

DO CARBON OFFSETS OFFSET CARBON?



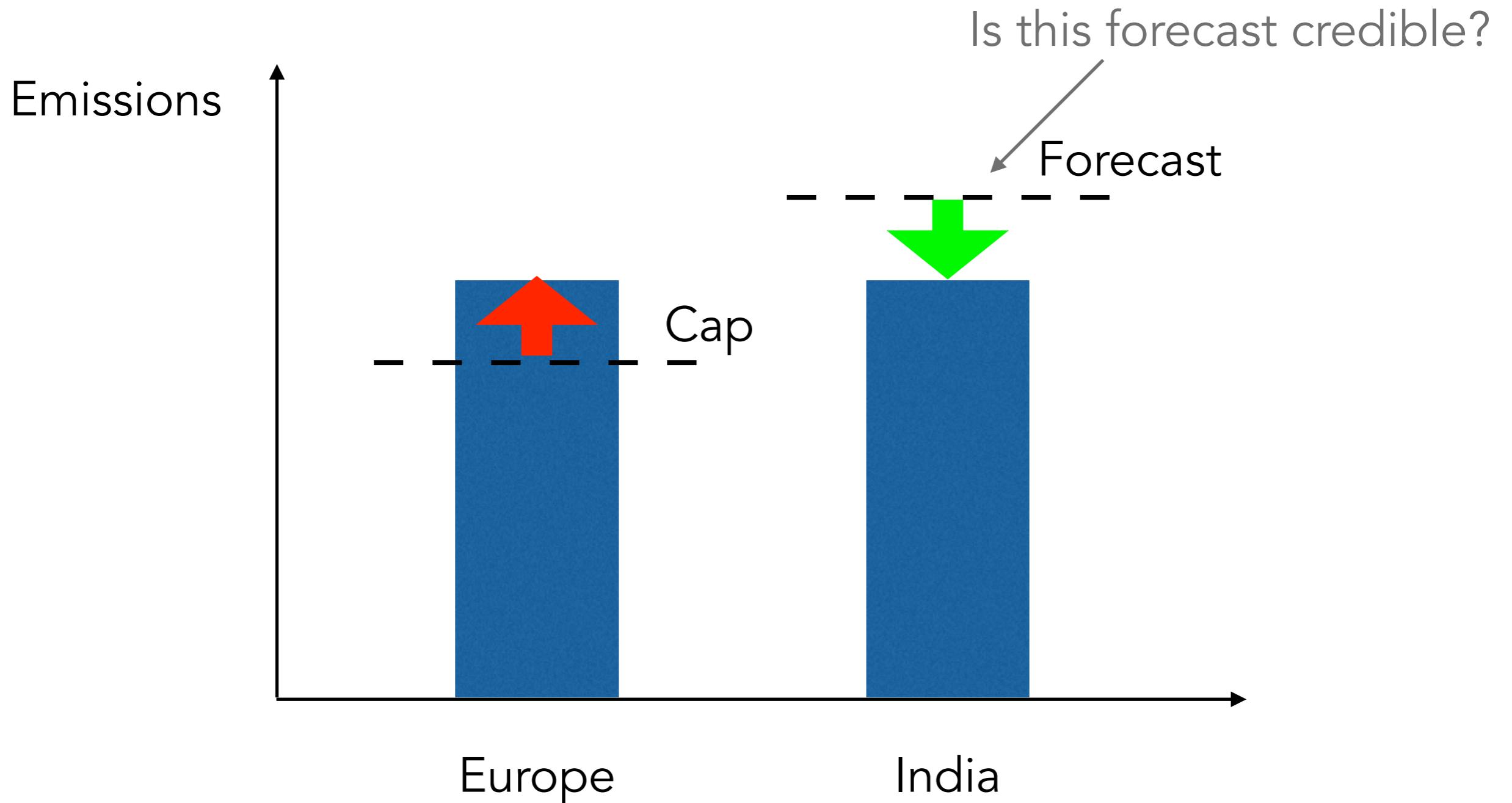
Raphael Calel, Georgetown University
Jonathan Colmer, University of Virginia

Antoine Dechezleprêtre, OECD
Matthieu Glachant, MINES ParisTech

WHAT'S THE PROBLEM?

- We need renewable energy to replace fossil fuels.
- Market won't finance enough renewable energy, especially in developing countries.

How Do Offsets Work?



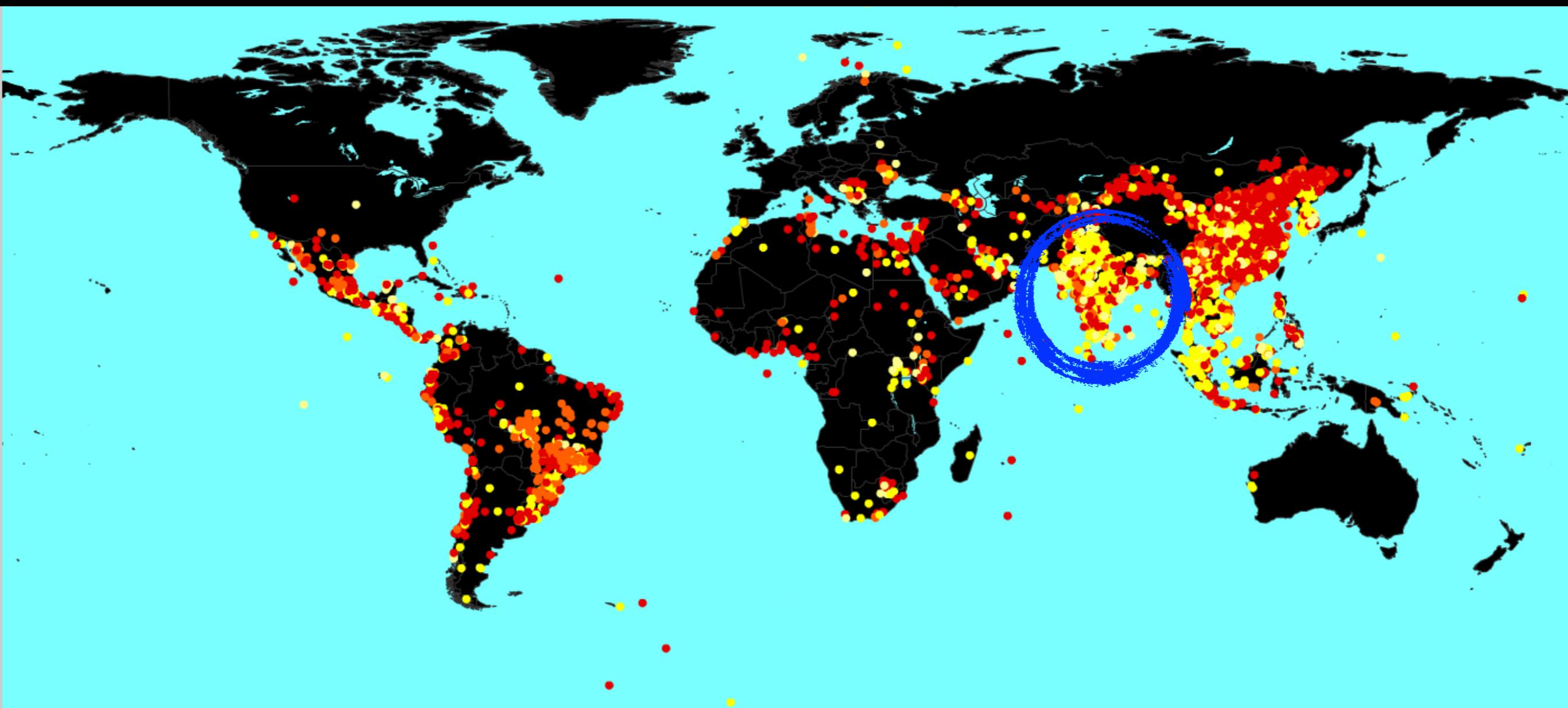
WHY OFFSET?

- Lower cost of climate mitigation
- Promote sustainable development

United Nations Framework Convention on Climate Change
Third Session, Conference of the Parties
Kyoto, 1 - 10 December 1997

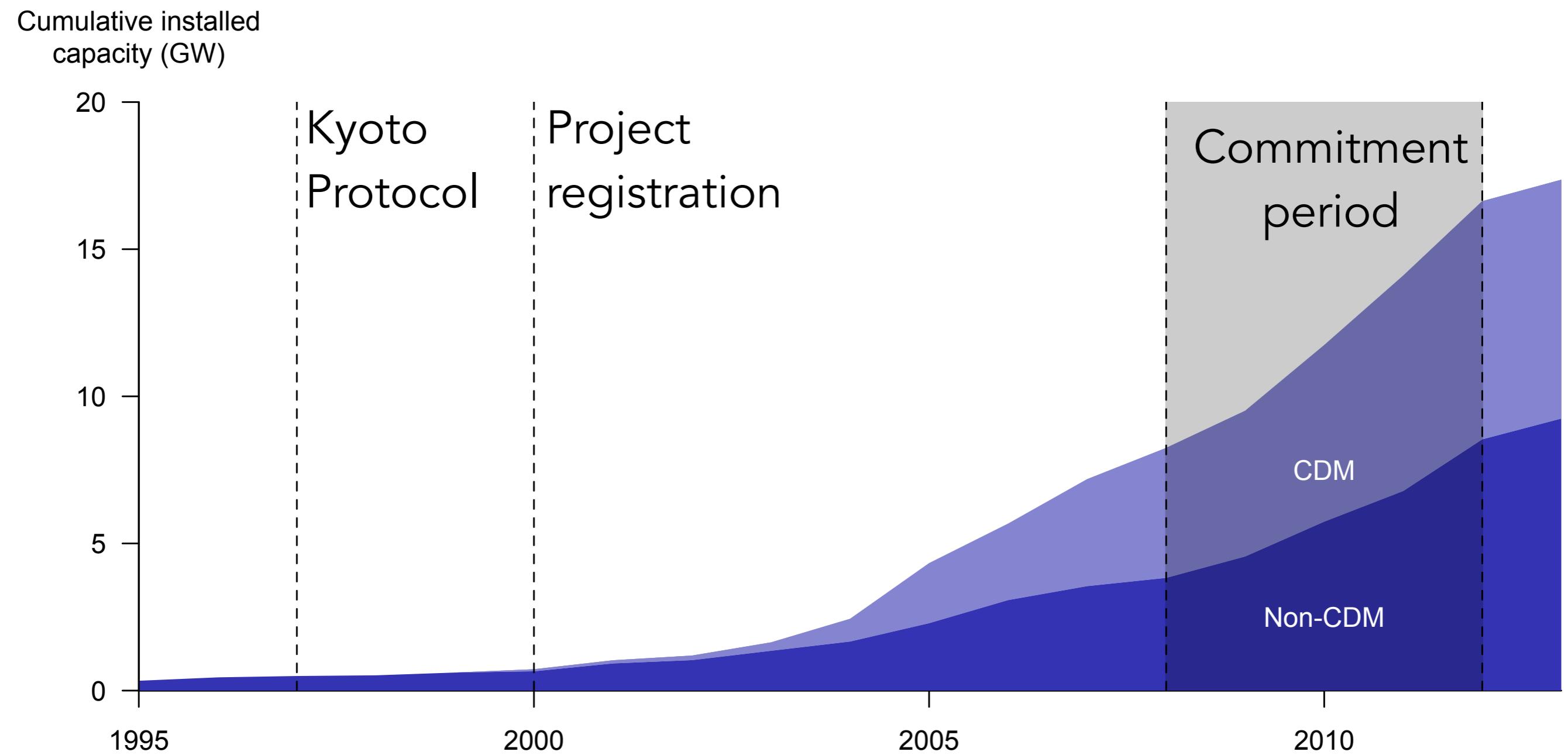


CLEAN DEVELOPMENT MECHANISM (CDM)



- = CDM project, Large scale, one location
- = CDM project, Large scale, several locations
- = CDM project, Small scale, one location
- = CDM project, Small scale, several locations

OFFSETS IN INDIAN WIND POWER



MARGINAL VS. INFRA-MARGINAL

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We can then, in principle, rank projects from most to least valuable, for a given subsidy rate $s = 0$.

$$V(0, x_1) \geq V(0, x_2) \geq R \geq V(0, x_3) \geq V(0, x_4) \geq V(0, x_5)$$

R is the reservation rate.

