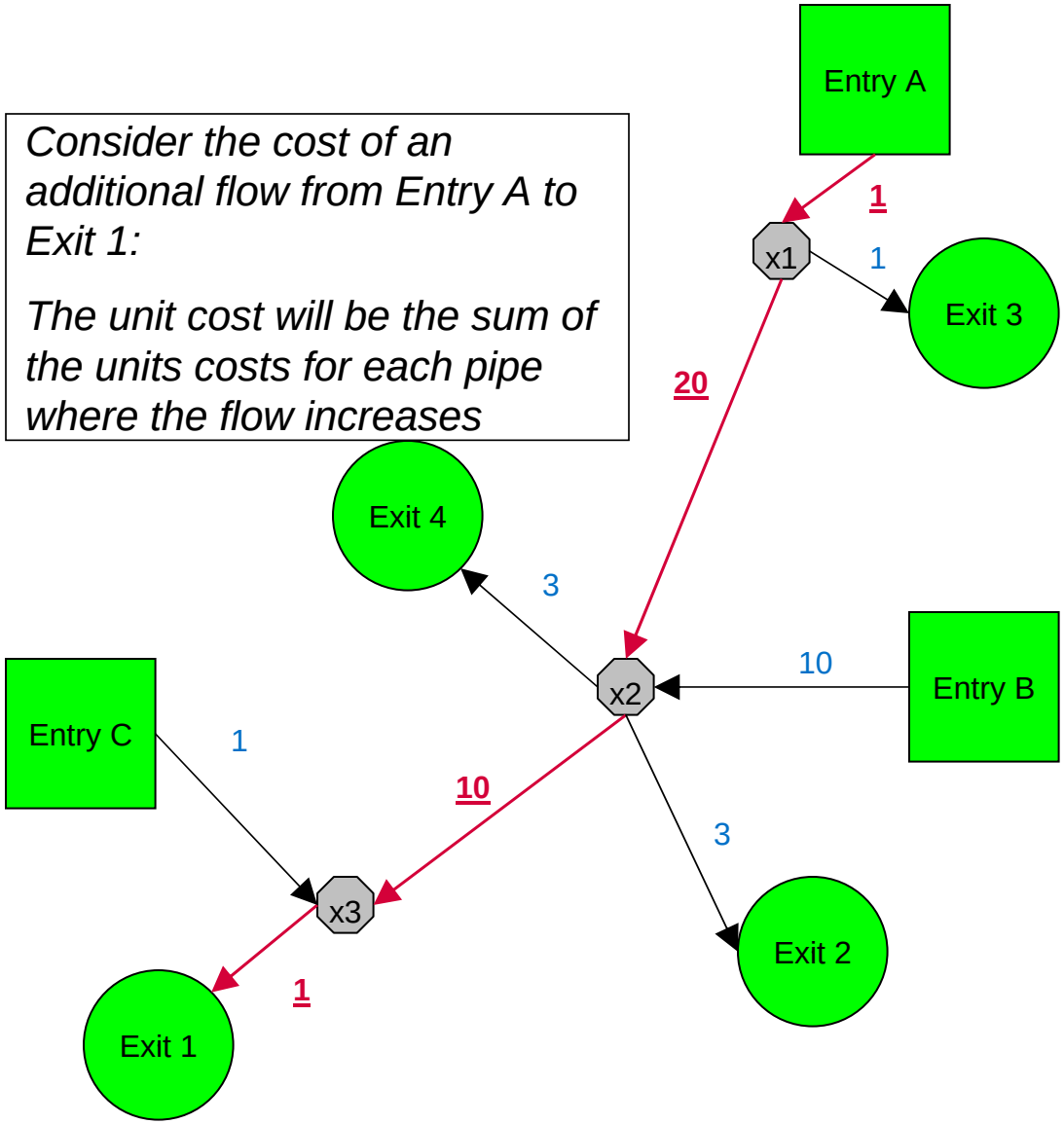
Example Network
Example Route Costs (No backhaul costs)

Consider the cost of an additional flow from Entry A to Exit 1:

The unit cost will be the sum of the units costs for each pipe where the flow increases



	Entry A	Entry B	Entry C
Exit 1	**32**	21	2
Exit 2	24	13	4
Exit 3	2	11	2
Exit 4	24	13	4

NB Only consider costs for a route if the flow increases

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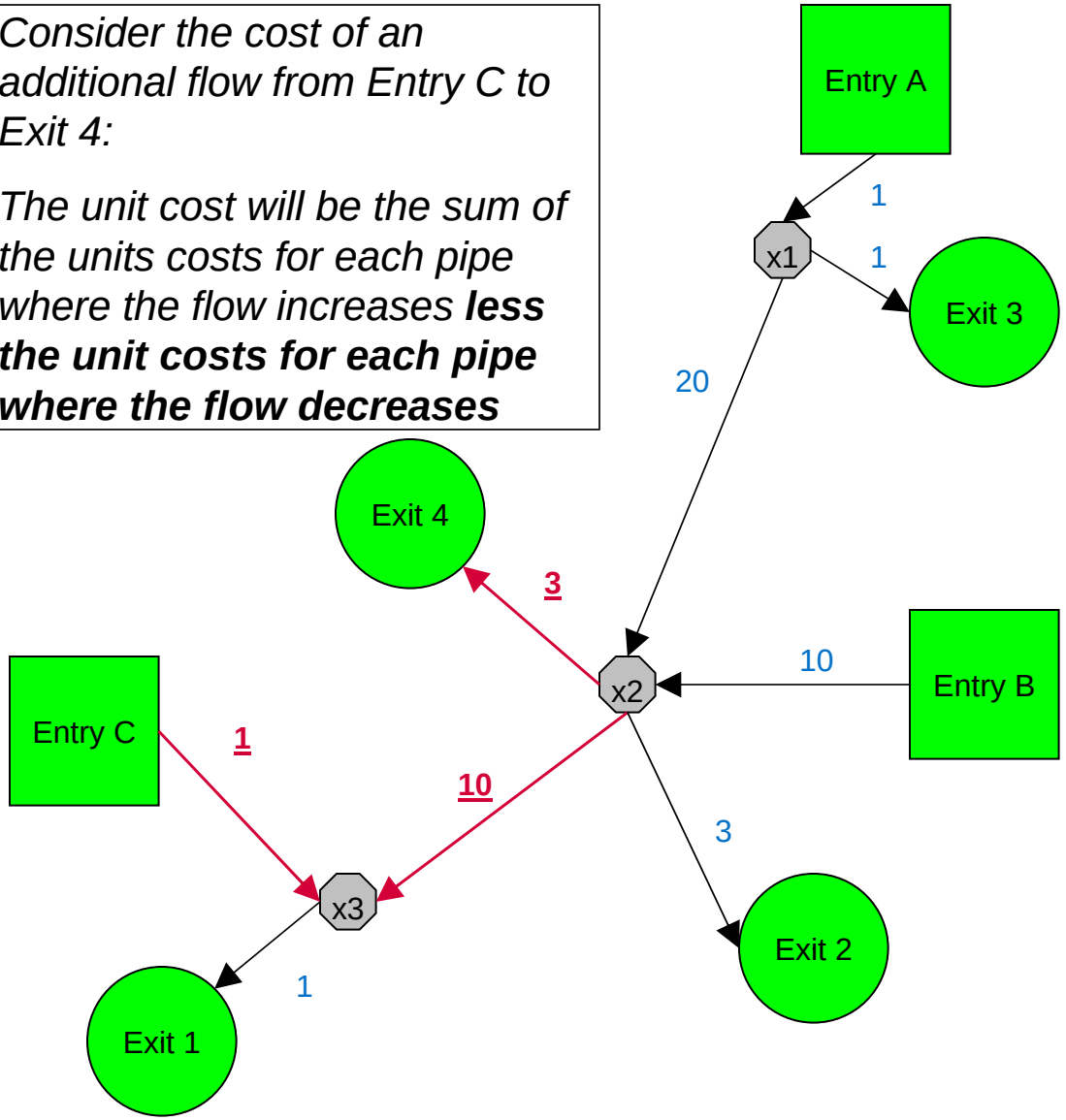
Example Network
Example Route Cost (inc backhaul costs)

Consider the cost of an additional flow from Entry C to Exit 4:

The unit cost will be the sum of the units costs for each pipe where the flow increases ***less the unit costs for each pipe where the flow decreases***



	Entry A	Entry B	Entry C
Exit 1	32	21	2
Exit 2	24	13	**-6**
Exit 3	2	**-9**	**-28**
Exit 4	24	13	**-6**

