PURDUE UNIVERSITY | Mitchell E. Daniels, Jr. School of Business

Feed-in tariff Optimization

off-shore wind industry

TEAM ONE

Chu-Yun Hsiao, Chun-Yi Chiang, Hsiang-Yu Wang, Yi-Chun Huang, Vincent Lee

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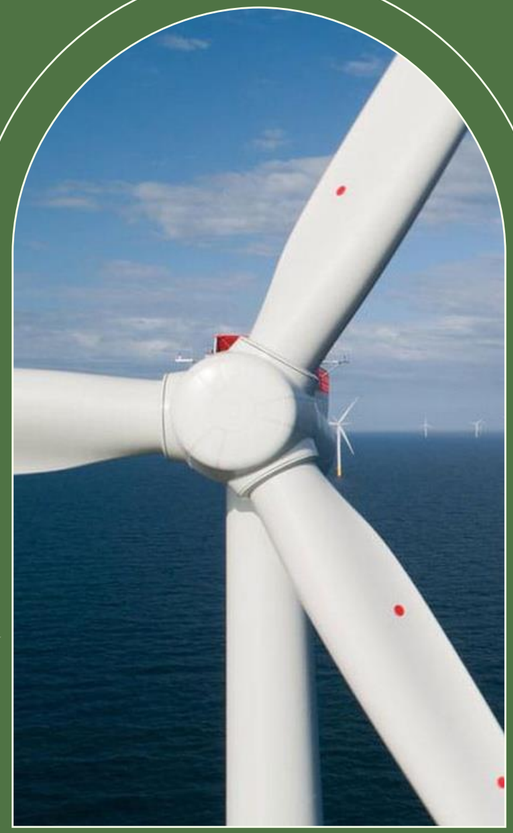
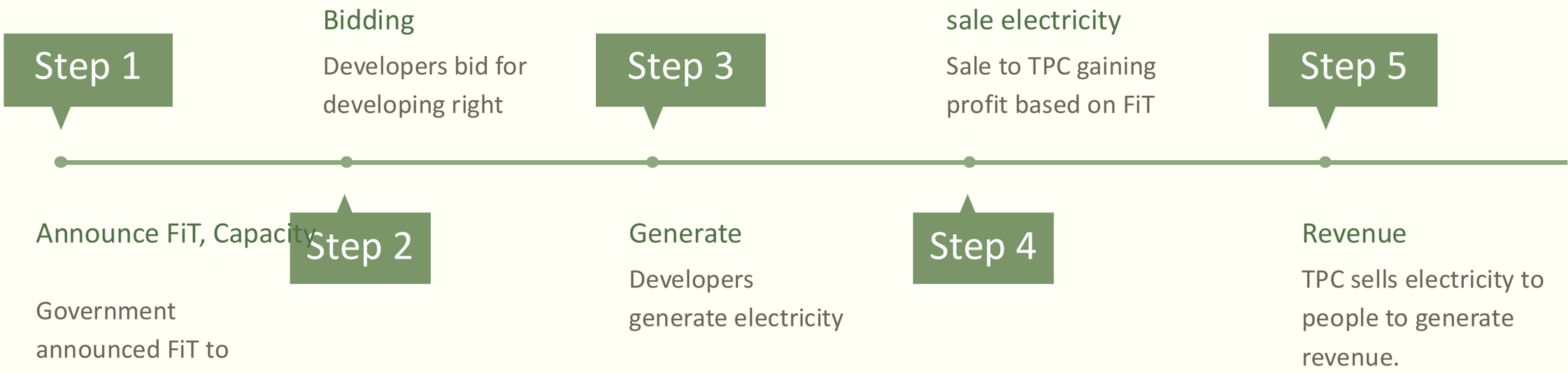


BACKGROUND

This project focuses on offshore wind industry in Taiwan.

The government wants to attract developers and therefore provide a Feed-in Tariff (FiT), which is a price announced every year higher than the normal purchase price.