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Marginal

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Infra-marginal

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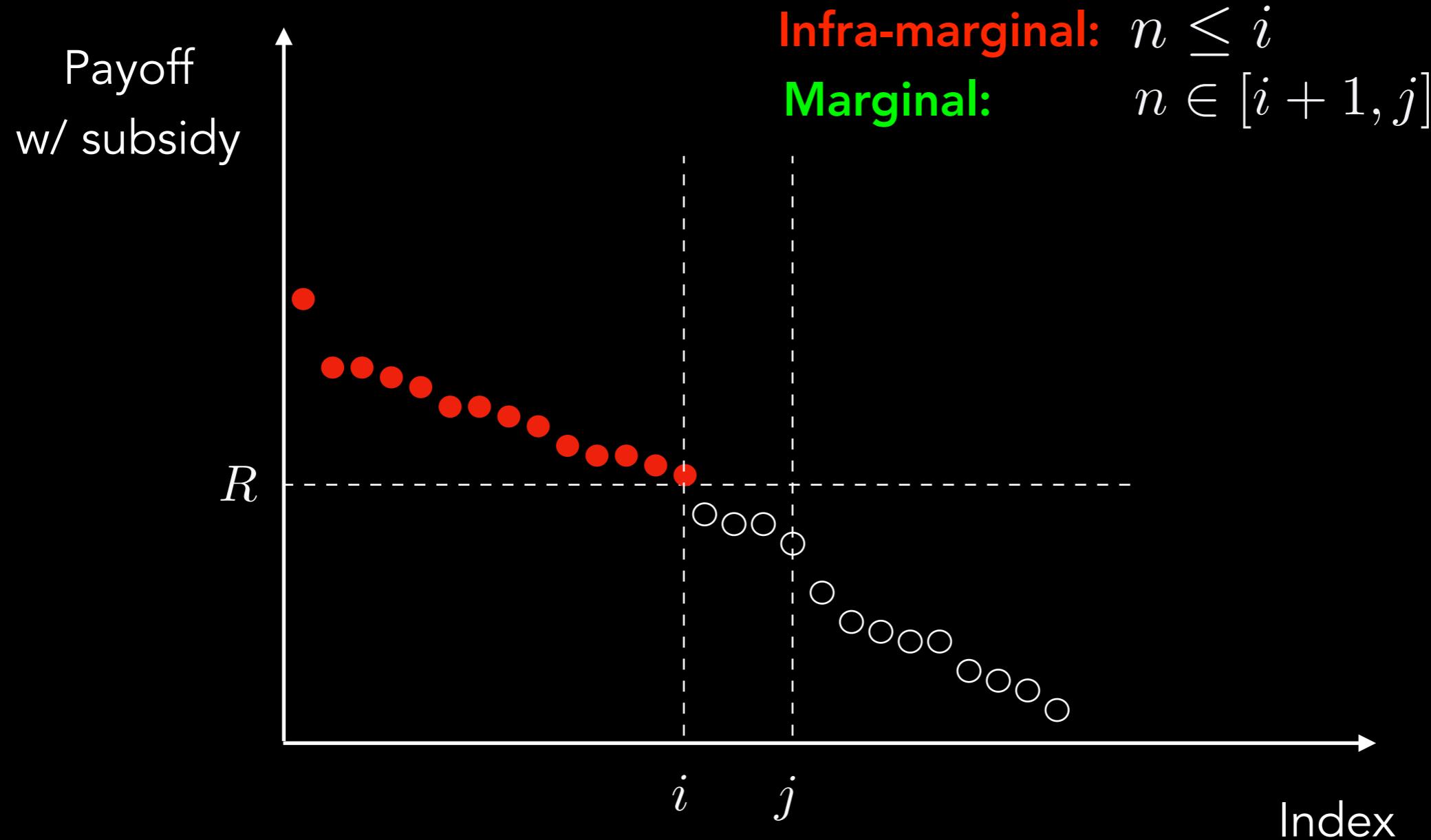
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MARGINAL VS. INFRA-MARGINAL



MARGINAL VS. INFRA-MARGINAL

If V is monotonic in some subset of characteristics, $\tilde{x} \subset x$, then we can infer that project n is infra-marginal if a project m exists such that:

(1) m did not receive a subsidy $\implies m \leq i$

(2) \tilde{x}_m is inferior to \tilde{x}_n , and $\implies n \leq m$

(3) $x_m = x_n$ for all characteristics not in \tilde{x} .

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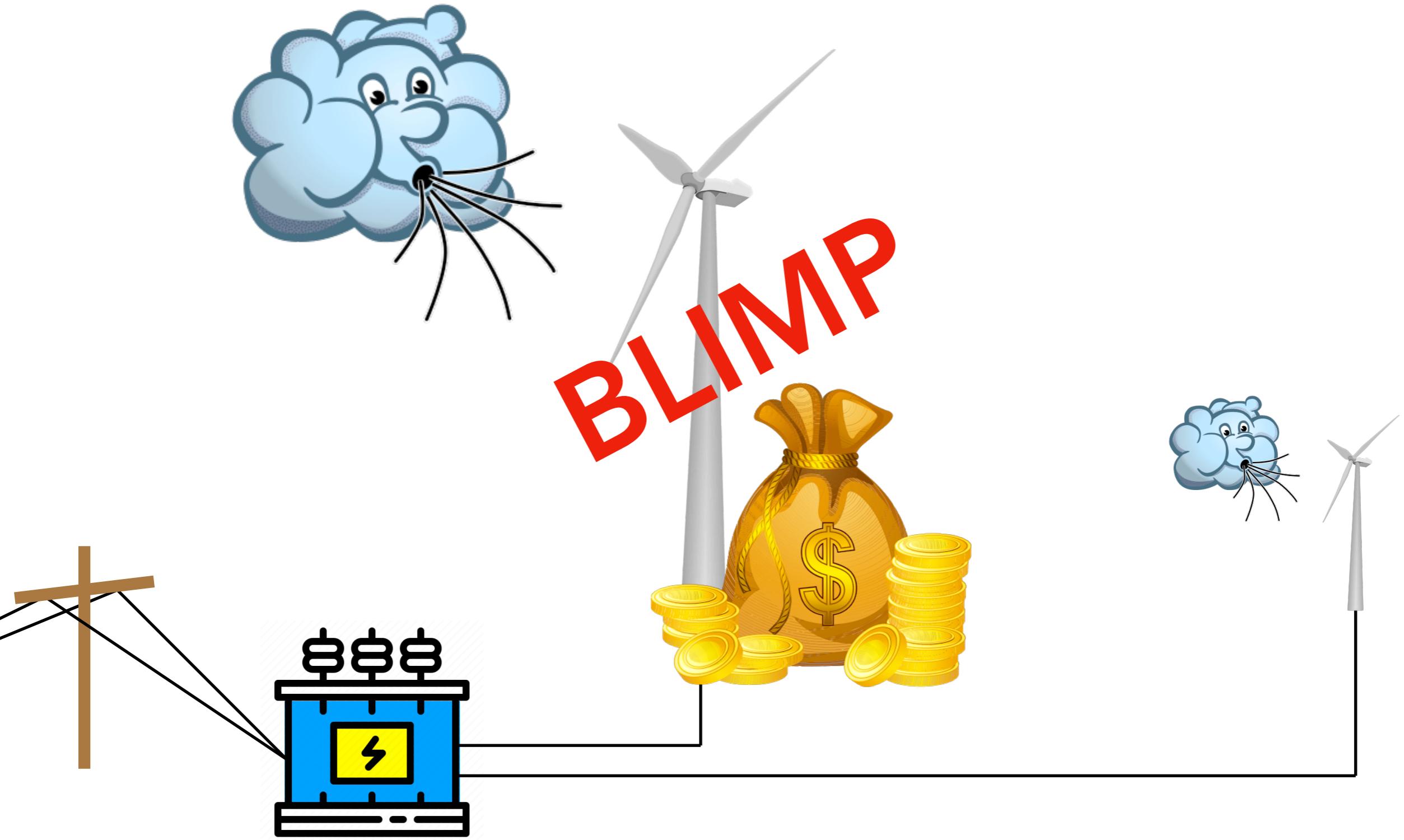
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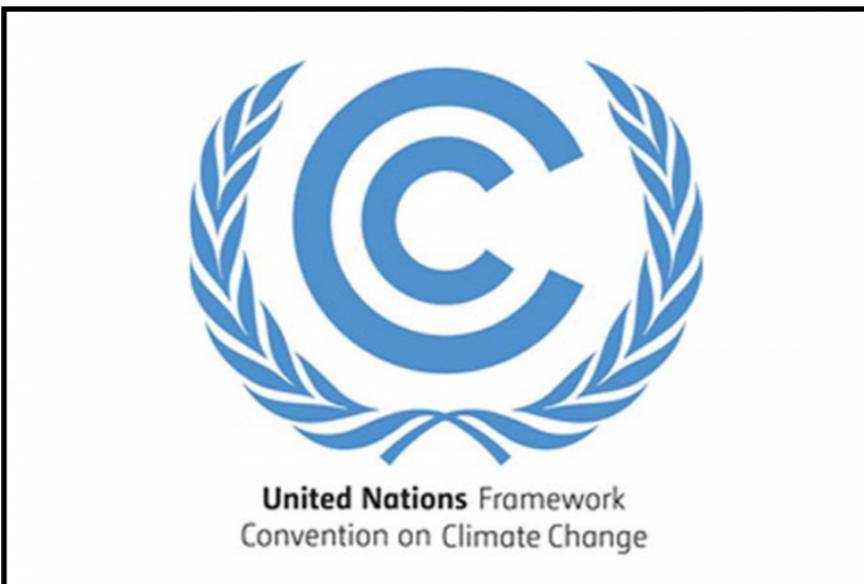
$\implies n \leq i$

n is a **blatantly infra-marginal project (BLIMP)** by virtue of the existence of an inferior unsubsidized project m .

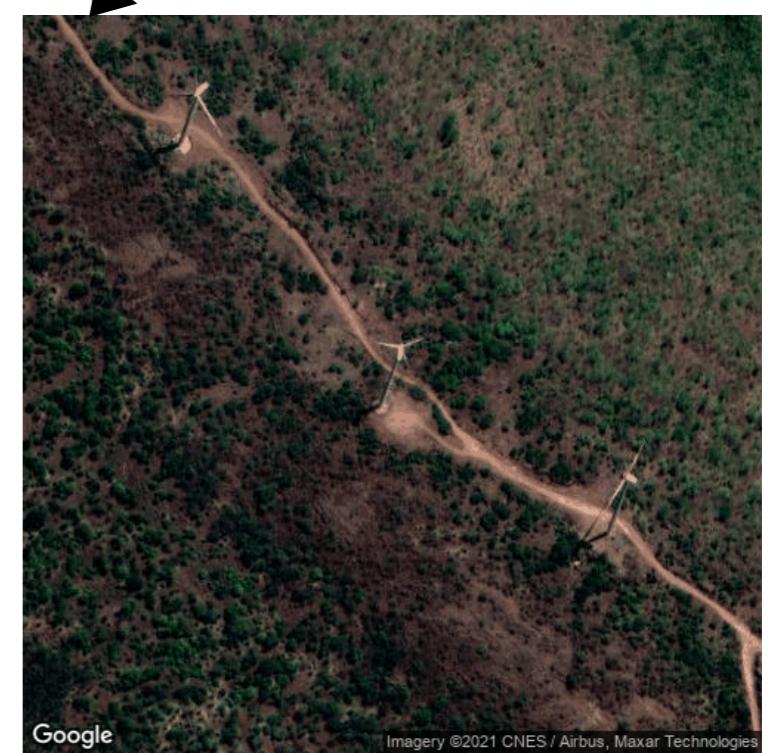
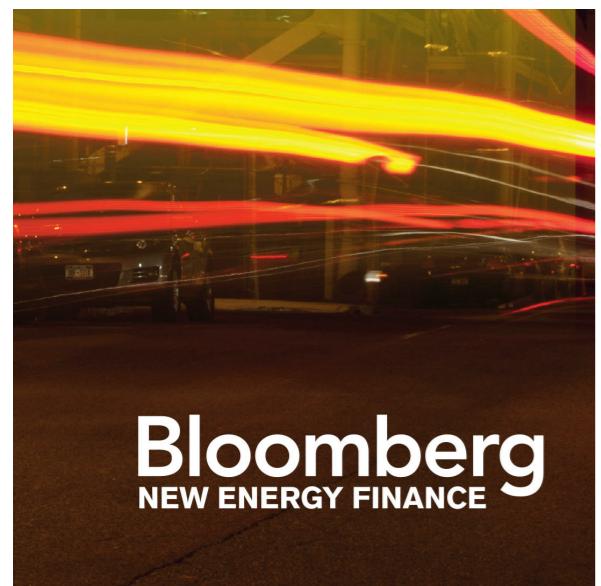
WIND FARM ECONOMICS