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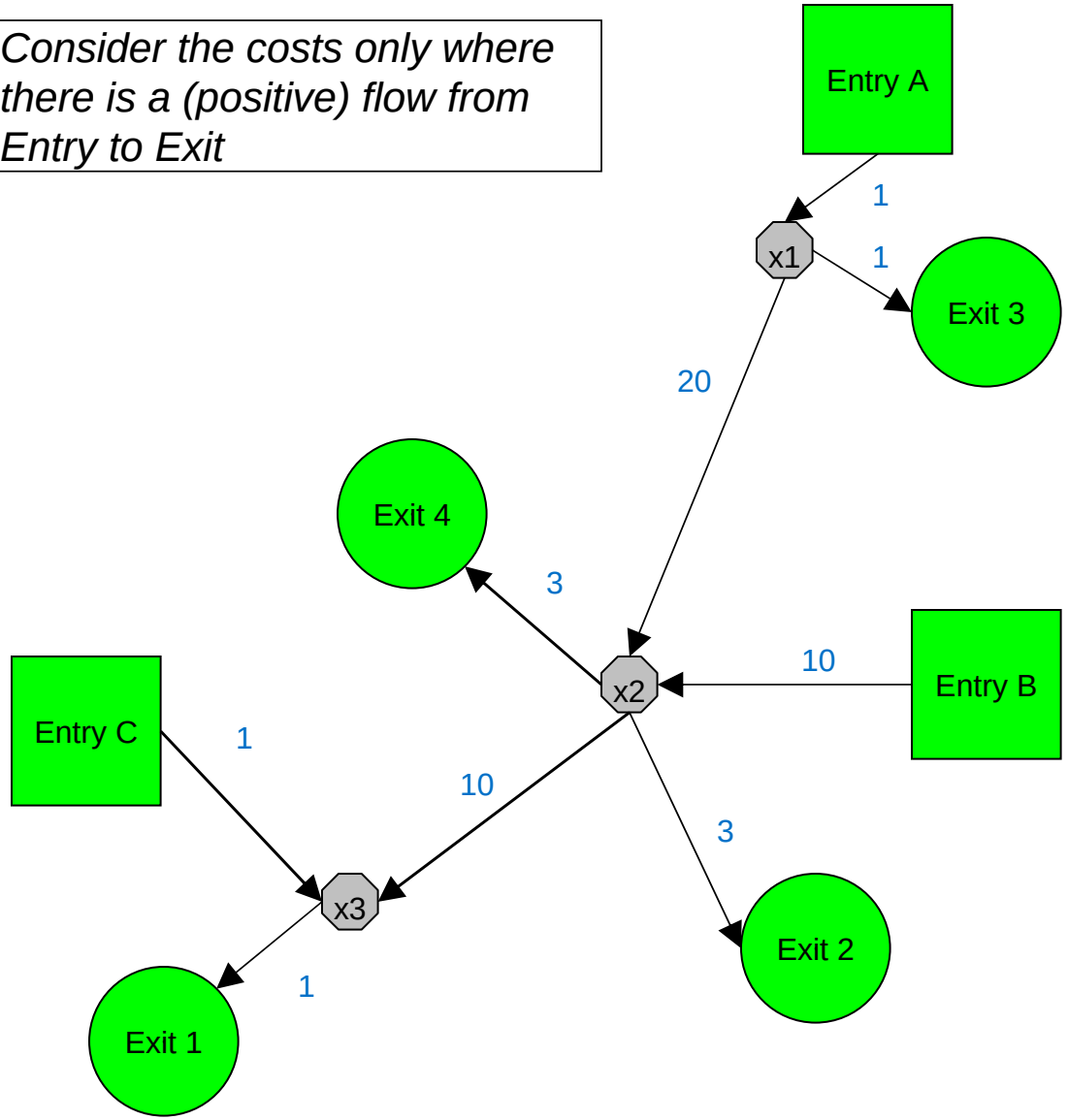
Example Network
Example Route Cost (Positive flows only)

Consider the costs only where there is a (positive) flow from Entry to Exit



	Entry A	Entry B	Entry C
Exit 1	32	21	2
Exit 2	24	13	**na**
Exit 3	2	**na**	**na**
Exit 4	24	13	**na**

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Example Network
Route Cost Matrices (£/peak day GWh)

No Backhaul			
	Entry A	Entry B	Entry C
Exit 1	32	21	2
Exit 2	24	13	4
Exit 3	2	11	2
Exit 4	24	13	4

Backhaul Included			
	Entry A	Entry B	Entry C
Exit 1	32	21	2
Exit 2	24	13	-6
Exit 3	2	-9	-28
Exit 4	24	13	-6

Flows Only			
	Entry A	Entry B	Entry C
Exit 1	32	21	2
Exit 2	24	13	na
Exit 3	2	na	na
Exit 4	24	13	na

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Solver Concept

- Find Entry & Exit Costs that minimise the sum of the differences (squared) between each
  - Route Cost, and
  - The relevant Entry + Exit Costs
- For all routes (Sum of Squared Errors ~ SSE)

$$SSE = \sum_{ForallXY} \left[EntryX + ExitY - Route\_Cost\_XY \right]^2$$

- Solver minimise SSE by varying Entry and exit cost estimates
- Constraints
  - All Entry and Exit costs must be greater than or equal to zero

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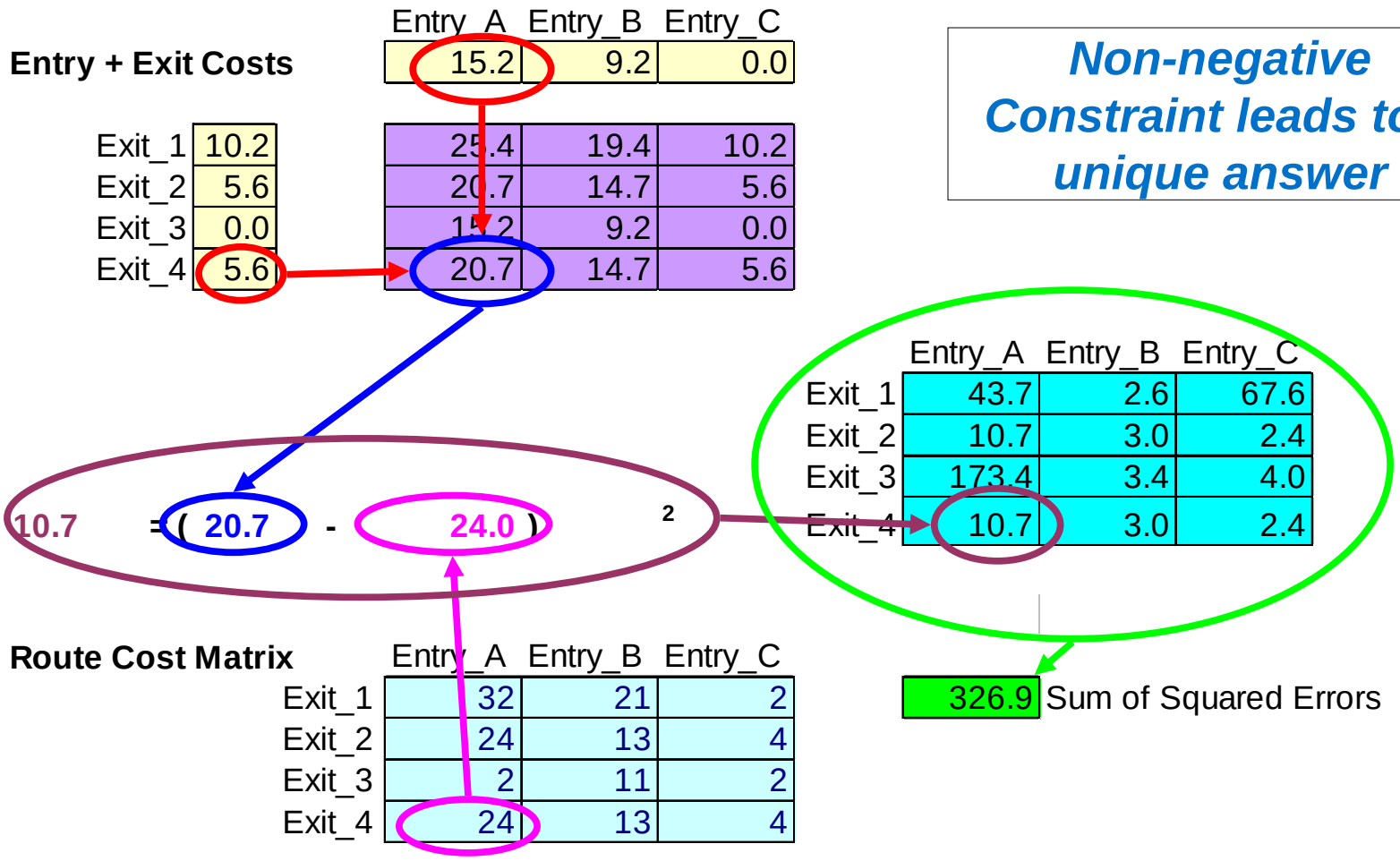
Solver Solution (No Backhaul)
Non-negative constraint