Taiwan Electricity Industry



PROBLEM & GOAL

Problem

the Taiwan Power Company will typically lose money from buying clean energy from developers

Goal

the goal is to allure foreign developers into the Taiwan market with the minimum loss for TPC by optimizing the FiT.

Optimization Process

1

Data collection

2

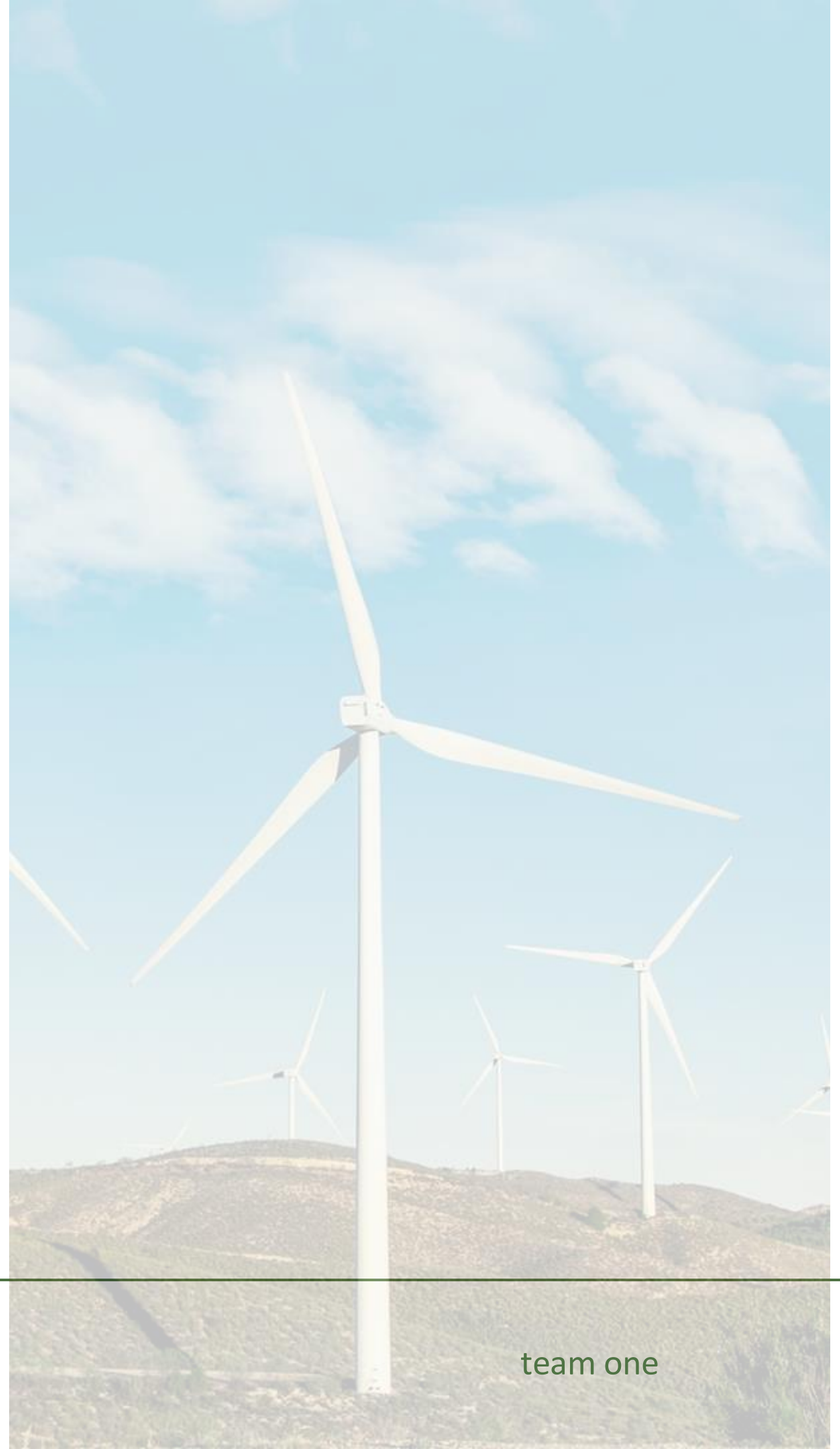
Regression

Incremental of Developers' number

3

Solver

minimize TPC loss by optimizing FiT



Data

- 01 Year
- 02 Developers
- 03 Average Electricity Fee
- 04 FiT (Feed-in tariff)
- 05 development expenditure
- 06 Announced capacity
- 07 Annual Yield = auction MW * 24 * 365 * 0.45（capacity factor)