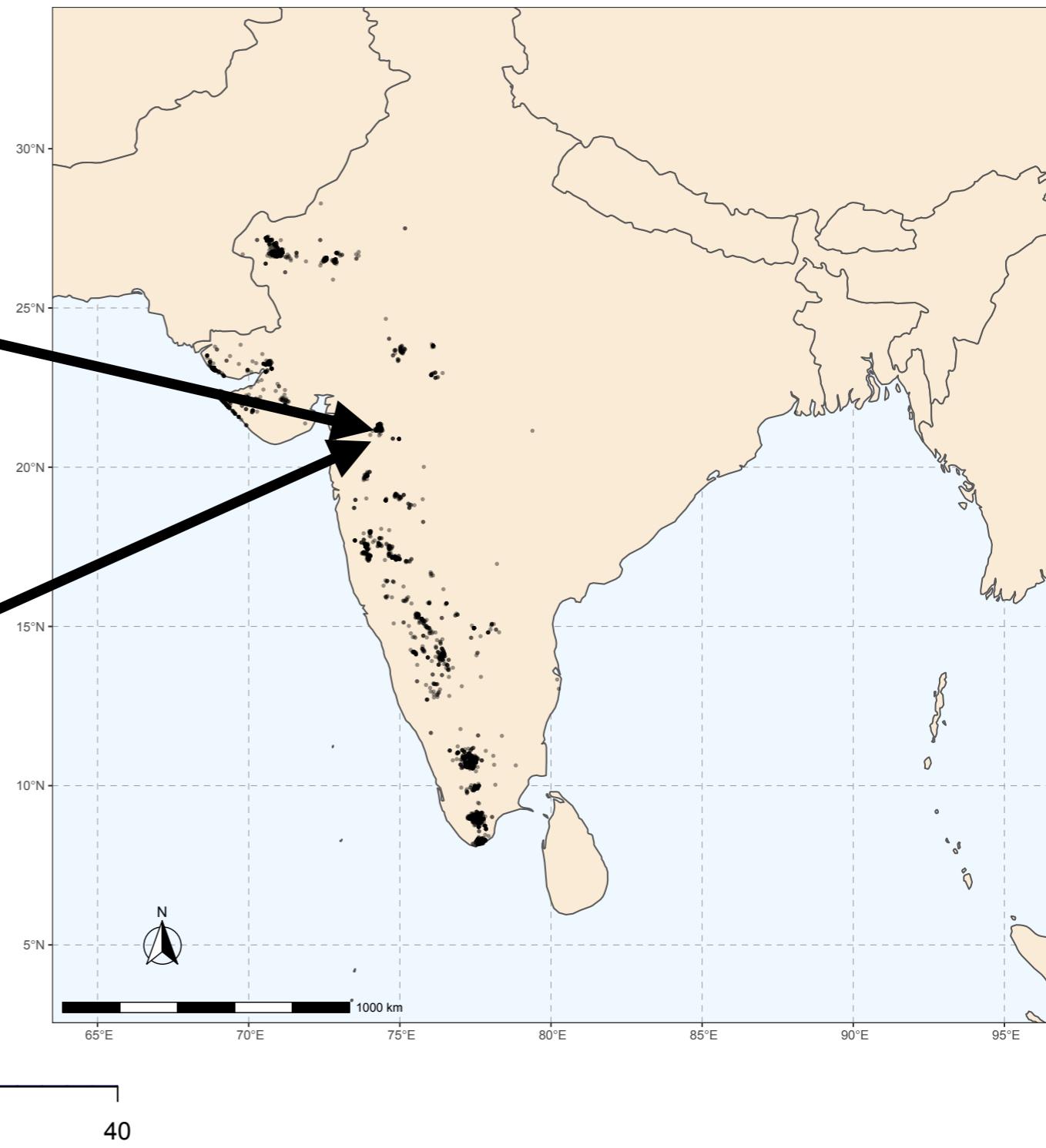
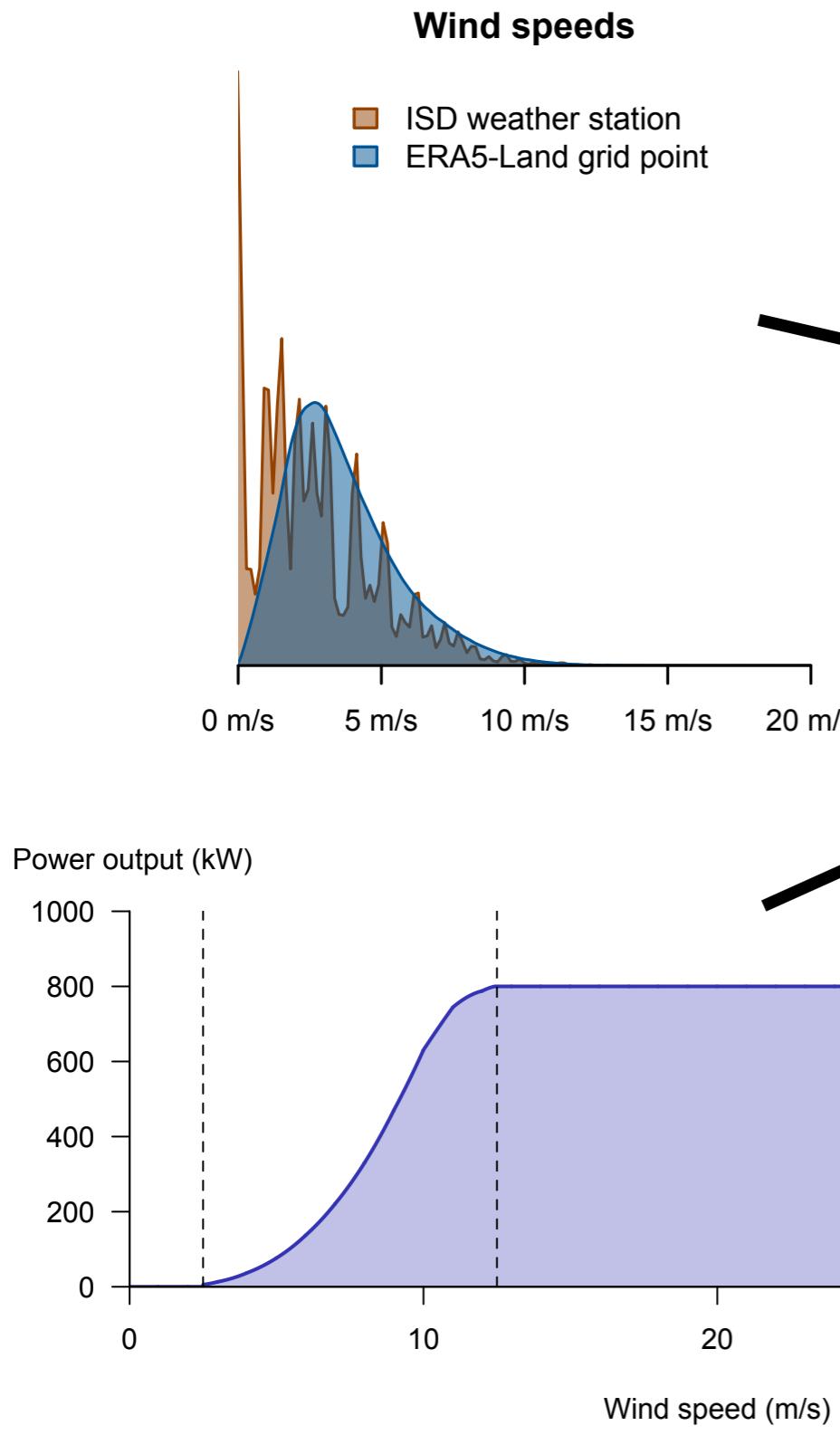
GEO-LOCATE WIND FARMS



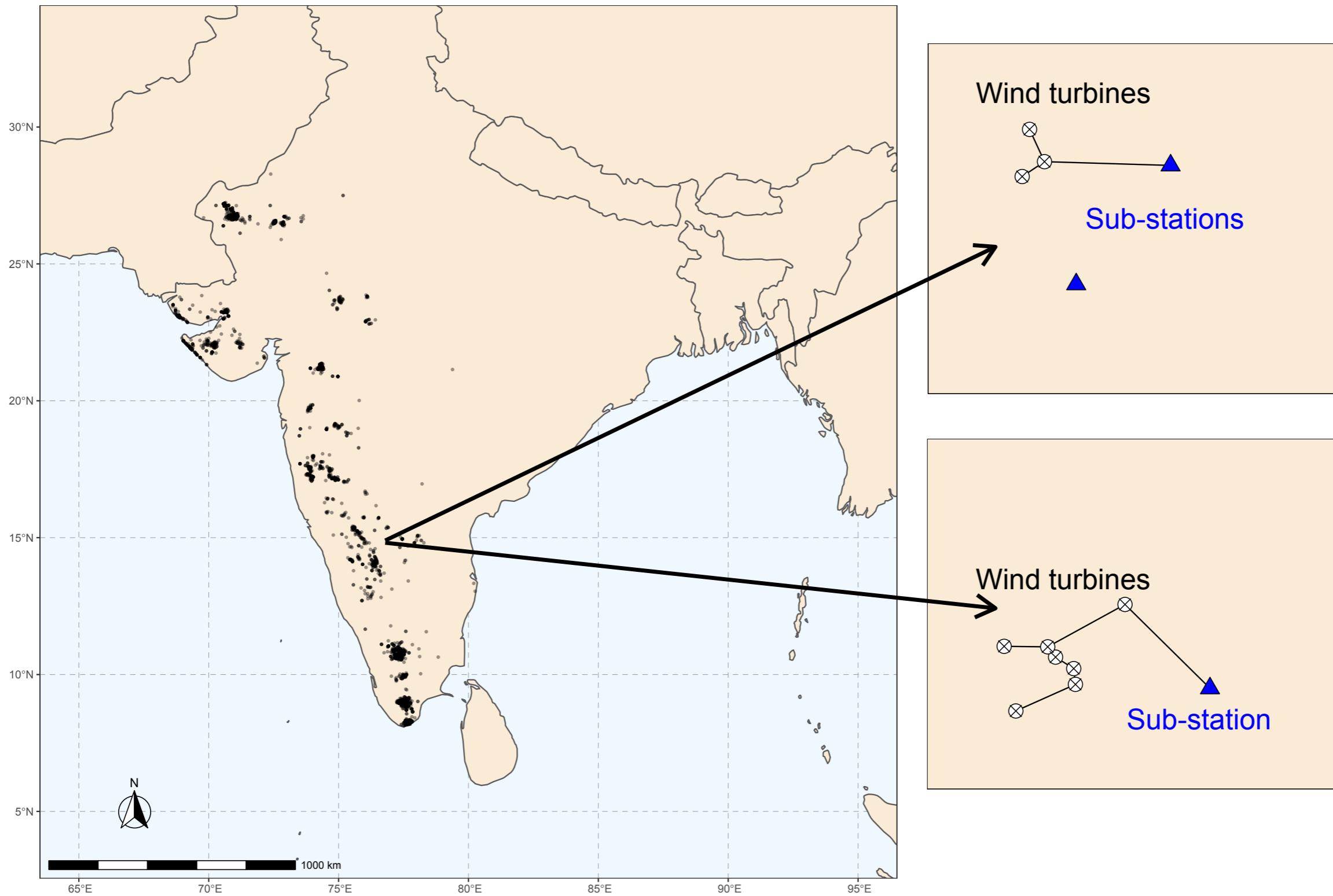
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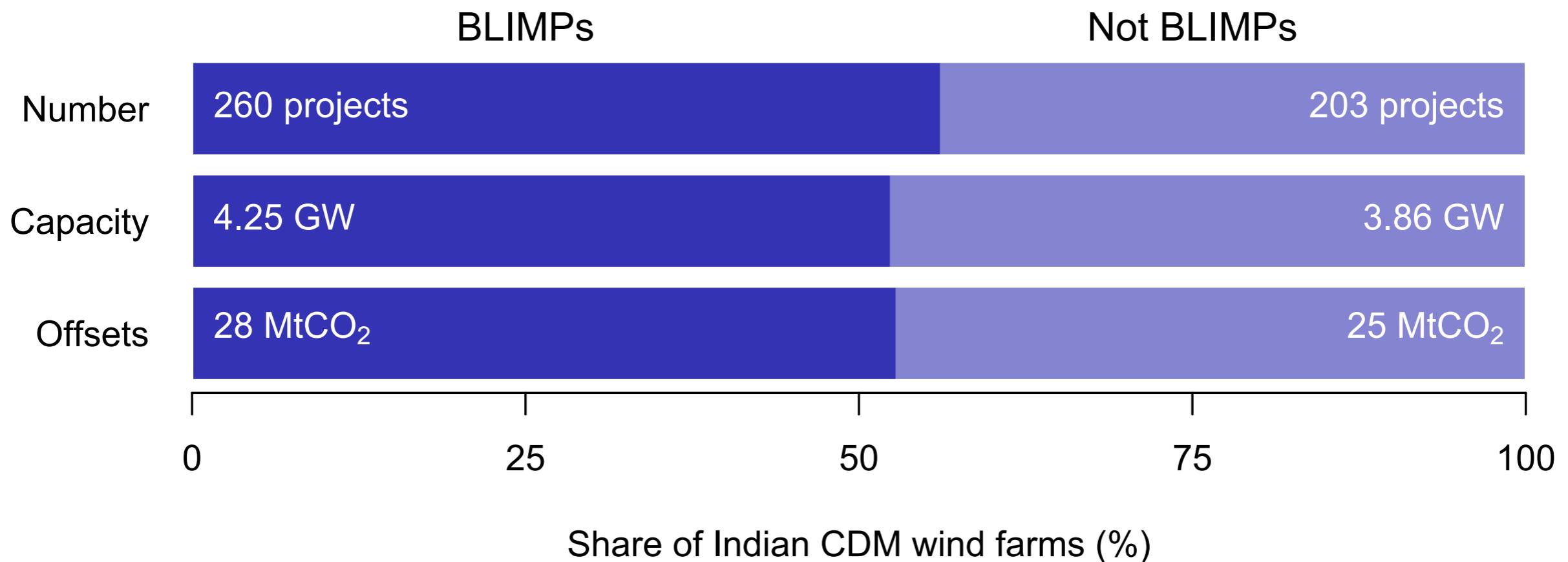
ESTIMATE CAPACITY FACTORS