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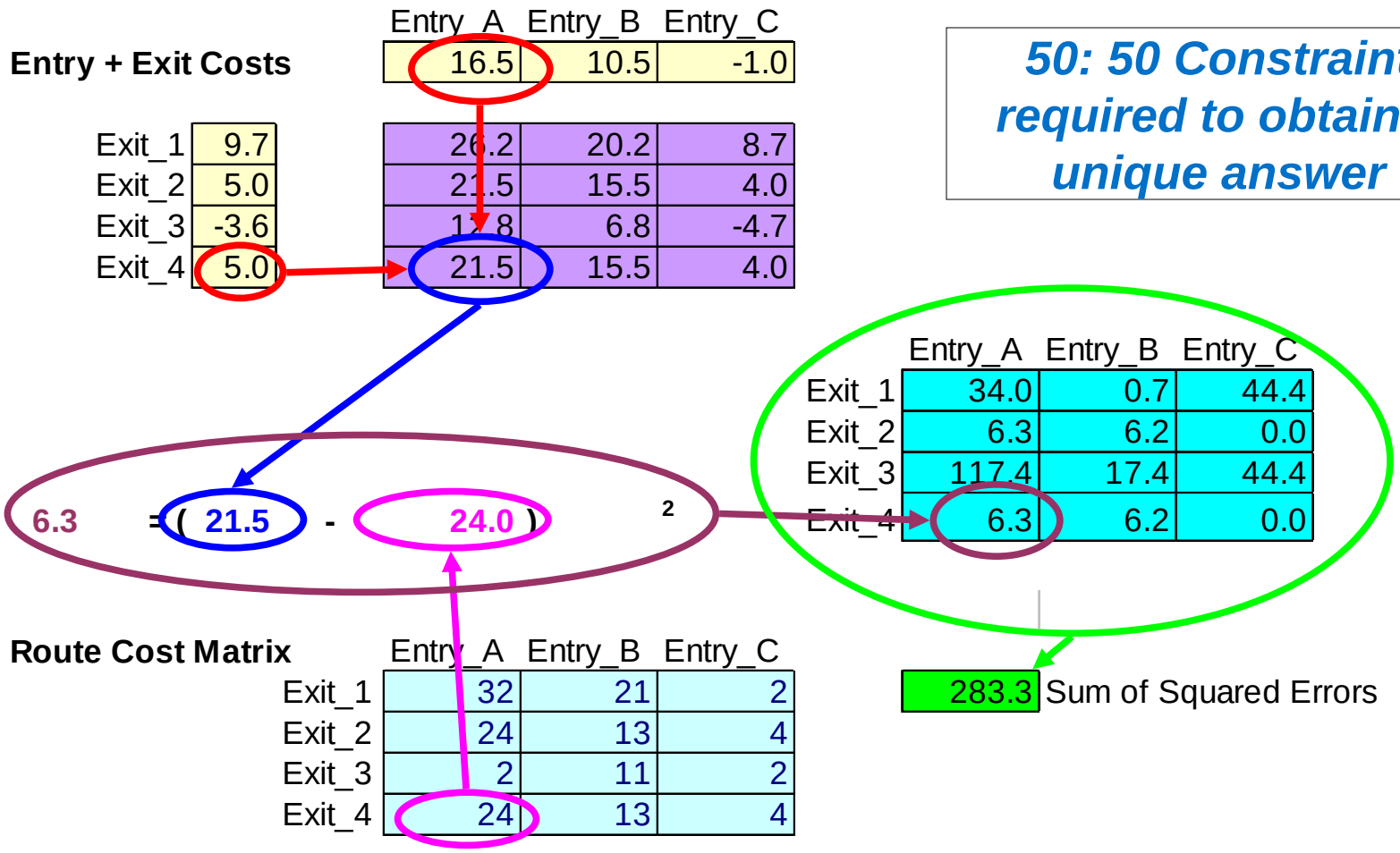
Solver Solution (No Backhaul)
50: 50 Constraint



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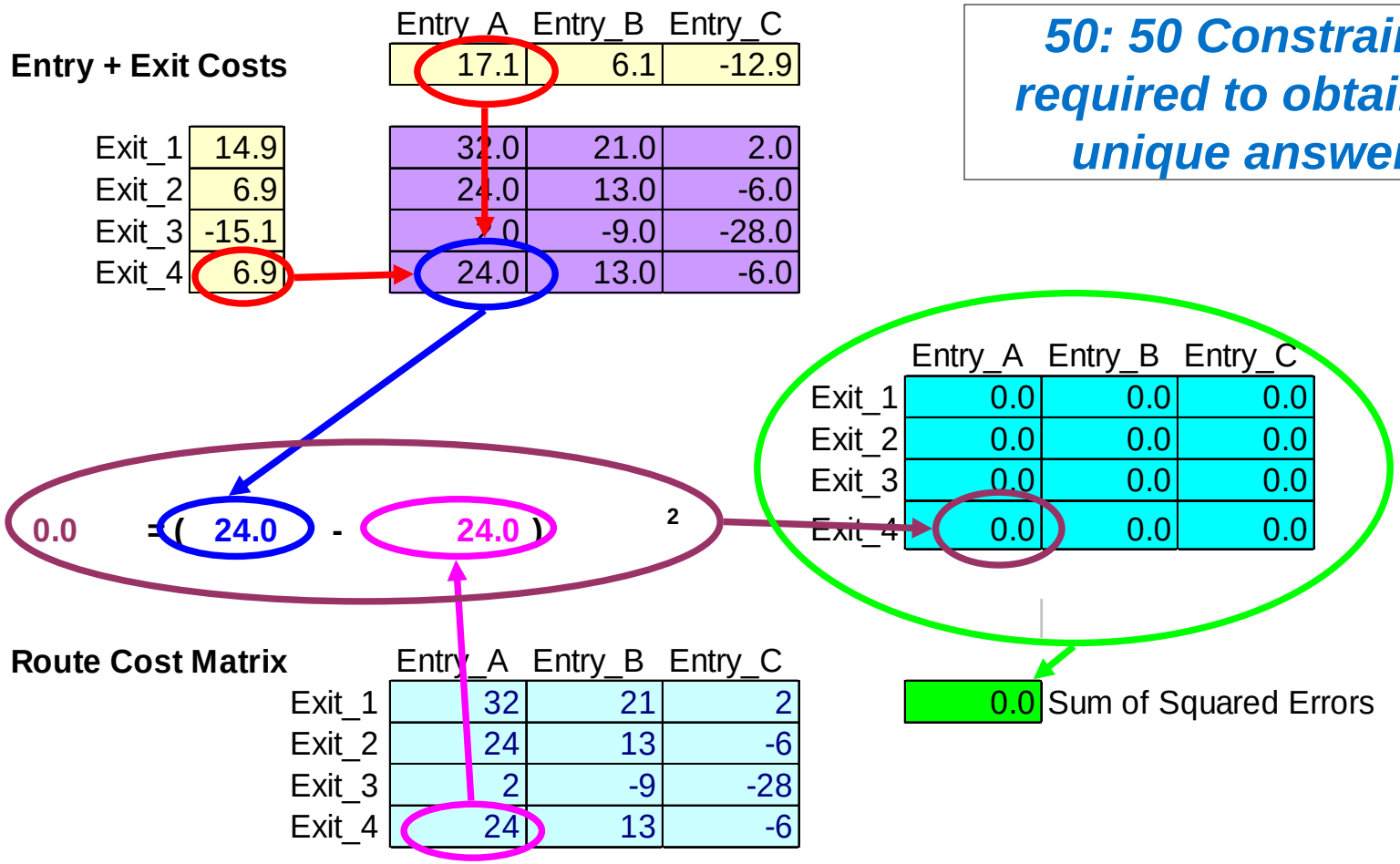
Solver Solution (Backhaul)
50: 50 Constraint



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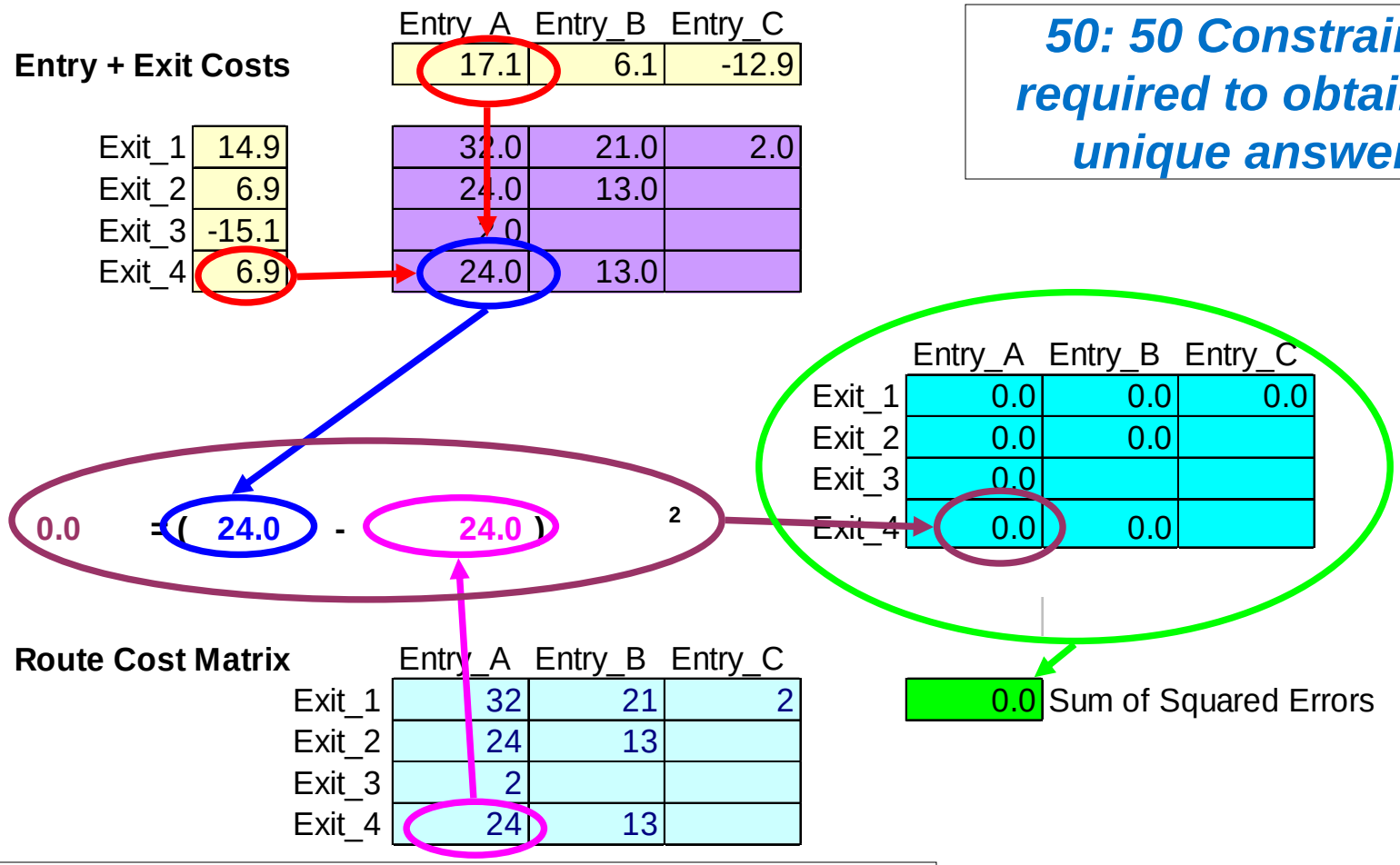
Solver Solution (Flow Only)
50: 50 Constraint