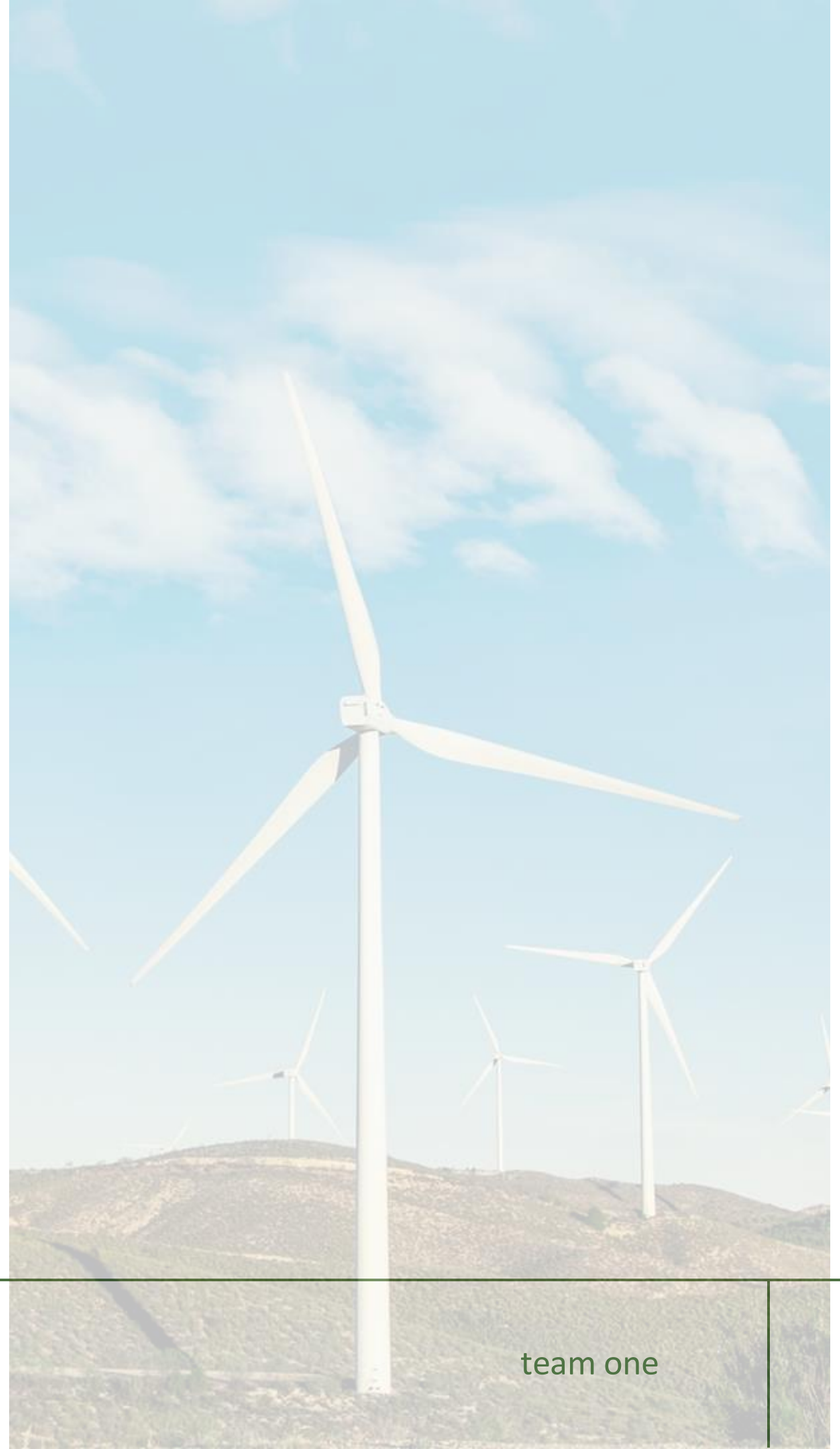
MODEL

Regression → Solver → Result

Regression

Incremental Developer

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.988517942
R Square	0.977167722
Adjusted R Square	0.863006335
Standard Error	0.36120653
Observations	7



Regression

Incremental Developer

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.308871252	5.903273829	0.391117085	0.762652033
Previous Year FiT	-1.891036233	1.111065861	-1.702001924	0.338178715
Previous 2 Year FiT	0.807784184	0.40308622	2.003998509	0.294658942
FiT	1.004837164	0.756596296	1.328102145	0.410867446
Devex (NTD/kW)	-3.20484E-05	3.28386E-05	-0.975936829	0.507752441
Announced Auction kW (cumulated)	4.60922E-07	2.72824E-07	1.689446444	0.3402412