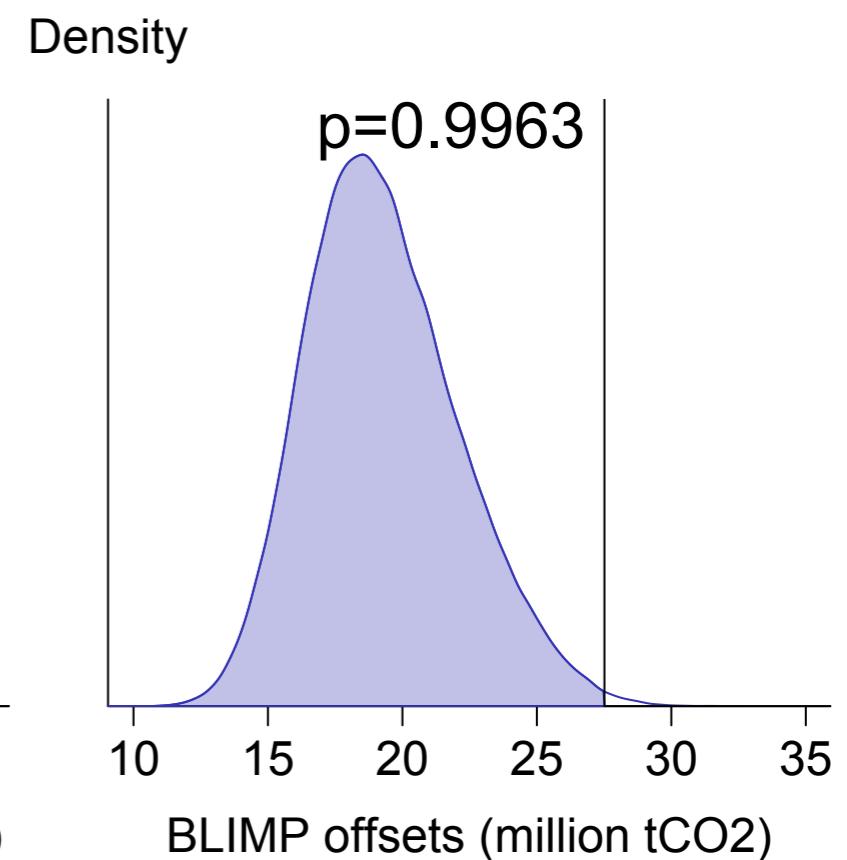
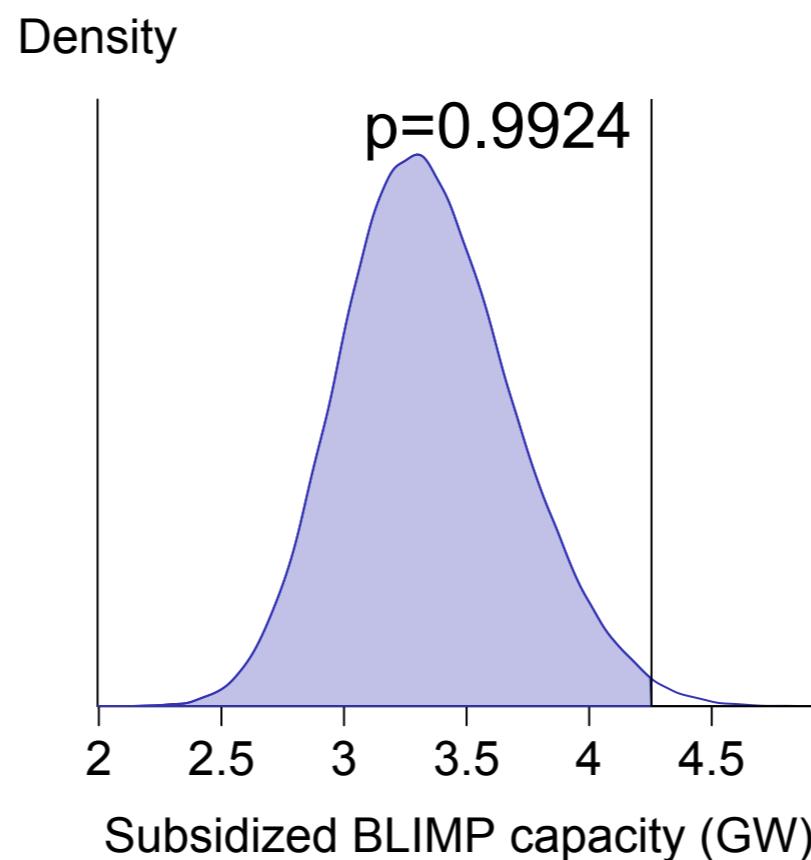
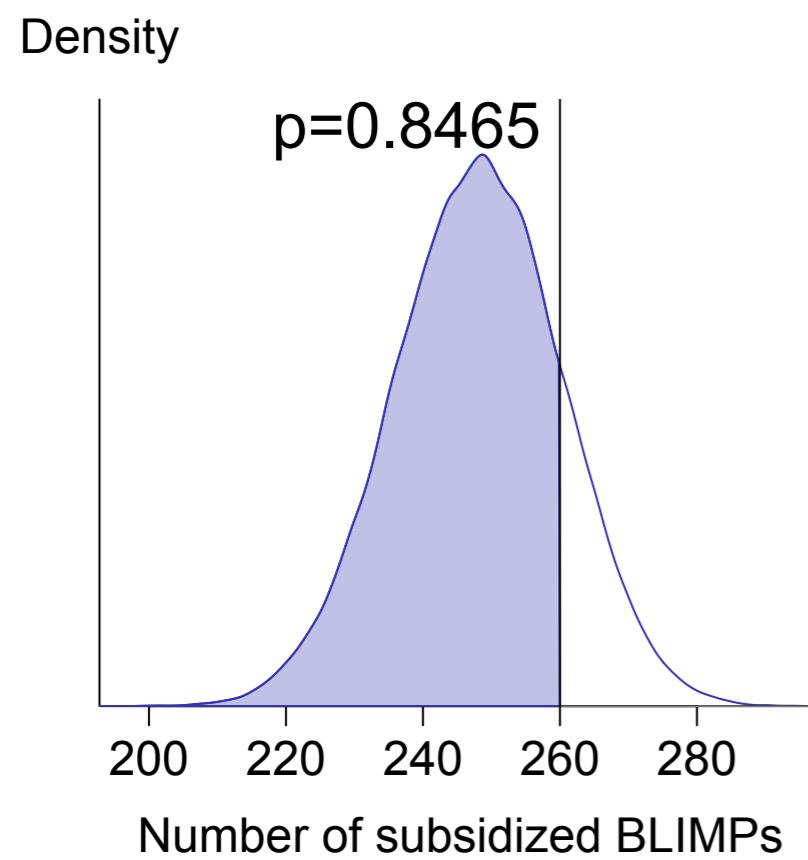
ESTIMATE GRID-CONNECTION COST