"Flow Only" results identical to backhaul

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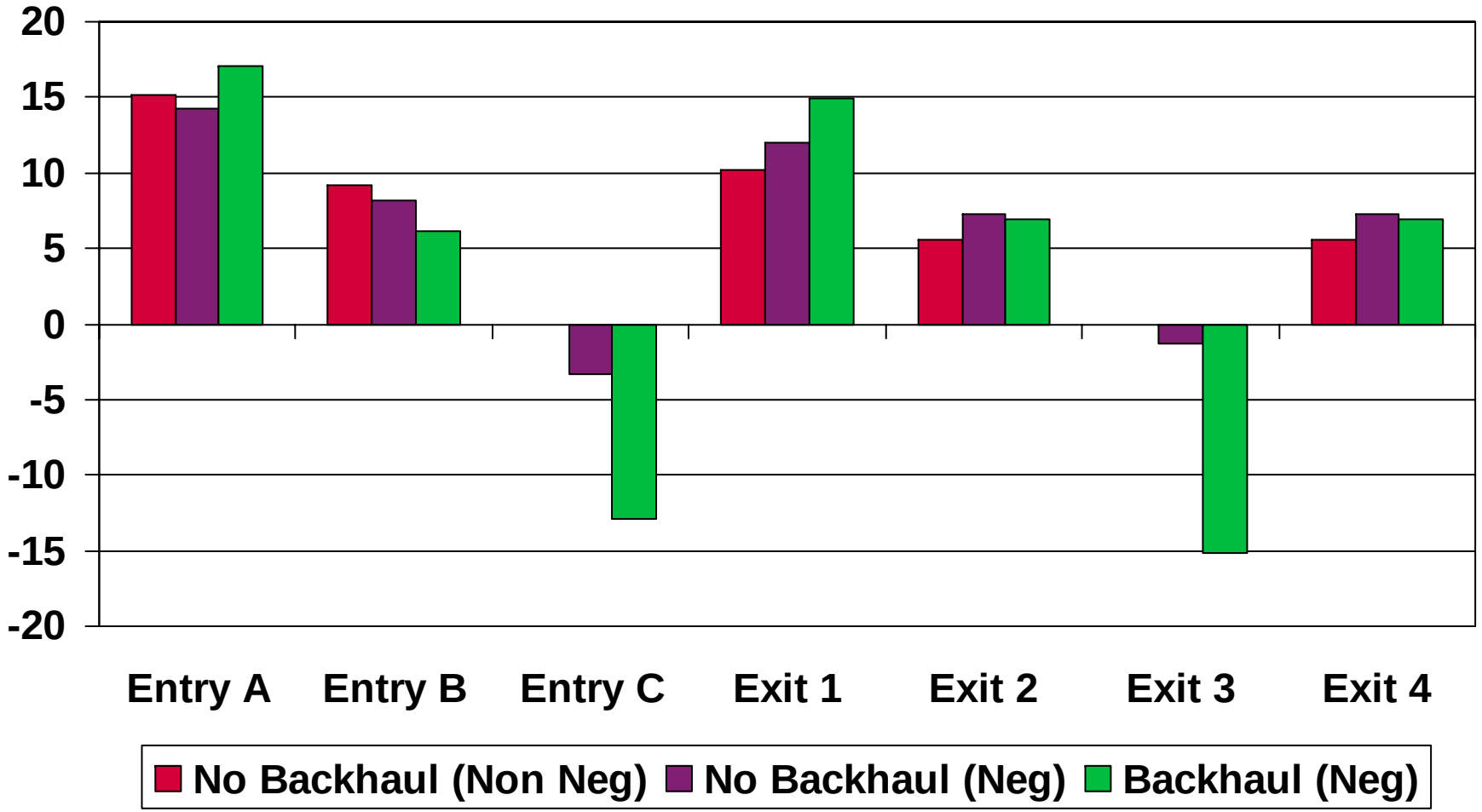
Impact of Backhaul on Marginal costs Solver Solution



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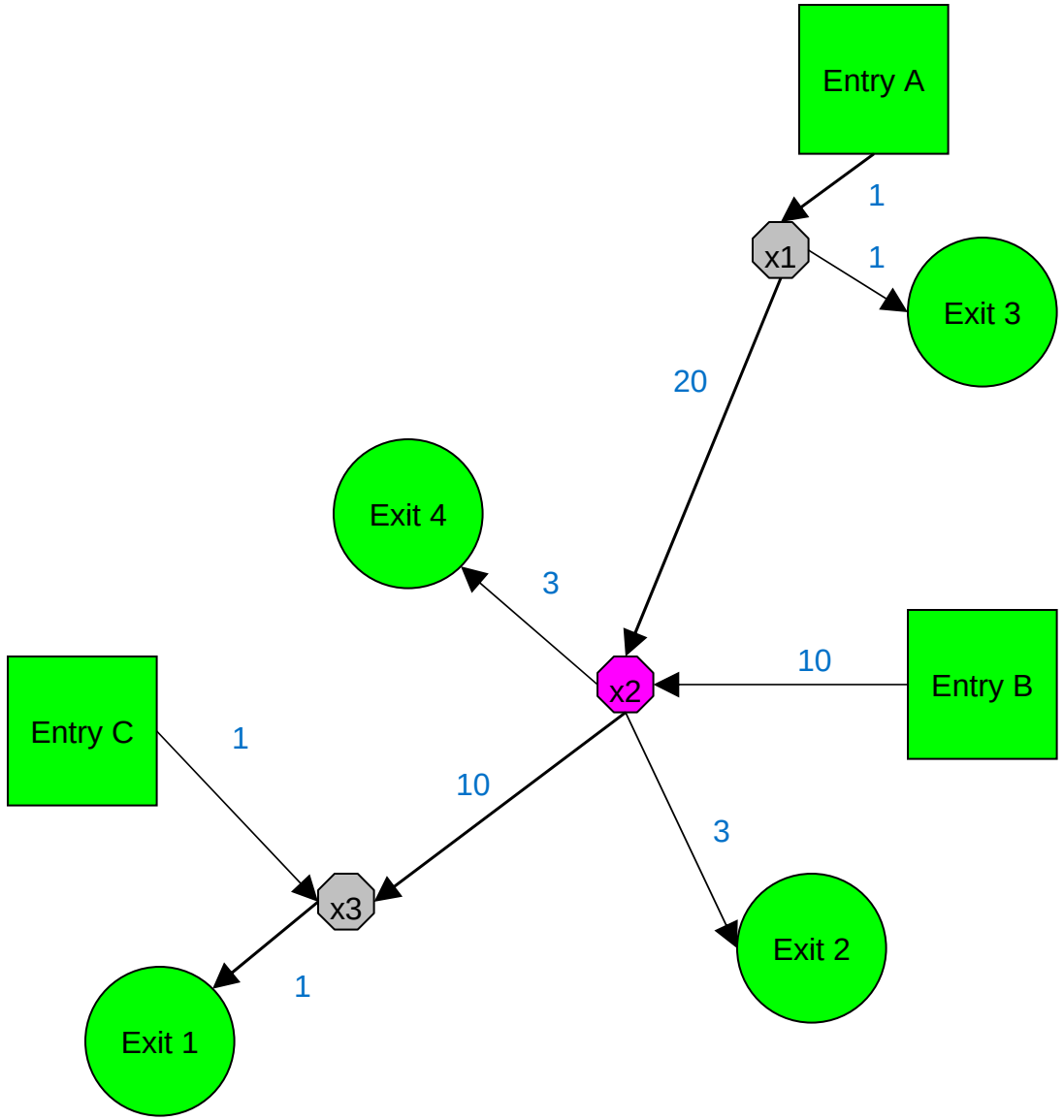
Example Network
Reference Node Costs (No backhaul costs)