Regression

Incremental Developer #

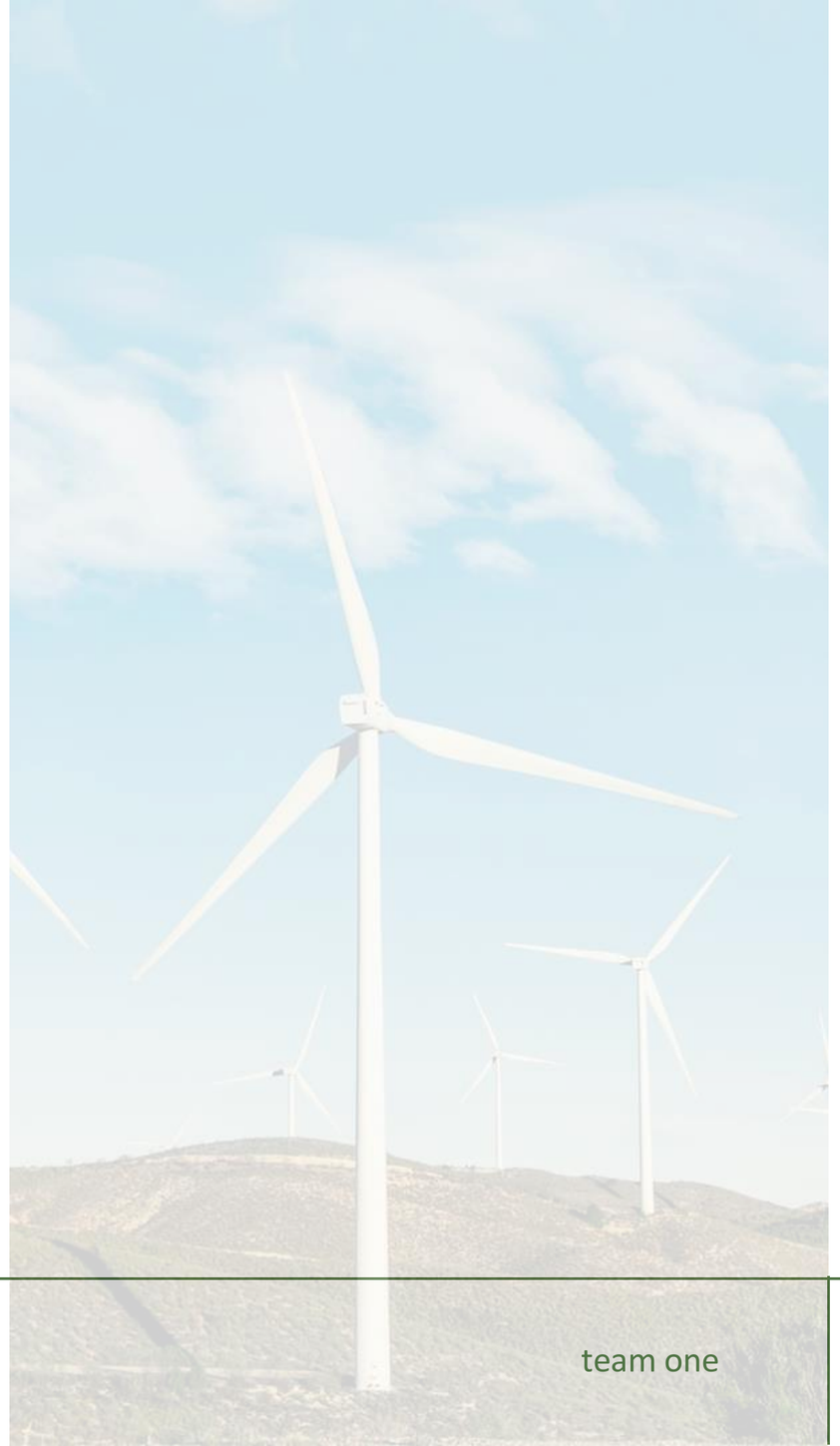
INCREMENTAL DEVELOPER #

= FiT + FiT last year + FiT 2 years before

\+ - +

+ DEVEX + Remaining Develop Capacity

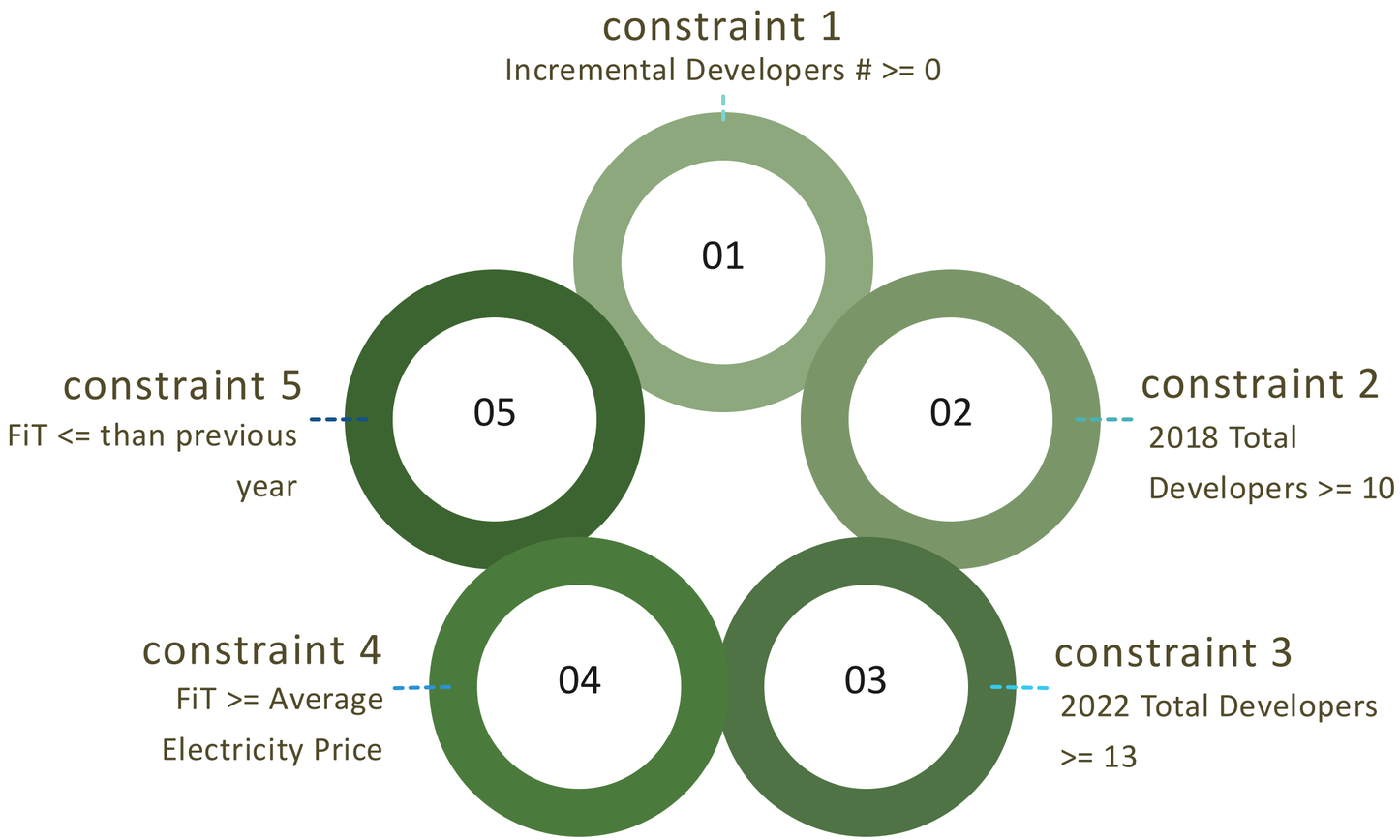
\- +



Solver

Minimize TPC loss

TPC profit/loss
= (Optimize FiT - Average Electricity Price)
* Annual Yield



Year	Incremental Developers	Previous Year FiT	Previous 2 Year FiT	FiT	Devex (NTD/kW)	Announced Auction kW (cumulated)	Average Electriciy Fee	Annual Yield = auction MW * 24 * 365 * 0.45 (capacity factor)	Optimized TPC profit/ Loss
2014				10.97063557	158,500				
2015				10.97063558	169200		2.8852		