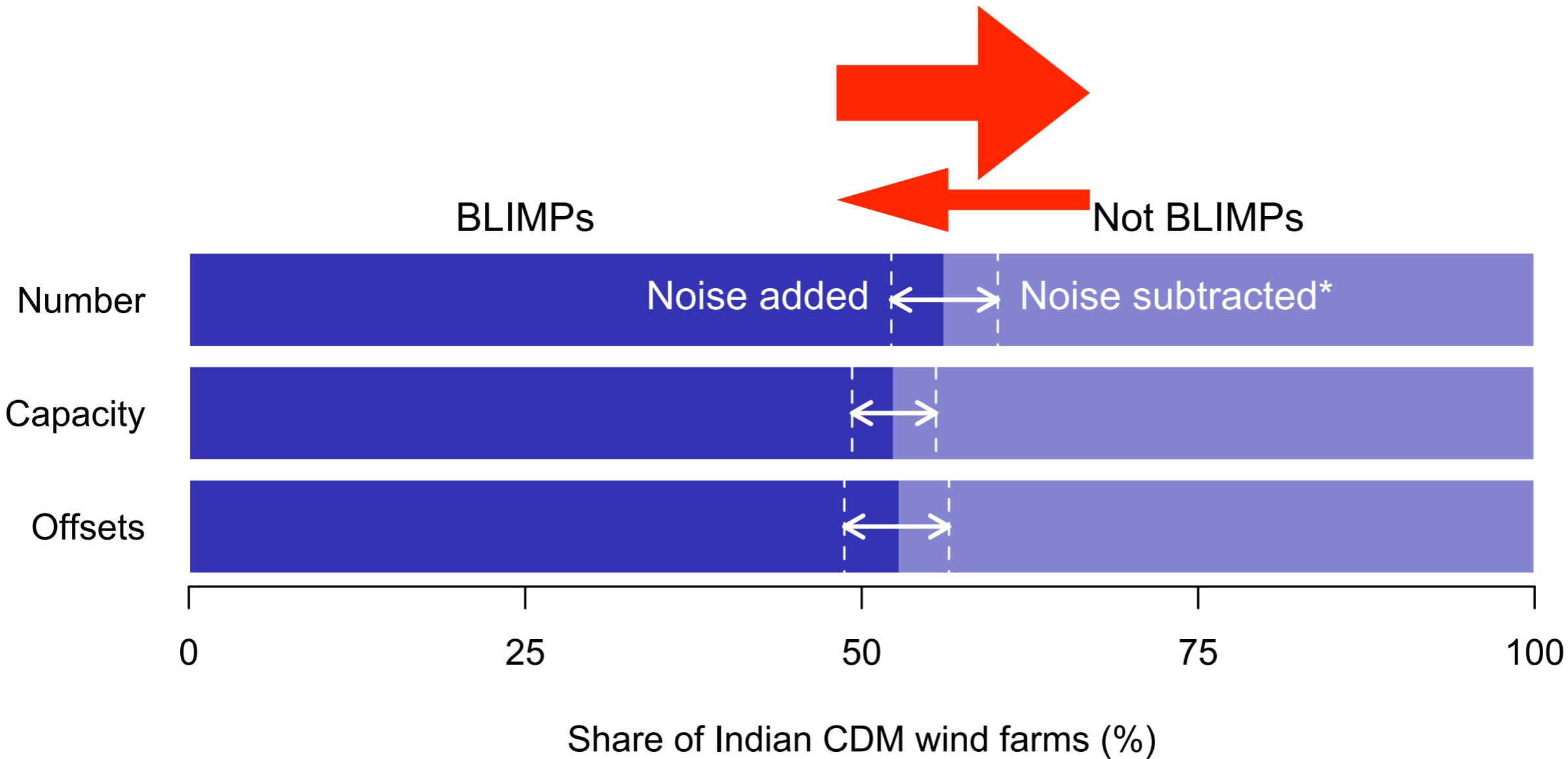
RESULTS



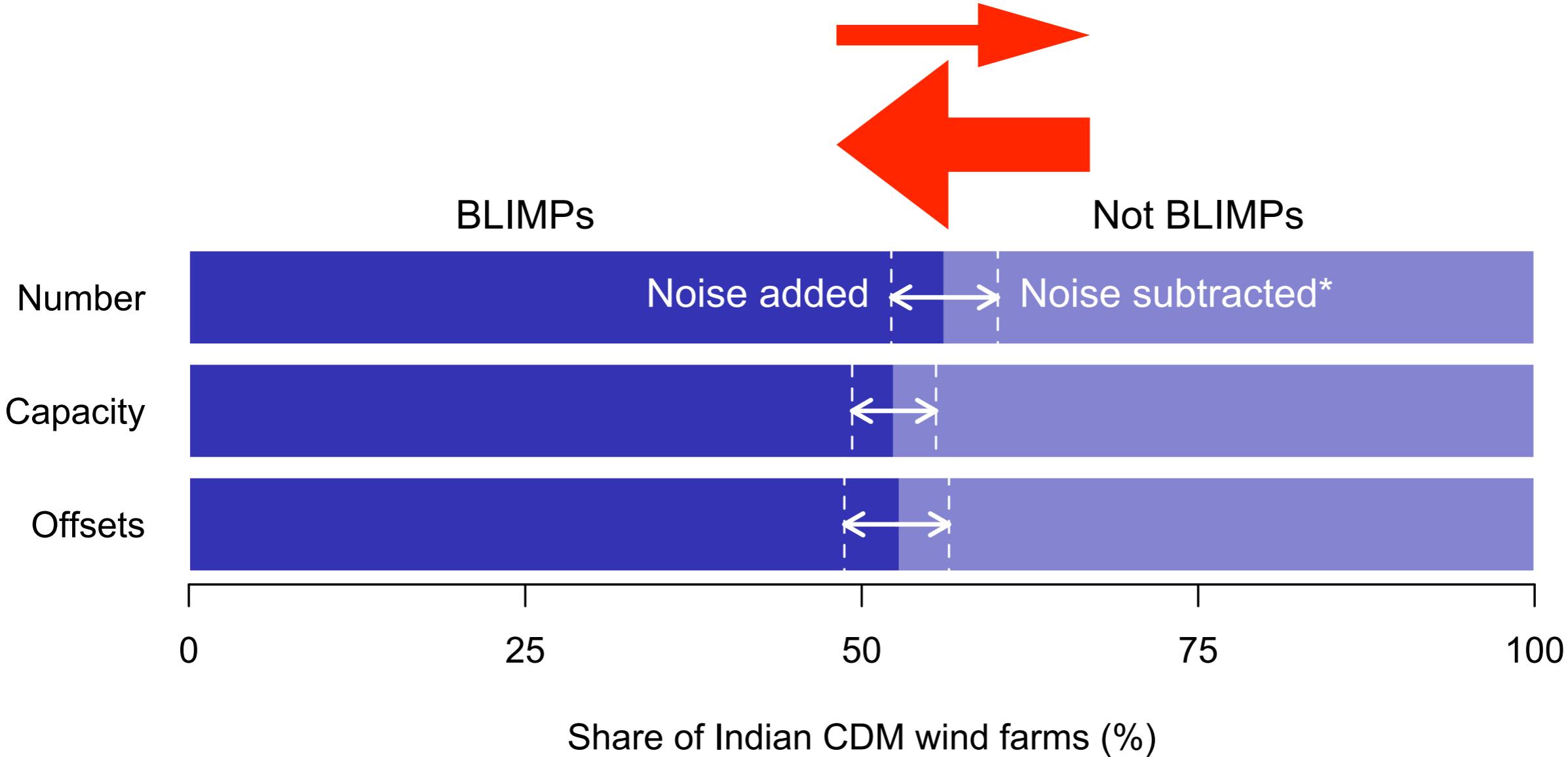
RESULTS



MEASUREMENT ERROR



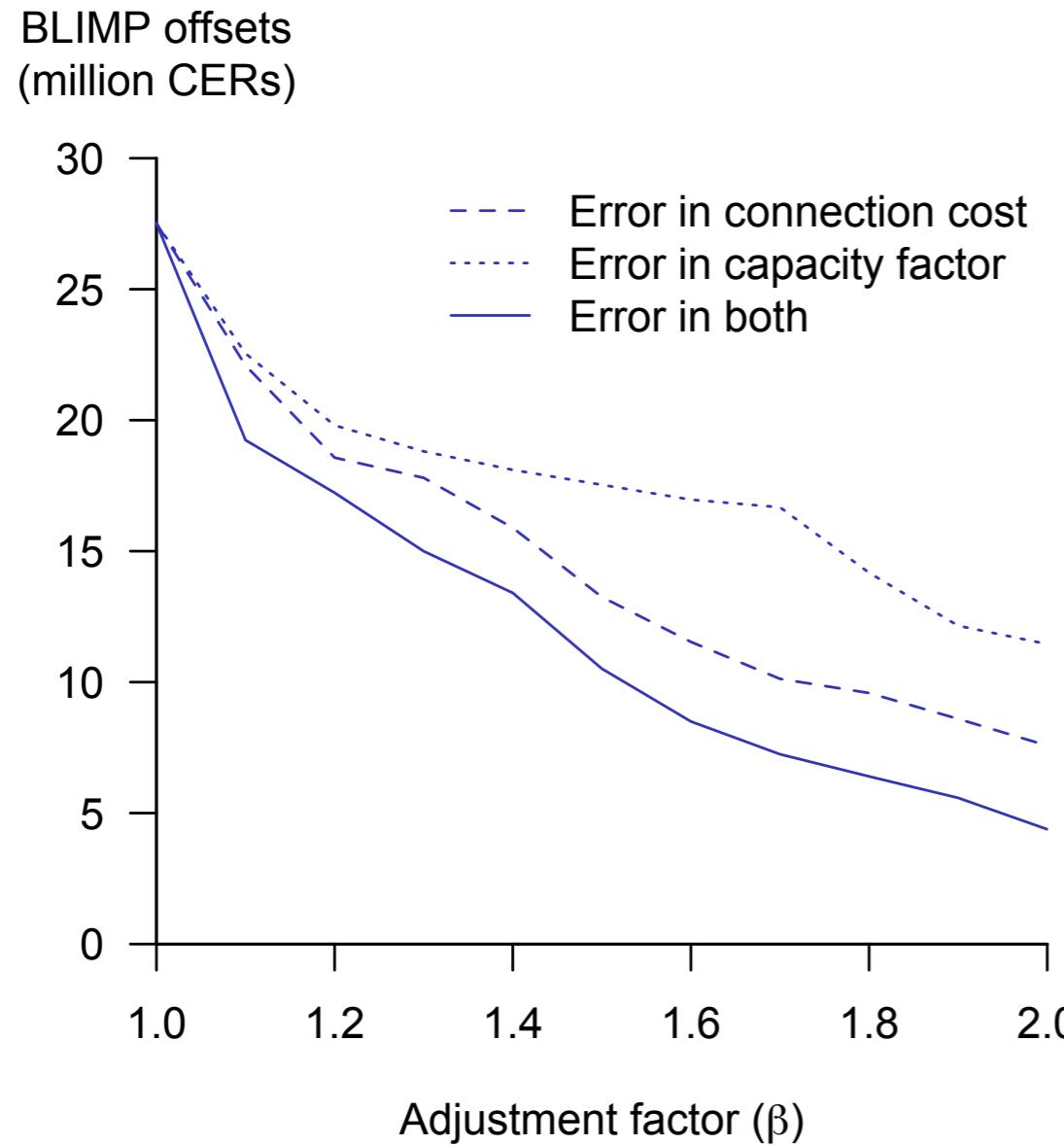
MEASUREMENT ERROR



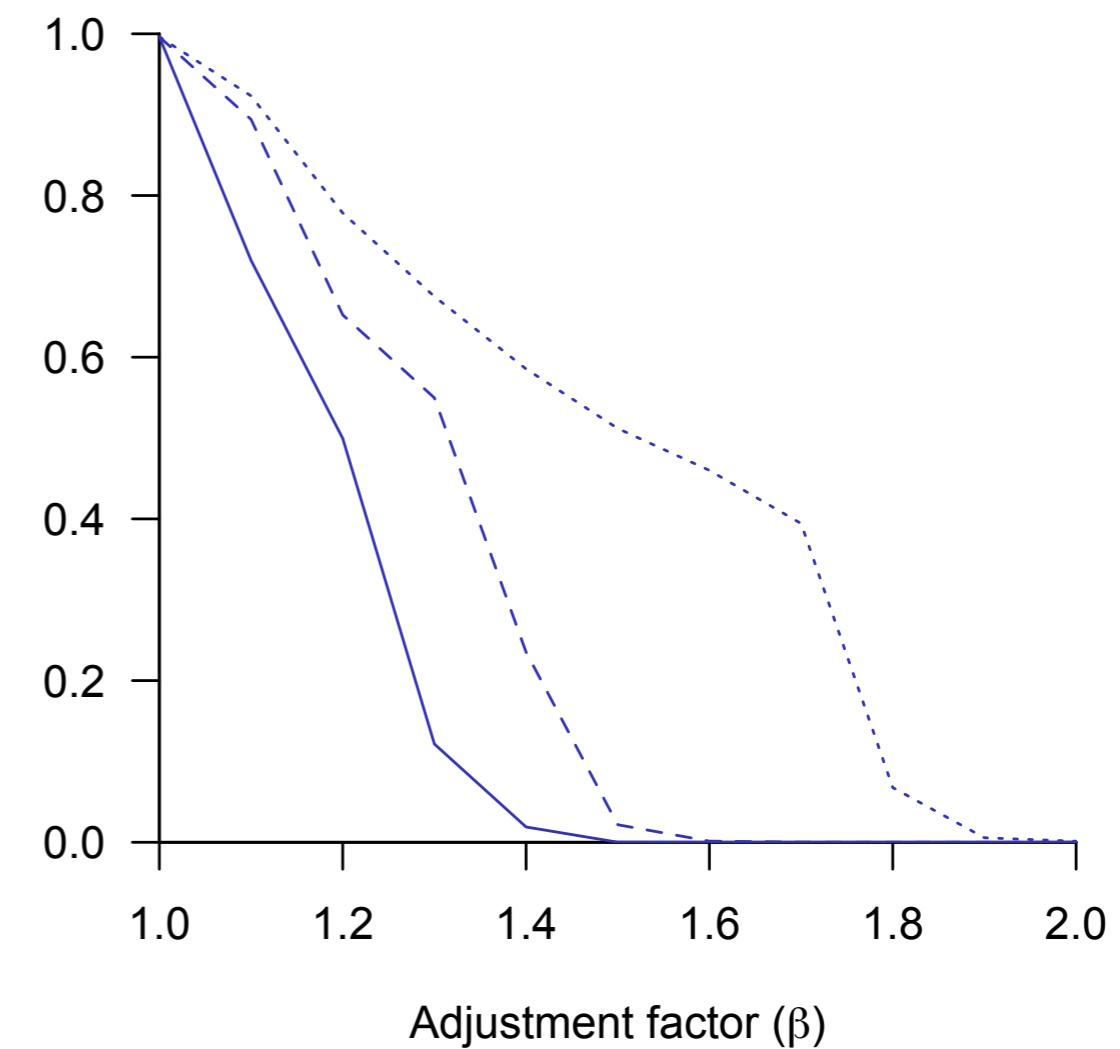
MEASUREMENT ERROR

	BLIMP fraction (in percent)	BLIMP capacity (in GW)	BLIMP offsets (in million tCO ₂)
Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Measurement errors			
(1) Connect within States	57 (0.8956)	4.351 (0.9957)	27.836 (0.9970)
(2) Connect to Power stations	52 (0.7215)	4.750 (0.9997)	30.602 (0.9999)
(3) Connect to Cities of >100,000	56 (0.9563)	4.186 (0.9999)	25.884 (0.9999)
(4) Connect to Cities with power	52 (0.8820)	4.098 (0.9988)	25.531 (0.9988)
(5) Suzlon benchmark turbine	56 (0.8013)	4.230 (0.9916)	27.329 (0.9959)
(6) Standard air density	56 (0.8452)	4.254 (0.9924)	27.513 (0.9963)
(7) Adjustment factor $\beta = 1.2$	36 (0.0001)	2.752 (0.1032)	17.228 (0.4996)