	Entry A	Entry B	Entry C
	21	10	1
Exit 1	11		
Exit 2	3		
Exit 3	1		
Exit 4	3		

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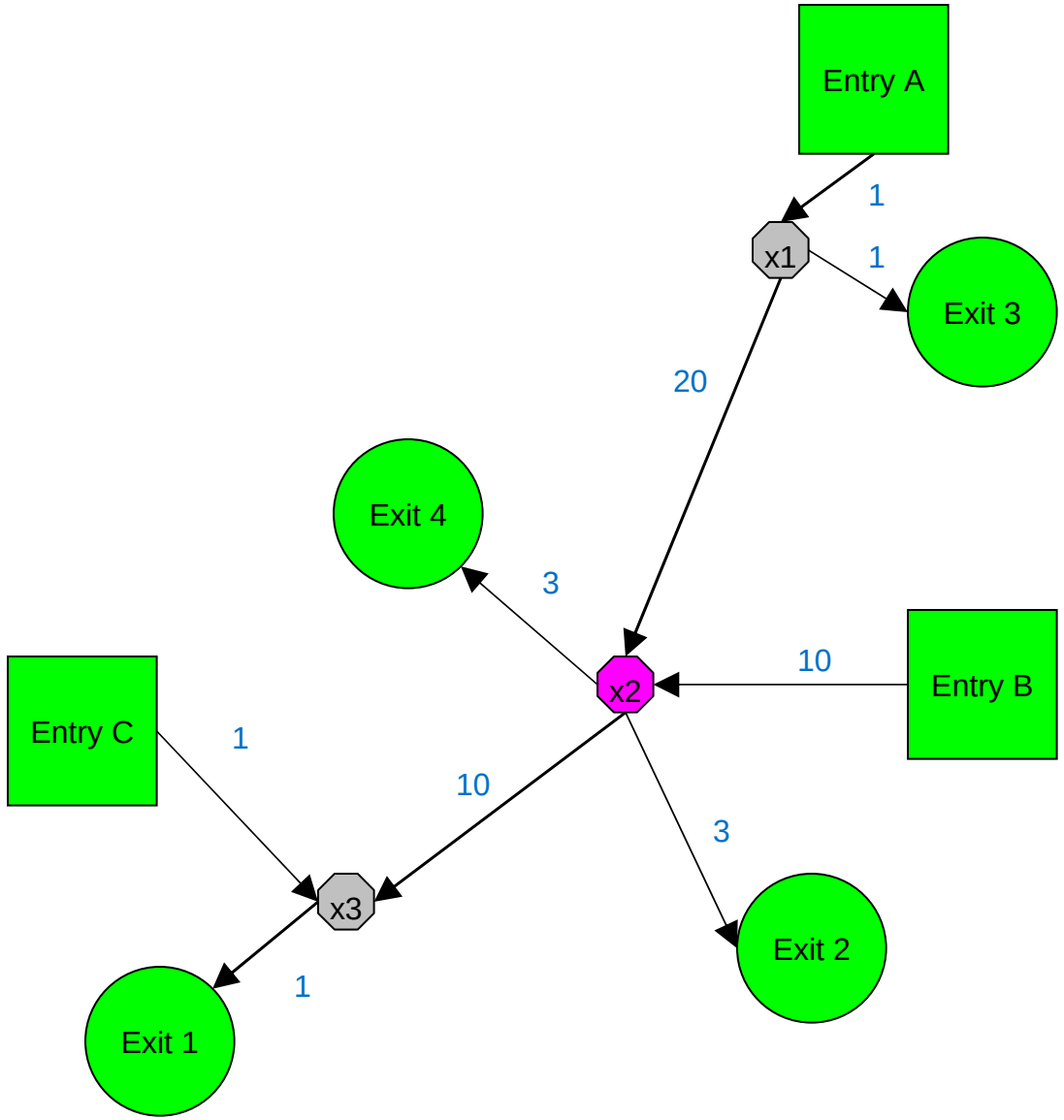
Example Network
Reference Node Costs (Inc backhaul)



	Entry A	Entry B	Entry C
	21	10	-9
Exit 1	11		
Exit 2	3		
Exit 3	-19		
Exit 4	3		

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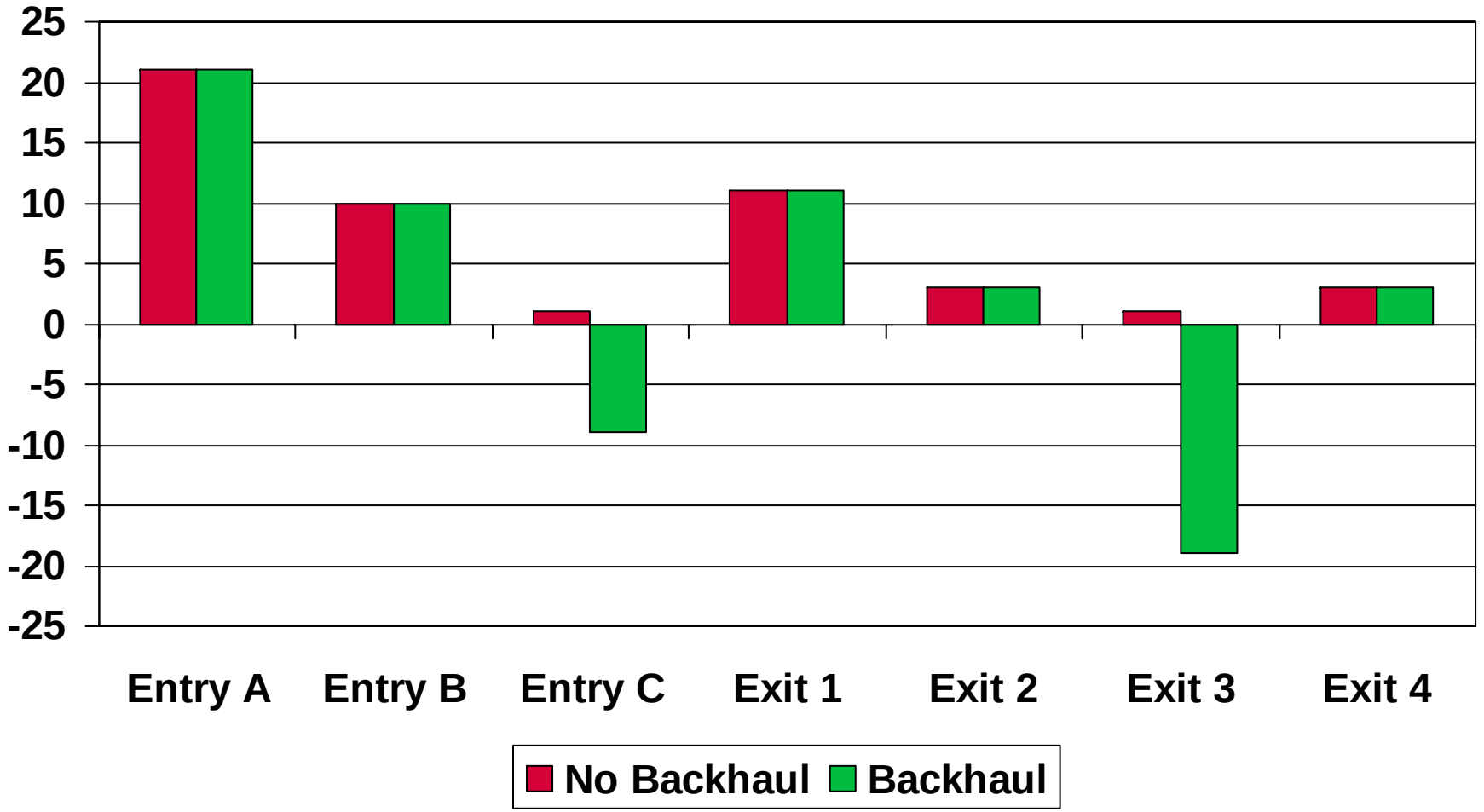
Impact of Backhaul on Marginal costs Reference Node Solution



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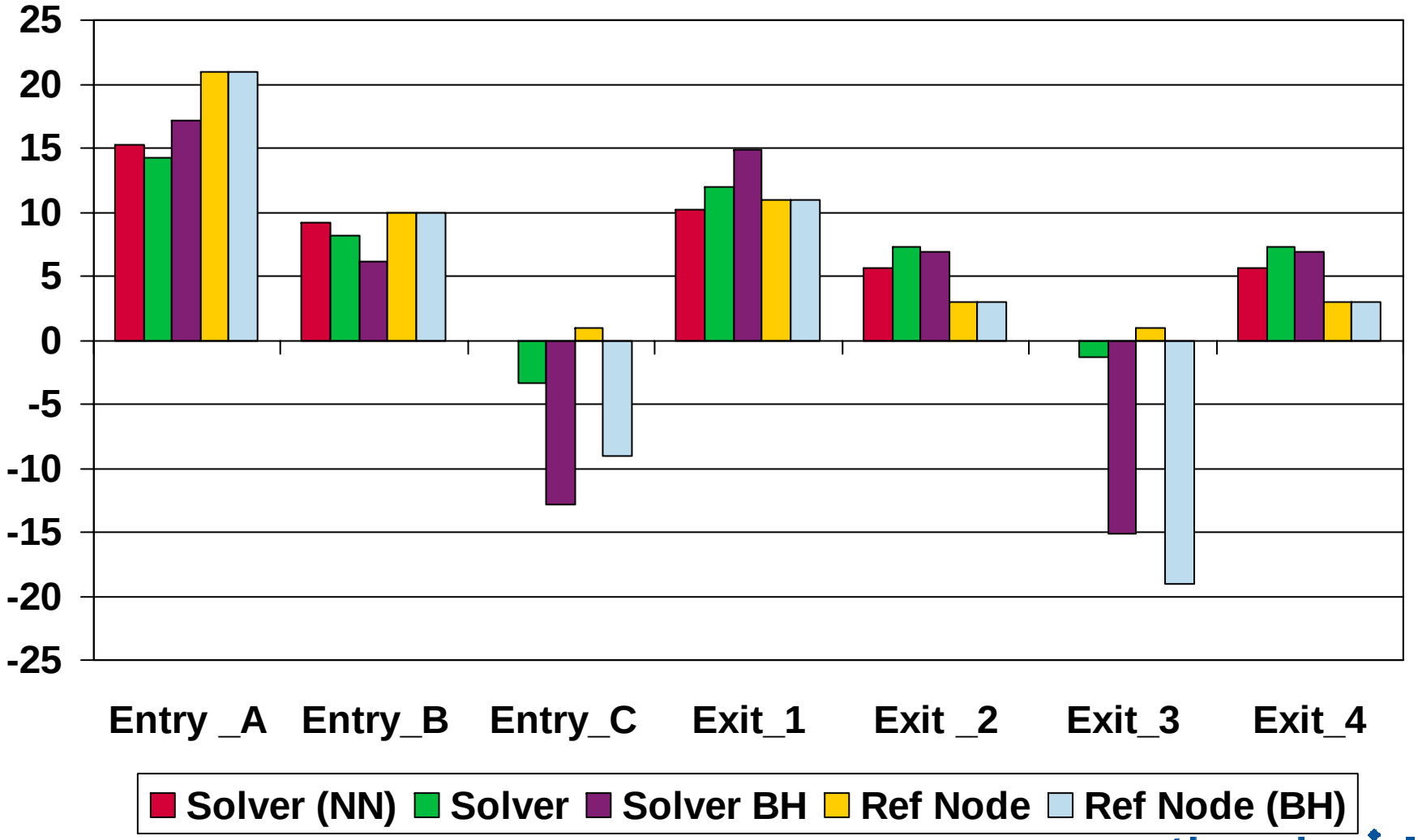
Example Unscaled LRMCs



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Entry Exit Cost Disaggregation

- Solver
  - Removing negative constraint allows cost differences to be maintained more closely
  - Consideration of backhaul allows for an exact fit
  - Multiple solution can be found when considering negative prices and hence a 50: 50 split must be imposed
- Reference Node
  - Without imposing a 50: 50 Entry: Exit split, selection of the reference node affects prices and defines the entry exit split

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Key Questions for the Review

1. S&D Scenarios: 1 Year or multiple Year?
2. How should incremental costs be modelled?
3. How should spare network capacity be treated?
4. Should decrement (back flow) costs be considered?
5. How should entry and exit costs be disaggregated?
6. **How should negative costs be treated?**
7. Should … 0:50 entry:e…
8. Are zo…
9. Should … ecover allowe…
10. Should … ped?

