A NEW APPROACH FOR RISK MANAGEMENT IN ELECTRICAL ENERGY MARKETS:

RISK SHARING CONTRACTS

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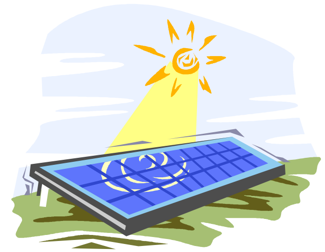
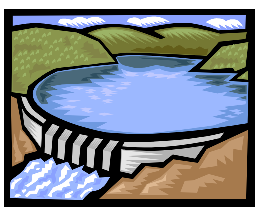
BRAZILIAN SYSTEM

ENERGY SOURCES

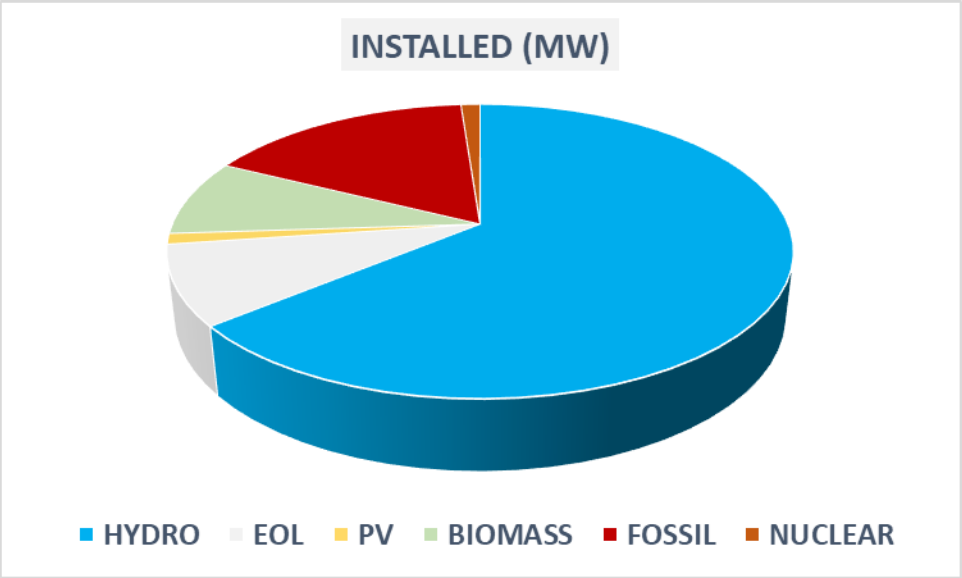




GOD IS BRAZILIAN…

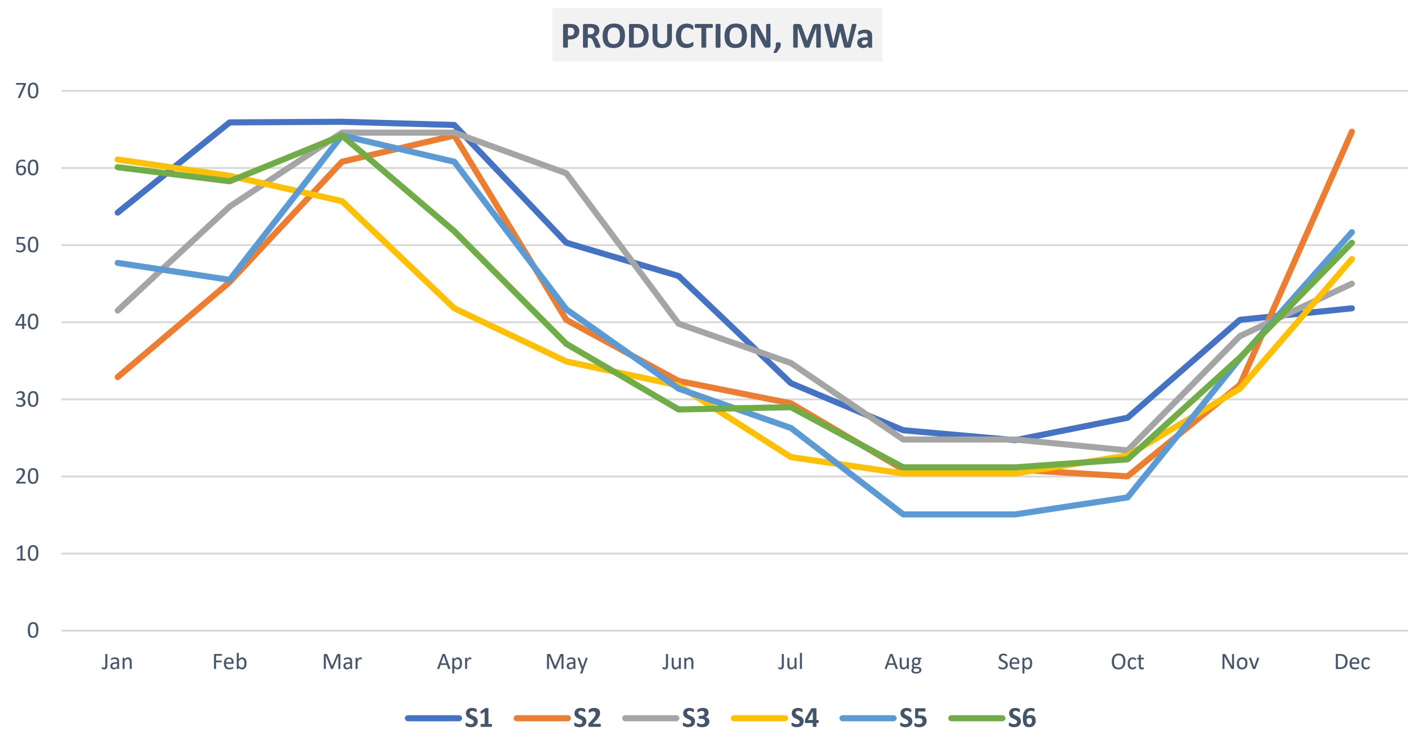
ENERGY SOURCES

SOURCE	INSTALLED (MW)	PART
HYDRO	108.149	64,04%
EOL	14.784	8,75%
PV	1.988	1,18%
BIOMASS	14.188	8,40%
FOSSIL	27.784	16,45%
NUCLEAR	1.990	1,18%
TOTAL	168.883	100,00%