MEASUREMENT ERROR



$\Pr(\text{Lottery allocates fewer CERs to BLIMPs than does CDM})$

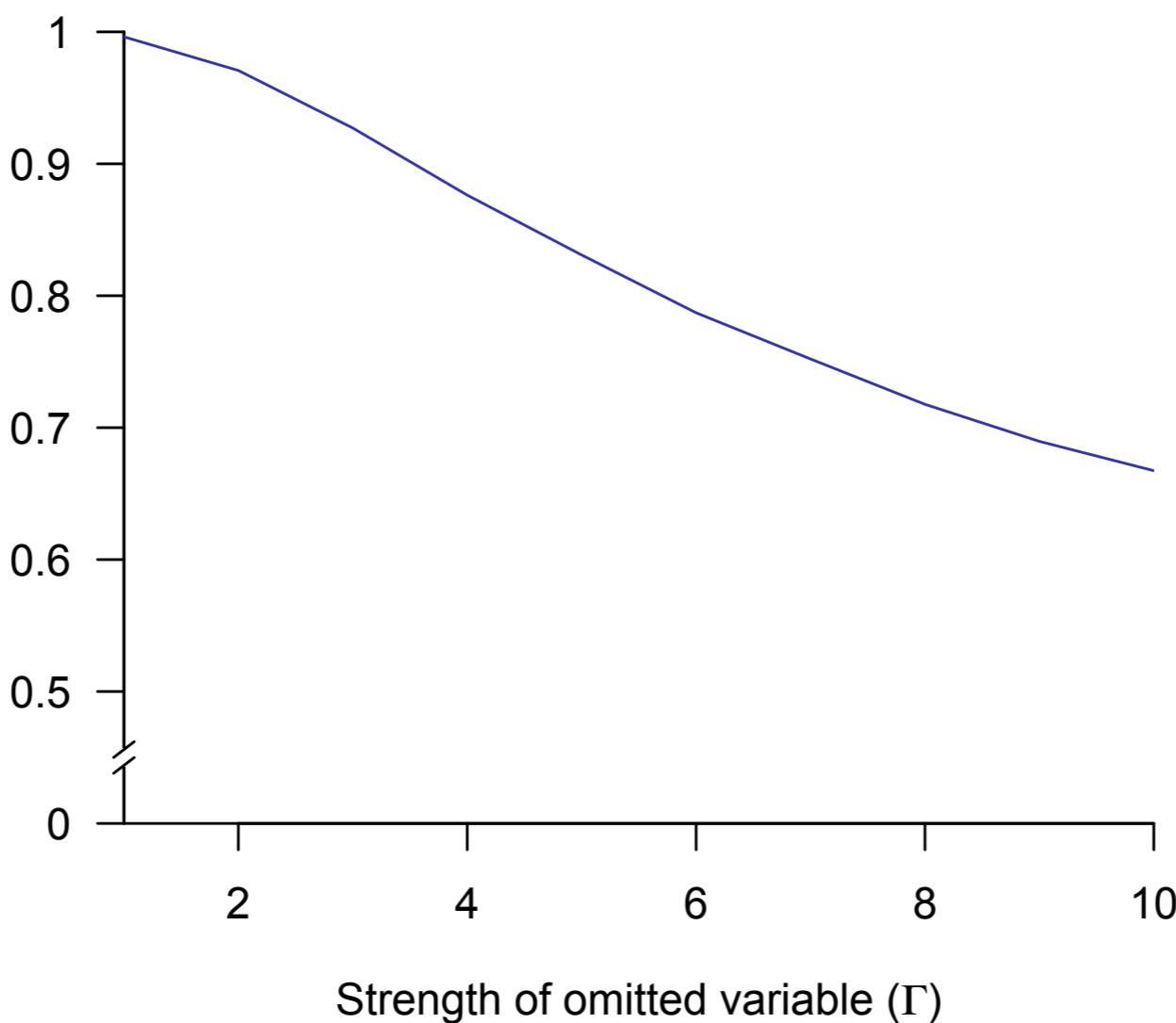


OMITTED VARIABLES

	BLIMP fraction (in percent)	BLIMP capacity (in GW)	BLIMP offsets (in million tCO ₂)
Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Omitted variables			
(8) Match manufacturer	30 (0.0619)	1.907 (0.6701)	9.950 (0.6490)
(9) Match number of sites	39 (0.1043)	2.776 (0.8845)	15.389 (0.8413)
(10) With 5MW threshold	45 (0.5134)	3.267 (0.9012)	19.208 (0.8794)
(11) Within District-year	33 (0.1785)	2.521 (0.9243)	13.665 (0.8561)
(12) Within Village-year	14 (0.0016)	0.897 (0.8169)	4.797 (0.7849)
(13) CDM developers only	36 (0.5889)	2.932 (0.7145)	17.964 (0.7556)

OMITTED VARIABLES

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MISSPECIFICATION TESTS

	BLIMP fraction (in percent)	BLIMP capacity (in GW)	BLIMP offsets (in million tCO ₂)
Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Mis-specification tests			
(14) Match connection distance	25 (0.0001)	1.419 (0.7585)	8.746 (0.8636)
(15) Match capacity factor	25 (0.0001)	1.353 (0.7316)	7.483 (0.8313)
(16) Match capacity	10 (0.0018)	0.441 (0.8378)	2.327 (0.8794)

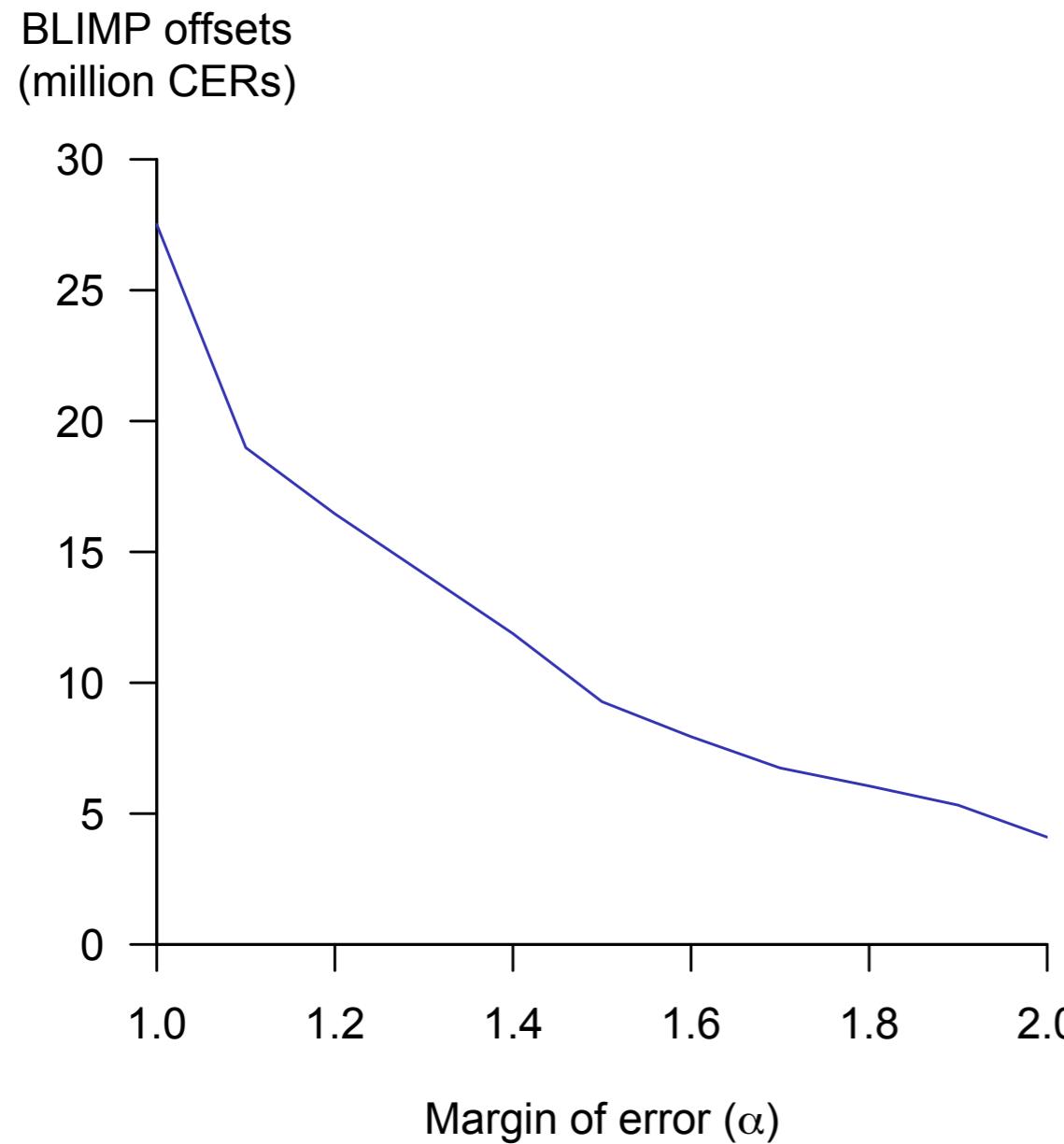
INCOMPLETE DATA

	BLIMP fraction (in percent)	BLIMP capacity (in GW)	BLIMP offsets (in million tCO ₂)
Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Incomplete data			
(17) With unconfirmed projects	43 (0.3238)	4.642 (0.7258)	28.760 (0.9536)

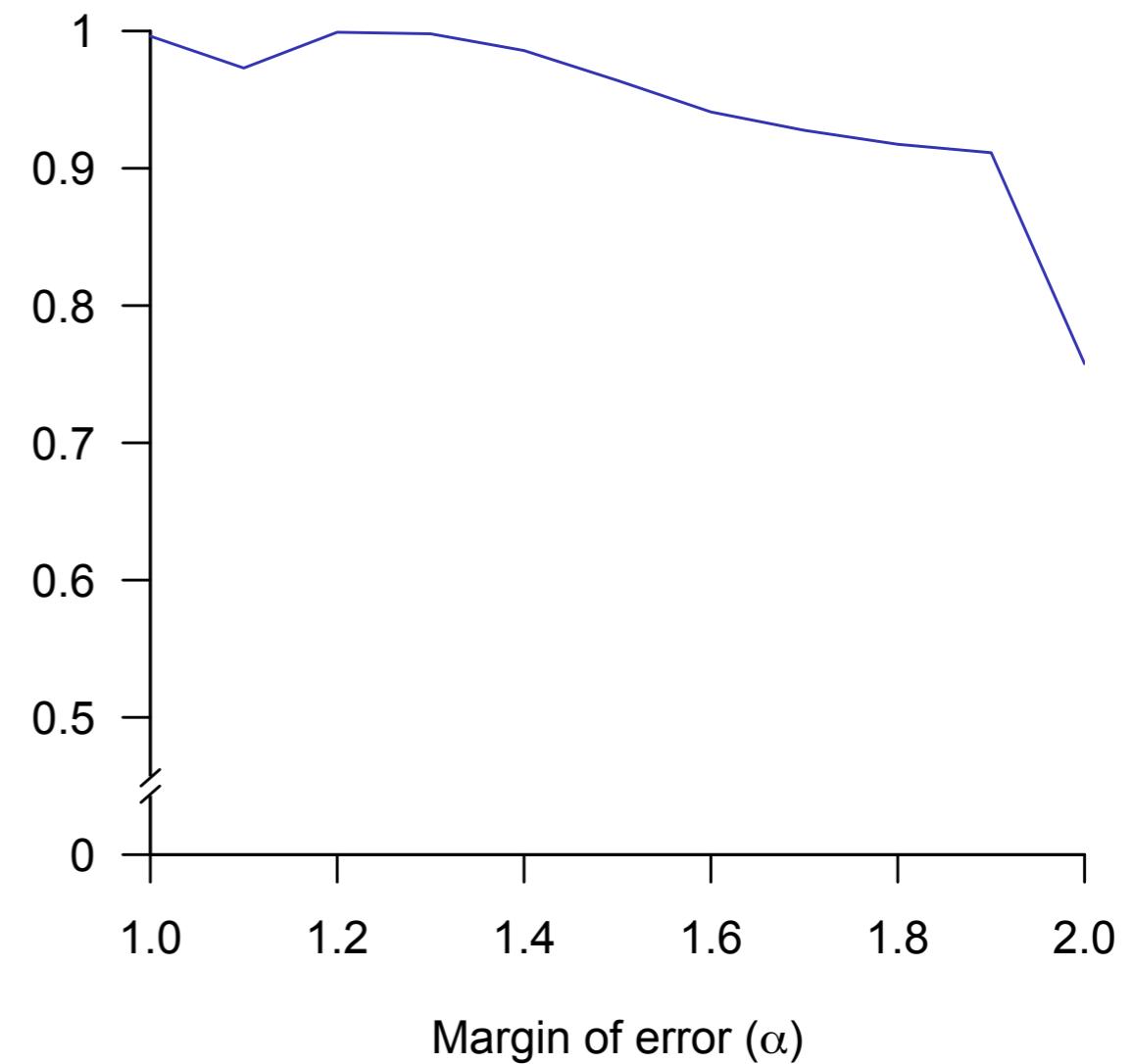
ALLOWING FOR MISTAKES

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Allowing for mistakes			
(18) Margin of error $\alpha = 1.2$	32 (0.8848)	2.572 (0.9835)	16.456 (0.9991)
(19) Two inferior projects	33 (0.2630)	2.664 (0.8619)	15.565 (0.8568)