- *A) Removed …*
  - *by solver?*
  - *as last step in Methodology?*
- *B) Retained;*
  - *With obligation to flow?*
  - *Commoditised?*

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Negative Costs

- Negative Entry
  - Entry flows would have to be at capacity level for the same period and duration as exit flows to avoid investment and hence for negative Entry prices to have meaning
  - These arrangements are effectively in place via the constrained LNG arrangements
- Negative Exit
  - Beach terminals expected to be close to peak for up to 100 days in a 1-in-50 winter
  - Exit flows would have to be at capacity level for the same duration to avoid investment and hence for negative Exit prices to have meaning

Allowing Negative prices within the solver allows for Entry and Exit Costs that are more reflective of the route cost for all routes.

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5. How should entry and exit costs be disaggregated?
6. How should negative costs be treated?
7. **Should capacity charges be adjusted to 50:50 entry:exi**
8. Are zone
9. Should c over allowed
10. Should y ed?

- *A) 50:50*
  - *Scaling (multiplicative)?*
  - *Adjustment (additive)?*
  - *by solver?*

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50:50 Entry: Exit Split

- Scaling
  - Erodes cost differentials
  - Consistent with no backhaul modelling (no negative prices)?
- Adjustment
  - Maintains cost differences
  - Consistent with modelling of backhaul (and negative prices)

Consideration of a single pipe or a more complex system with backhaul benefits indicates that a split between entry and exit costs should be imposed.

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Tariff Option Variants

Issue	Variant A	Variant B	Variant C	Variant D	Variant E
Backhaul	No Backhaul	No Backhaul	Backhaul	No Backhaul	Backhaul
Entry Exit	Solver with non-negative constraint	Solver	Solver 50: 50 Constraint	Reference Node	Reference Node
50: 50 & Revenue recovery	Scale or Adjust	Scale or Adjust	Scale or Adjust	Scale or Adjust	Scale or Adjust
Negative Costs	Removed by Solver	Removed as final step	Removed as final step	Removed as final step	Removed as final step

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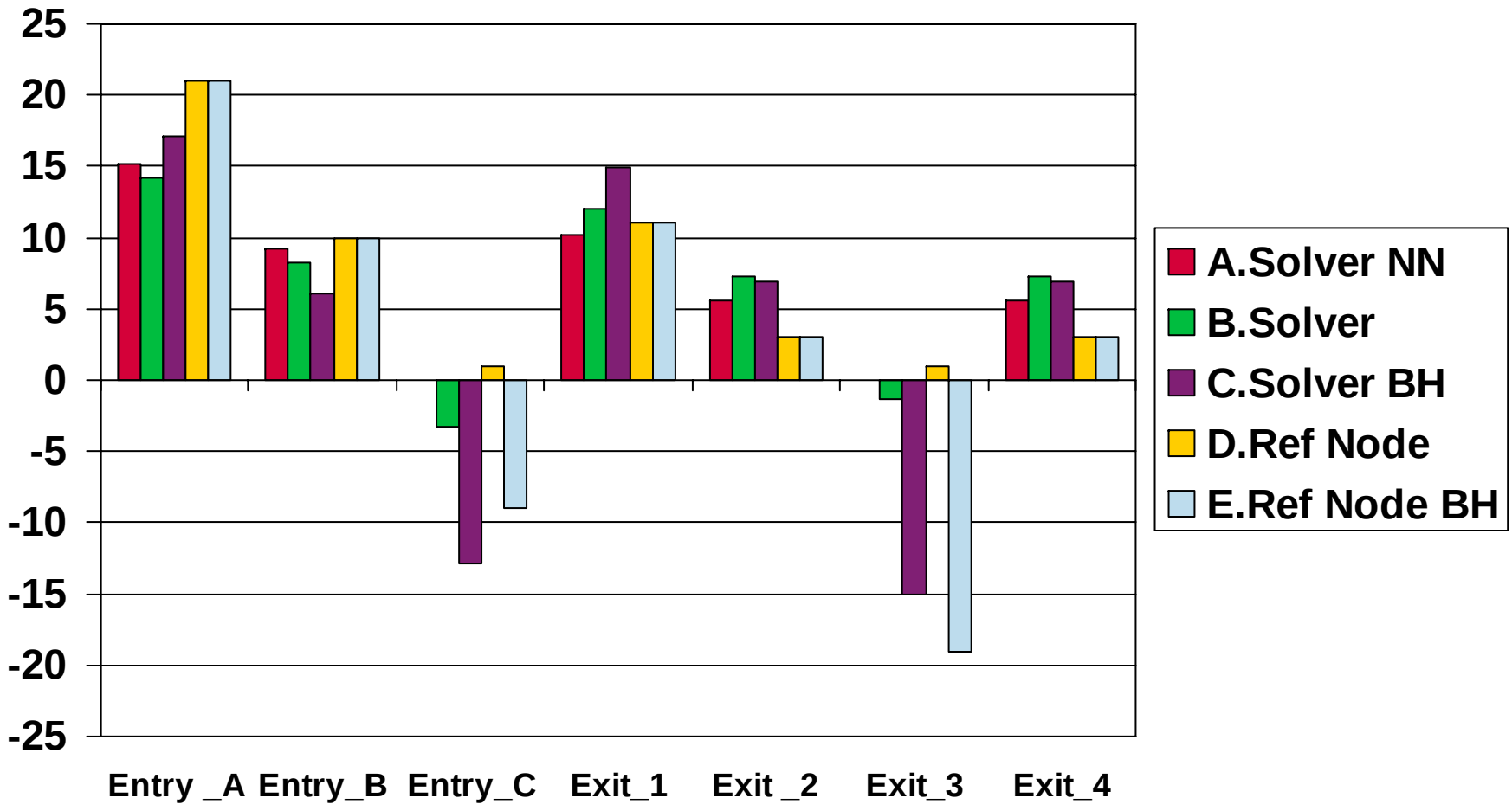
Unscaled LRMCs



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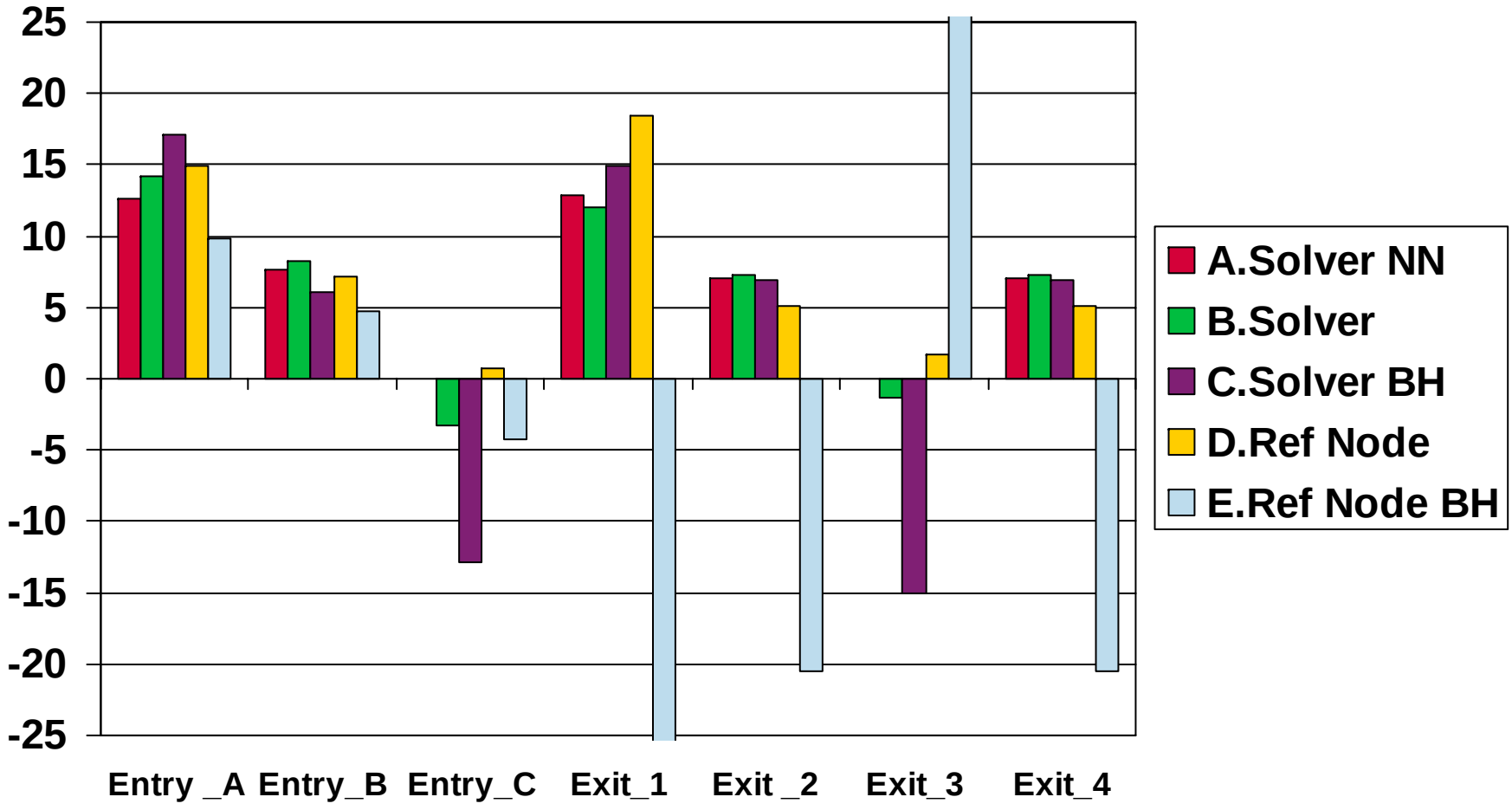
LRMCs Scaled to 50: 50 Entry: Exit