82% CLIMATE-DEPENDENT

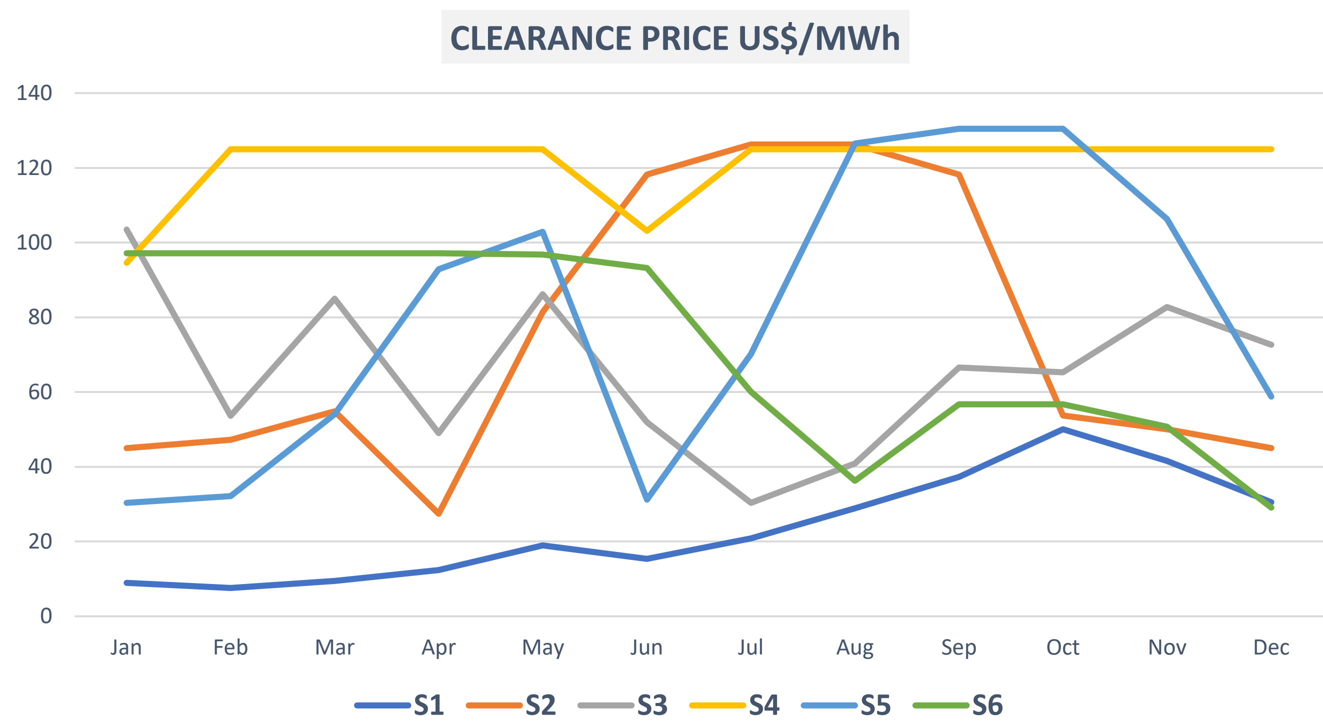
UNCERTAINTIES



Rio Claro, Hydro, Southeast

Up to 70% difference

UNCERTAINTIES



Clearance Price, Southeast

More than 1000% difference

DEFAULTS

- Generators' output not enough to supply contracts
- Necessary to buy in clearance Market
- Not able to pay!
- Consumers do not get energy, generators get debts