2016	0.229082413	10.97063558	10.97063557	8.402682731	180100	15475000	2.8852		
2017	1.18558E-07	8.402682731	10.97063558	3.837064341	181600	14500000	2.8852		
2018	6.770917599	3.837064341	8.402682731	3.837064343	175000	14500000	2.5488	15741000000	-20278569021
2019	1.807316198	3.837064343	3.837064341	3.83706434	135700	9000000	2.5488		
2020	0.884322591	3.83706434	3.837064343	3.83706434	164500	9000000	2.6253		
2021	-3.99858E-09	3.83706434	3.83706434	2.6253	154100	9000000	2.6253		
2022	1.091401305	2.6253	3.83706434	2.6253	148400	6000000	2.6253	8586000000	0
									-20278569021

Model result

	Original		Optimized	
Year	Developers in Market	FiT(NTD/KW)	Developers in Market	FiT(NTD/KW)
2014	-	5.6076	0	10.97063557
2015	3	7.1085	3	10.97063558
2016	5	7.1085	3.229082413	8.402682731
2017	8	7.4034	3.229082531	3.837064341
2018	10	7.1177	10.00000013	3.837064343
2019	11	6.2795	11.80731633	3.83706434
2020	12	5.8015	12.69163892	3.83706434
2021	13	5.3064	12.69163892	2.6253
2022	13	5.1356	13.78304022	2.6253

Model result

Original Loss	Optimized Loss
-88.18 b	-20.28 b

CONCLUSION

Future scope

- With High FiT from 2014-2016 is enough incentives for developers enter new markets
- It is alluring developer into the market without fulfilling promised FiT, harming government reputation.