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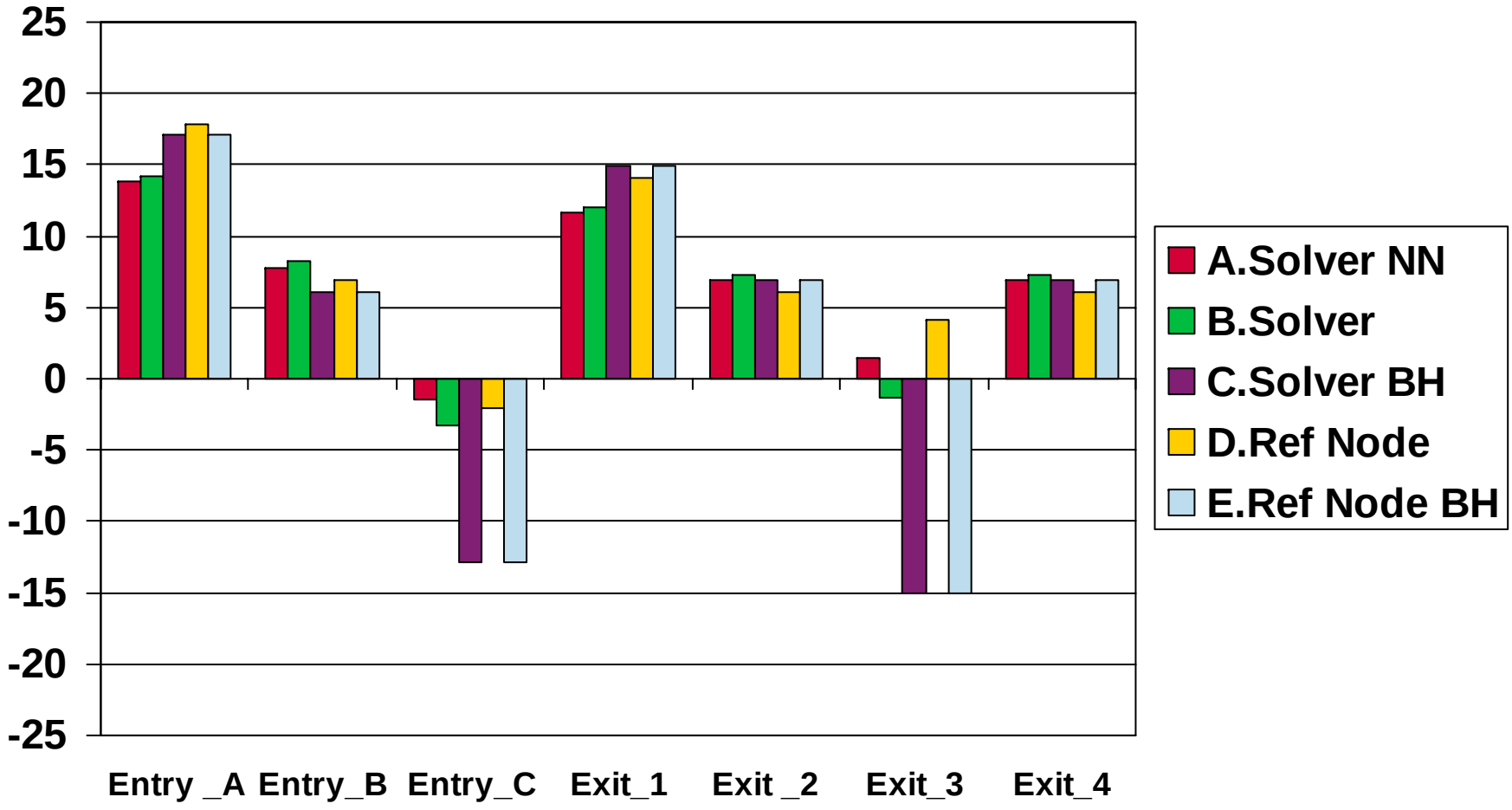
LRMCs Adjusted to 50: 50 Entry: Exit



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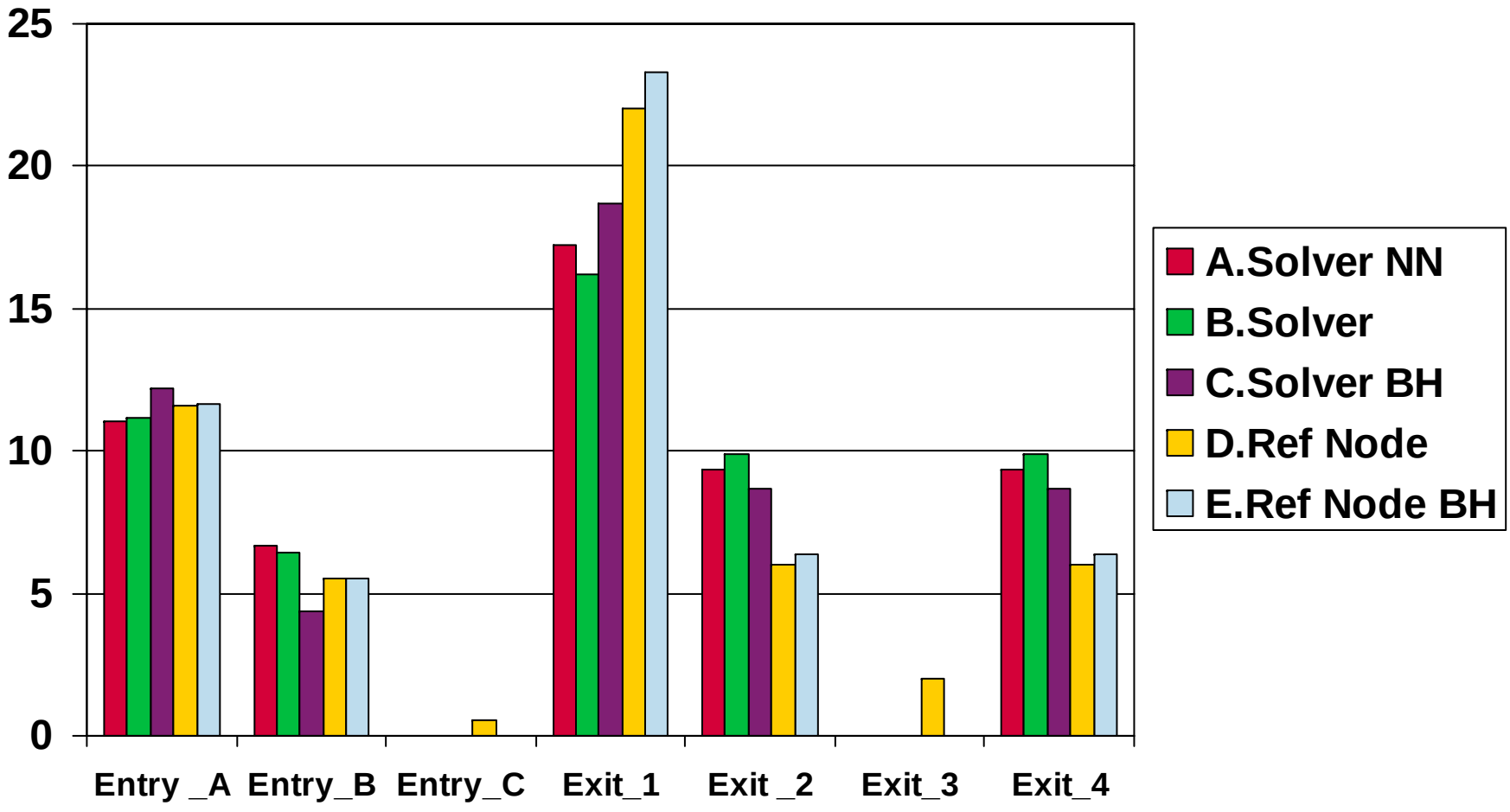
LRMCs Scaled to 50: 50 Revenue Recovery Negative prices removed