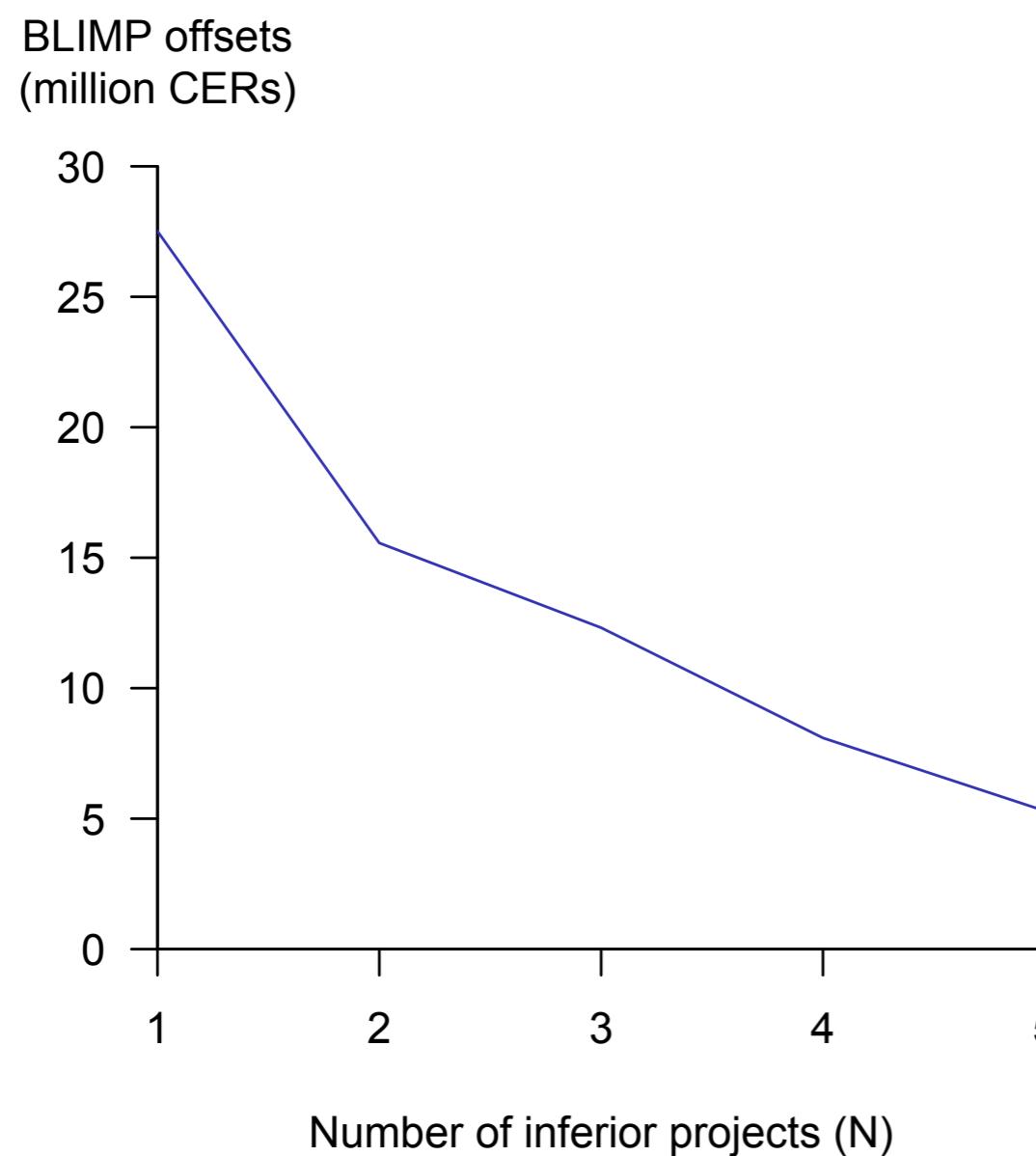
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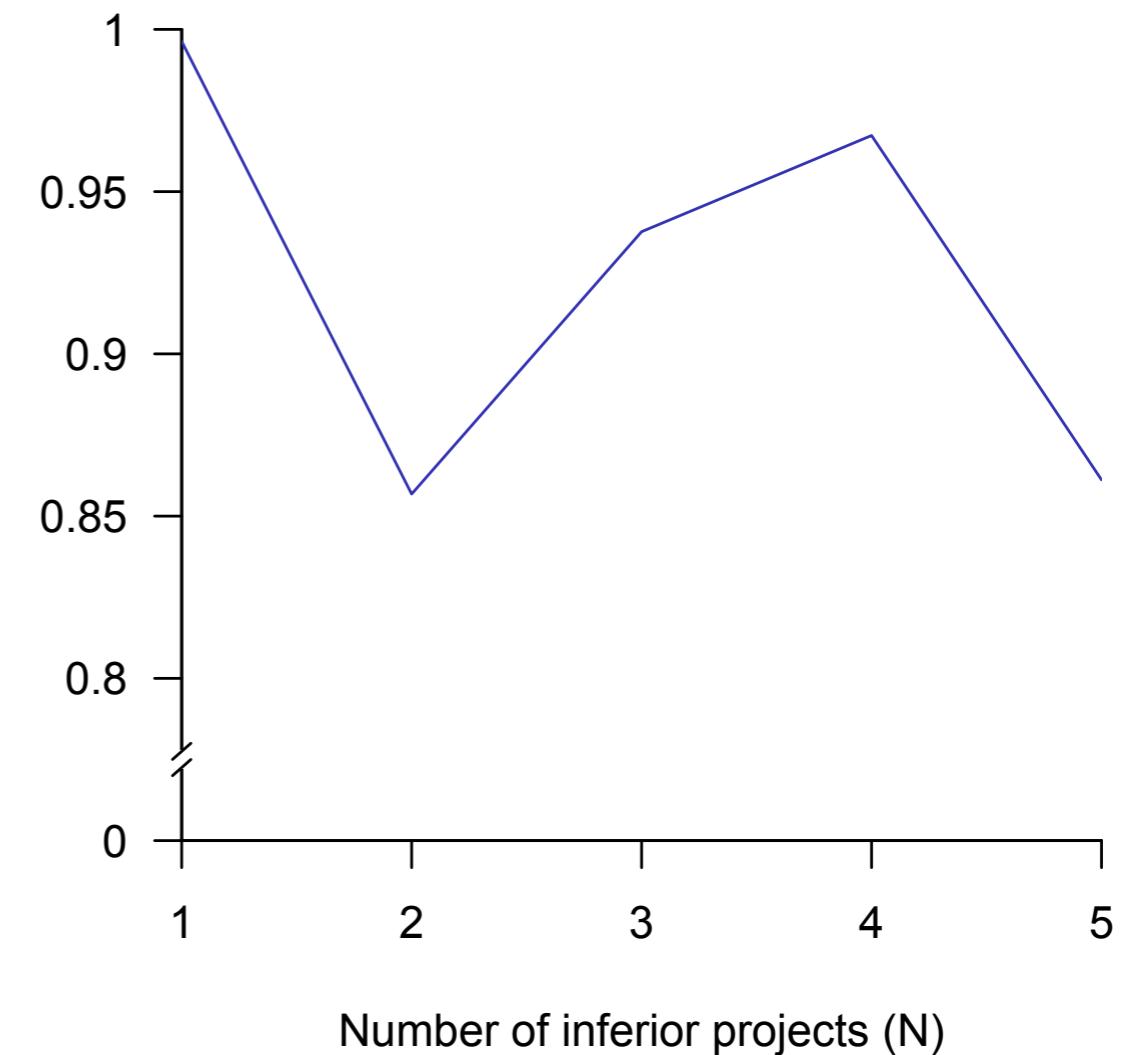
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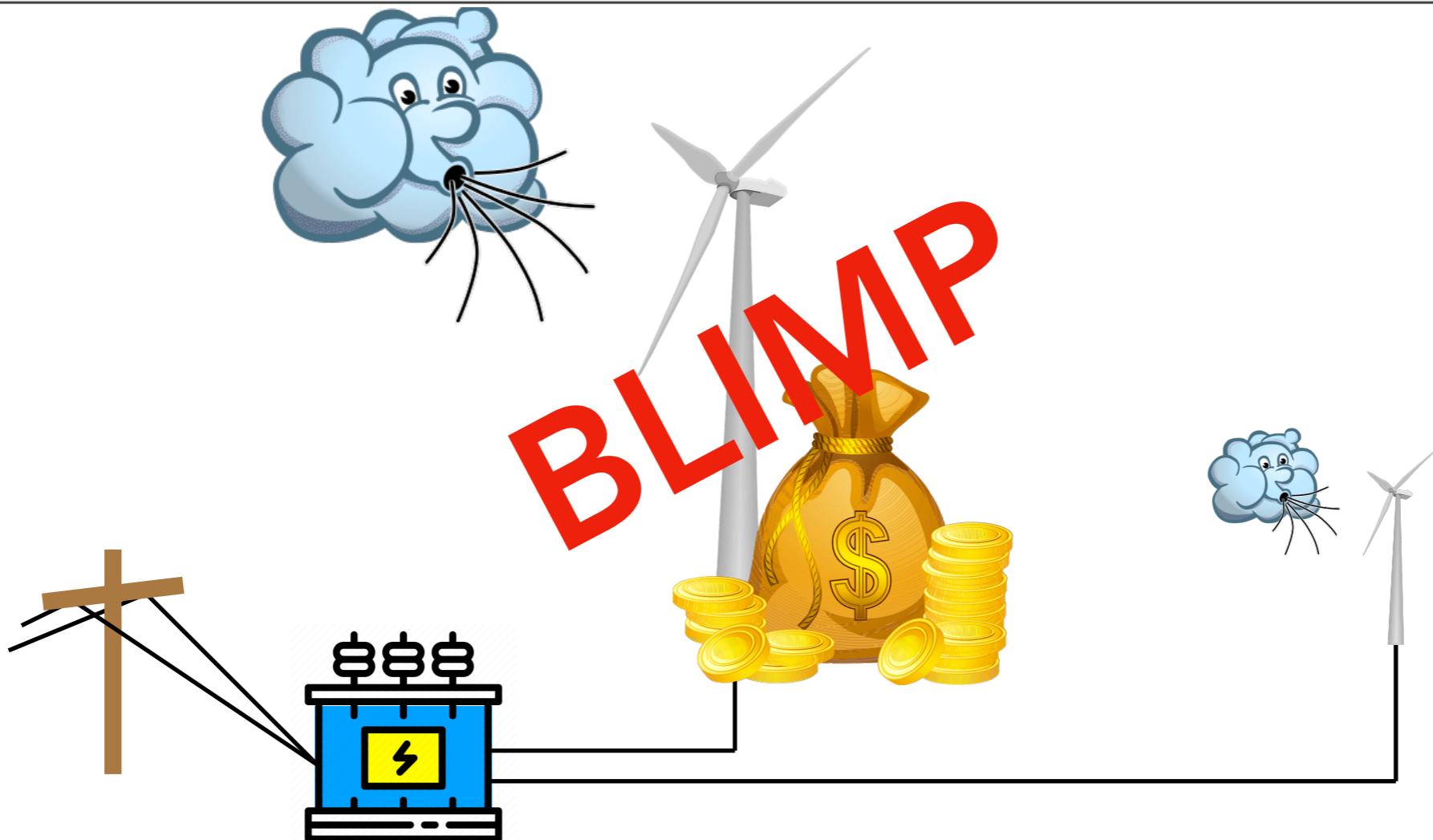