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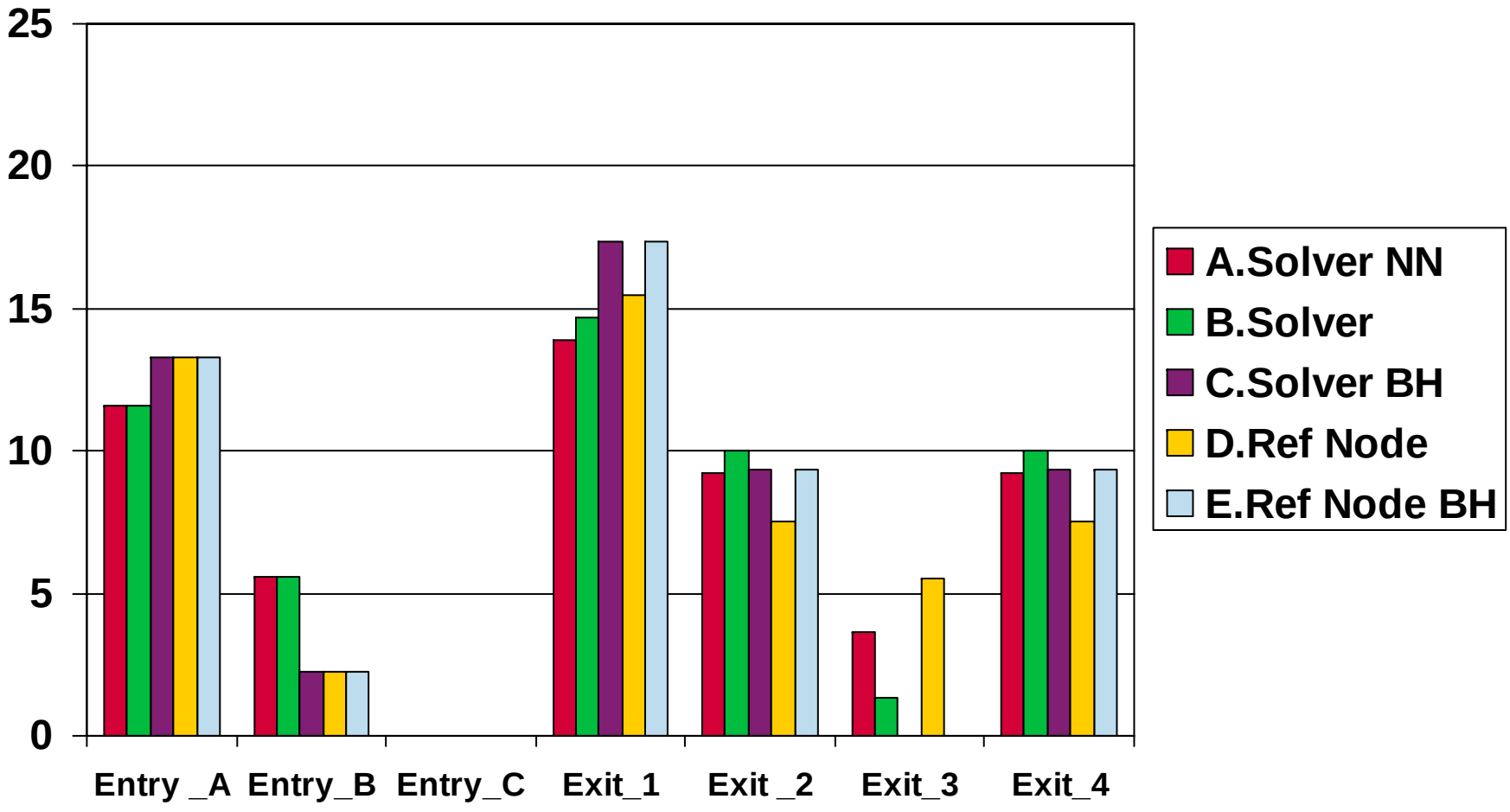
LRMCs Adjusted to 50: 50 Revenue Recovery Negative prices removed



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Reducing the Tariff Model Options

- Price adjustment, with negative prices removed as part of the final step, increases stability compared to scaling

- When Backhaul costs are included, the reference node approach produces identical answers to the solver

Issue	Variant A	Variant B	Variant C	Variant D
Backhaul	No Backhaul	No Backhaul	Backhaul	No Backhaul
Entry Exit	Solver with non-negative constraint	Solver 50: 50 Constraint	Solver 50: 50 Constraint (or Ref Node)	Reference Node
50: 50 & Revenue recovery	Scale	Adjust	Adjust	Adjust
Negative Costs	Remove by Solver	Remove as final step	Remove as final step	Remove as final step

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Options Assessment Variant A

No Backhaul, Solver (Non-negative), Scale to 50:50/ Revenue

Objective	Capacity prices should	Pros	Cons
GL1: **"Reflect Costs"**	reflect the costs associated with providing that capacity	Scaling maintains cost ratios	Solver Negative Constraint and scaling erode Cost differentials
GL2: **"Facilitate Competition"** GL5: **"Promote Competition"** GL3: **"Business Development"**	GM3: be easy to understand and implement.		Solver Negative Constraint reduces Transparency
	GM2: generate stable charges;	Scaling consistent with no backhaul benefit?	Solver Negative Constraint and scaling reduce stability
GL4 :"**Promote Efficiency"**	GM1: promote efficient use of the transportation system;		

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Options Assessment Variant B

No Backhaul, Solver , Adjust to 50:50 & Recover Revenue

Objective	Capacity prices should	Pros	Cons
GL1: **"Reflect Costs"**	reflect the costs associated with providing that capacity	50:50 Solver and adjusting charges helps to protect cost differentials	Cost ratios not maintained
GL2: **"Facilitate Competition"** GL5: **"Promote Competition"** GL3: **"Business Development"**	GM3: be easy to understand and implement.		
	GM2: generate stable charges;	50:50 Solver and adjusting charges increases stability	
GL4 :"Promote Efficiency"	GM1: promote efficient use of the transportation system;		

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Options Assessment Variant C

Backhaul, 50 50 Solver , Adjust to 50:50 / Recover Revenue

Objective	Capacity prices should	Pros	Cons
GL1: **"Reflect Costs"**	reflect the costs associated with providing that capacity	50:50 Solver and adjusting charges protects cost differentials	Cost ratios not maintained
GL2: **"Facilitate Competition"** GL5: **"Promote Competition"** GL3: **"Business Development"**	GM3: be easy to understand and implement.		
	GM2: generate stable charges;	50:50 Solver and adjusting charges increases stability	
GL4 :**"Promote Efficiency"**	GM1: promote efficient use of the transportation system;		

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Options Assessment Variant D

No Backhaul, Reference Node, Adjust to Revenue

Objective	Capacity prices should	Pros	Cons
GL1: **"Reflect Costs"**	reflect the costs associated with providing that capacity		Without backhaul, selection of the reference node affects cost reflectivity
GL2: **"Facilitate Competition"** GL5: **"Promote Competition"** GL3: **"Business Development"**	GM3: be easy to understand and implement.	Reference node may increase Transparency?	
	GM2: generate stable charges;		
GL4 :**"Promote Efficiency"**	GM1: promote efficient use of the transportation system;		

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Key Questions for the Review

1. S&D Scenarios: 1 Year or multiple Year?
2. How should incremental costs be modelled?
3. How should spare network capacity be treated?
4. Should decrement (back flow) costs be considered?
5. How sh… …gregated?
6. How sh…
7. Should… …0:50 entry:e…
   - *A) For DN purposes?*
   - *B) To mirror exit regime?*
   - *C) To enhance stability?*
8. **Are zones required?**
9. Should capacity charges be adjusted to recover allowed revenue and if so how?
10. Should year on year price changes be capped?

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Are Zones Required?

- Zones might be required by DNs but DNs could generate their own zonal charges.
- Zoning could erode cost differentials and hence should be avoided when possible.
- Zones increase stability

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Key Questions for the Review

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3. How should spare network capacity be treated?
4. Should decrement (back flow) costs be considered?
5. How shoul…ated?
6. How shoul…
7. Should cap… entry:exit a…
8. Are zones …
9. **Should capacity charges be adjusted to recover allowed revenue and if so how?**
10. Should year on year price changes be capped?

- *A) No, recover via commodity*
- *B) Yes*
  - *i) Scaling (multiplicative)?*
  - *Ii) Adjustment (additive)?*

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Should capacity charges be adjusted to recover allowed revenue and if so how?

- Recover Revenue via Capacity Charges
  - Any remaining allowed revenue Might reflect spare capacity and hence could be recovered by an adjustment of capacity charges
  - If LRMCs under recover allowed revenue, recovery via adjusting capacity charges would help to maintain cost differentials before any remaining negative prices were removed
  - Consistent with administered charges or a user commitment model
- Recover Revenue via Commodity Charges
  - Any remaining allowed revenue might reflect non-locational costs and hence could be recovered via a commodity charge.
  - Would make the capacity: commodity split less stable and predictable
  - Consistent with auction over or under recovery

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6. How should negative costs be treated?
7. Should capacity charges be adjusted to 50:50 entry:exit and if so how?
8. Are zone
9. Should c ver allowed
10. **Should year on year price changes be capped?**

- *A) To reflect uncertainty (forecast change)?*
- *B) To enhance stability?*

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Should year on year price changes be capped?

- Remove Capping
  - Capping erodes cost reflectivity
  - Price changes at an Entry/Exit point can be expected to change as a result of other S&D changes
- Retain Capping
  - Capping creates price stability
  - If prices are based on a single year, consider forecasting prices a year ahead and capping based on forecast

Should not be required if charges can become more stable and predictable

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Final Tariff Steps

	Issue	Prevailing Exit	Way Forward
8	**Are zones required?**	Yes	No (Unless required for the capacity product)
9	**Are capacity charges adjusted to recover allowed revenue and if so how?**	Yes	Adjust capacity charges where possible (Commodity may be required for auction over or under recovery)
10	**Should year on year price changes be capped?**	Yes (+/- 30%)	No capping

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Assessment of Final Tariff Setting Steps

Adjust to allowed revenue, No Zoning or Capping

Objective	Capacity prices should	Pros	Cons
GL1: **"Reflect Costs"**	reflect the costs associated with providing that capacity	Removing Capping and zoning maintains cost reflectivity	
GL2: **"Facilitate Competition"** GL5: **"Promote Competition"** GL3: **"Business Development"**	GM3: be easy to understand and implement.	Removing Capping and zoning simplifies the process	
	GM2: generate stable charges;		Removing capping and zoning might reduce stability
GL4 **:"Promote Efficiency"**	GM1: promote efficient use of the transportation system;	Removing zoning promotes efficient use of the system	

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