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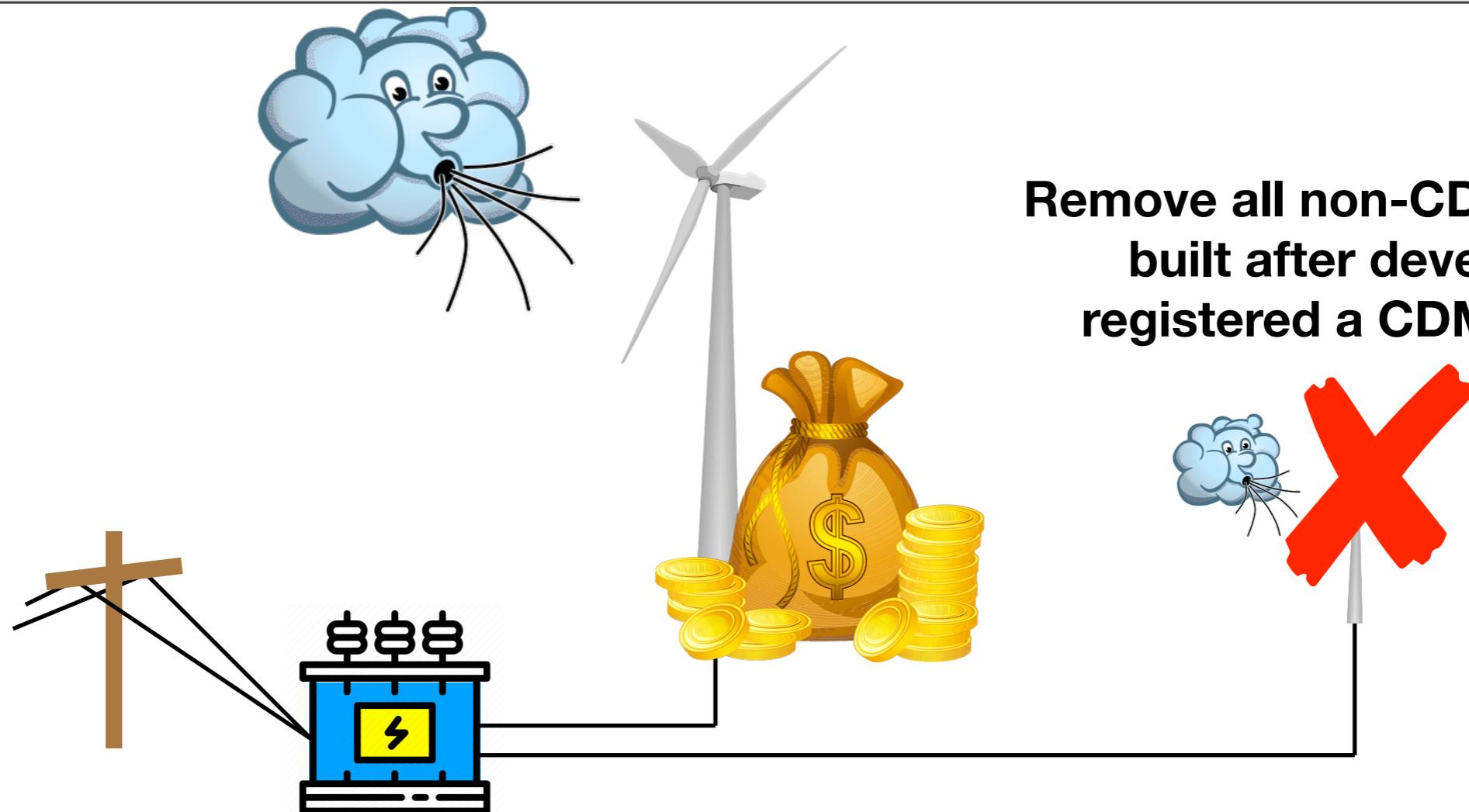
FINANCIAL SPILLOVERS

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Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Financial spillovers			
(20) No non-CDM projects from developers with prior CDM support	47 (0.7474)	3.665 (0.9596)	23.735 (0.9763)



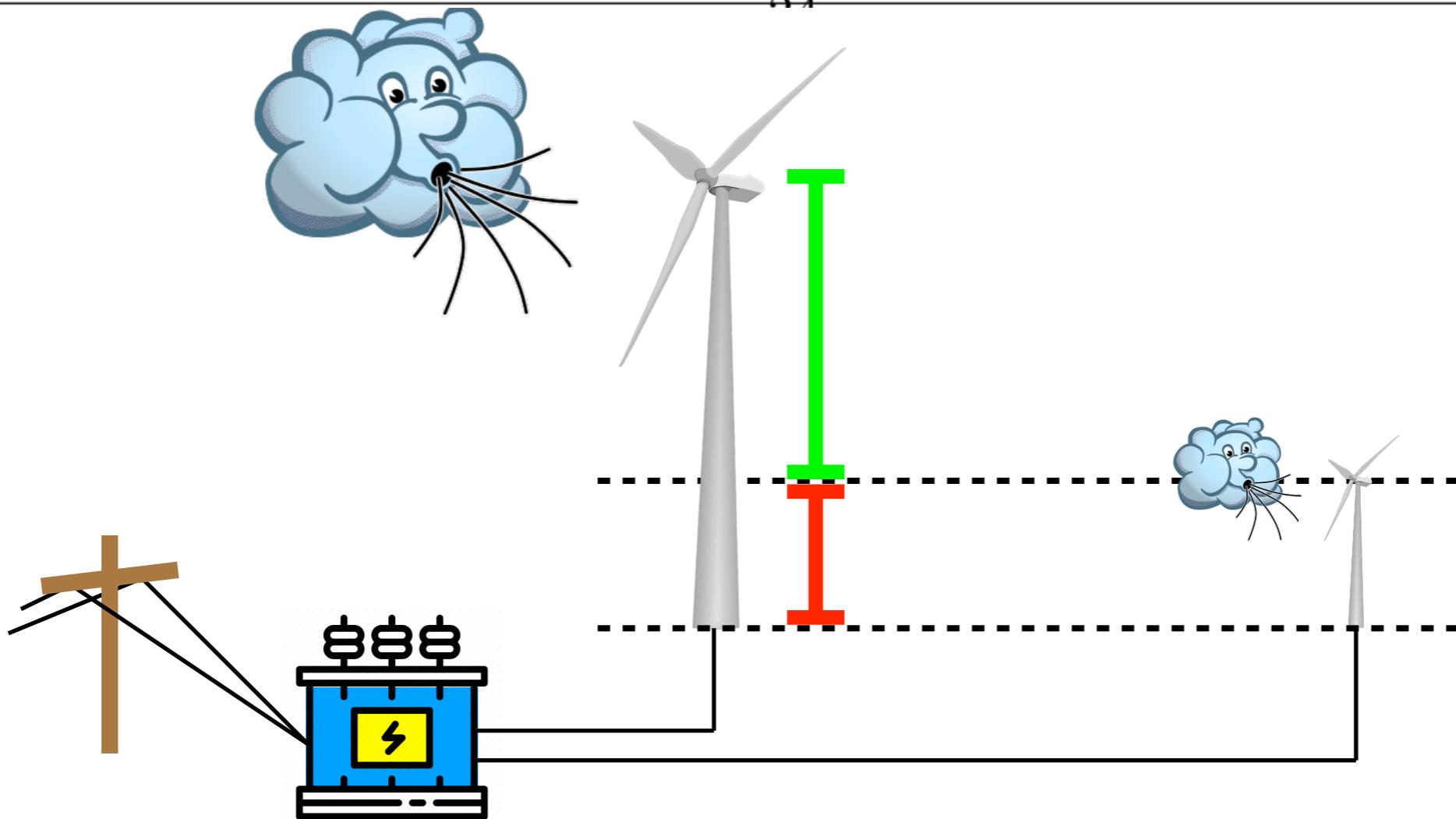
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A LOWER BOUND

	BLIMP fraction (in percent)	BLIMP capacity (in GW)	BLIMP offsets (in million tCO ₂)
Main result	56 (0.8465)	4.254 (0.9924)	27.513 (0.9963)
Partial infra-marginality			
(21) Next biggest project bound	56 (0.8465)	1.912 (0.6604)	8.891 (0.3619)



DO CARBON OFFSETS OFFSET CARBON?

- Too often, it seems they don't.
- Applied to the CDM as a whole, our estimates imply global carbon emissions might be 6.1 billion tonnes *higher than* without the CDM.
- To get carbon neutrality, need to postulate that every offset to a non-BLIMP offset at least 2.1 tonnes.

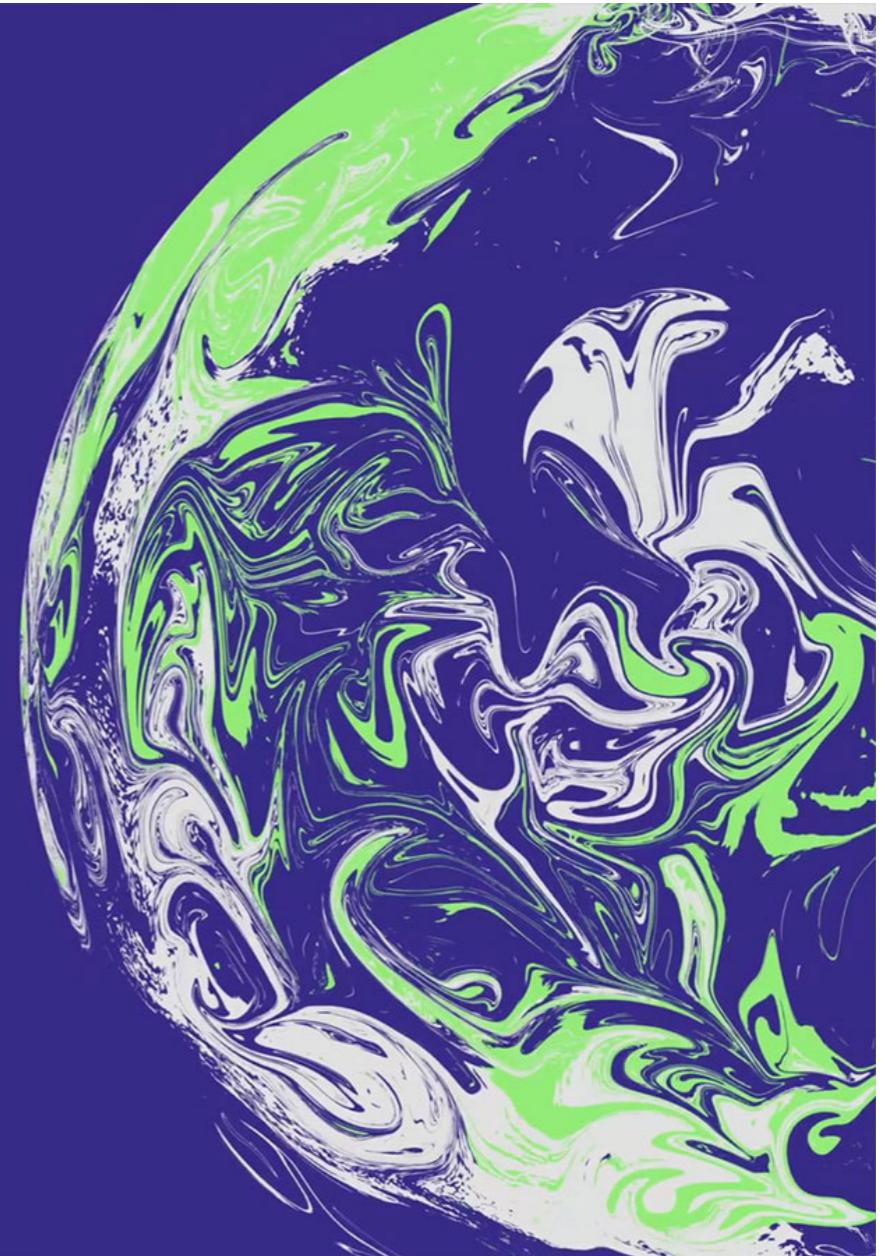
WHY IS THIS HAPPENING?

- **Local politics** (Bayer et al., 2014)
- **High application cost** (Chadwick, 2006)
- **Fraud** (Consulate Mumbai Diplomatic Cable, 2008; Point Carbon, 2010)
- **Verifier conflicts of interest** (Frunza, 2013)
- **Executive Board conflicts of interest**
(Transparency International, 2011)

01-12 NOV 2021
GLASGOW

COP26

IN PARTNERSHIP WITH ITALY



- COP26 has just agreed to allow transition of up to 3.1 billion carbon offsets from CDM to the next Commitment Period.