- Clearance trading chamber: defaults U$2-5 million/month

UNHAPPY CONSUMER

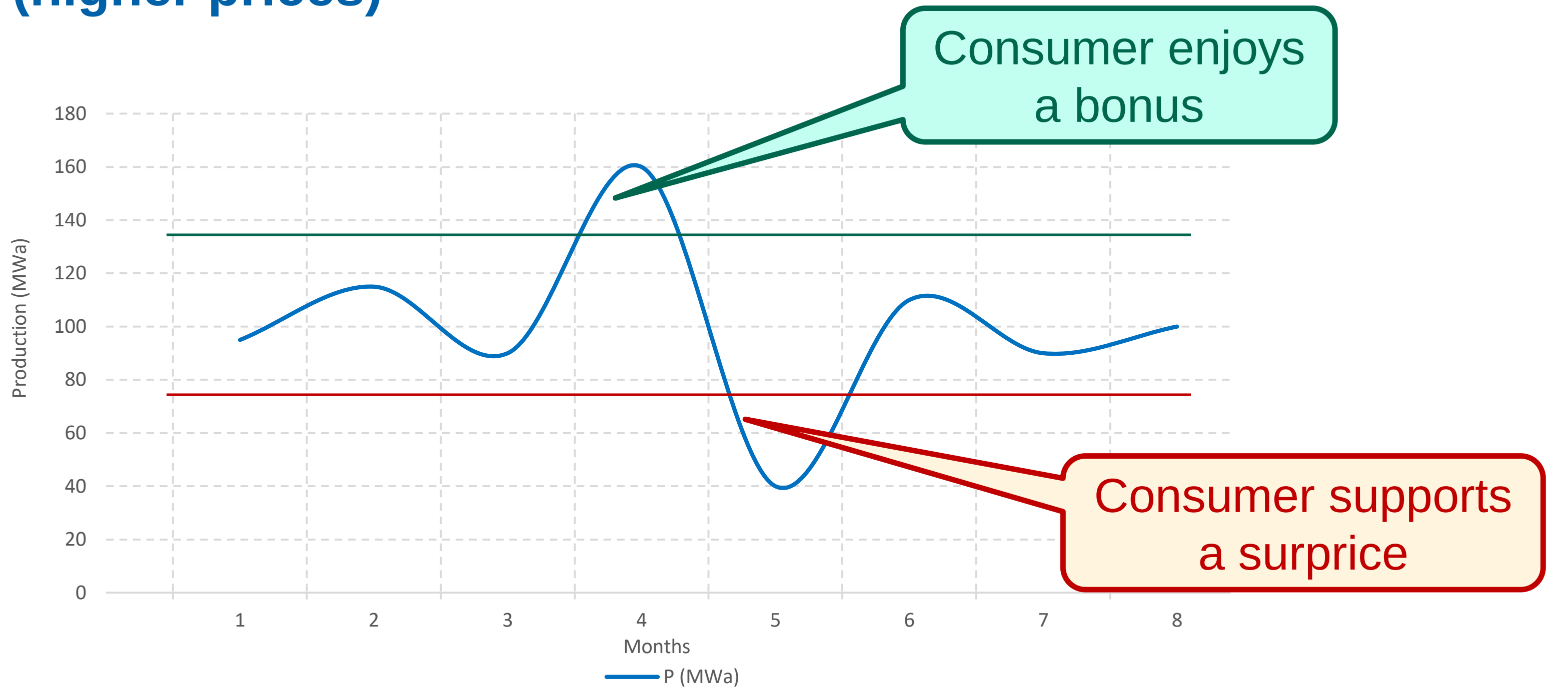
- High inflows: prices go down – consumers see their contracts as overpriced
- Low inflows: prices go high – generators see their prices as underpriced

It is almost a “game” – almost crossing the border between the uncertain and the unknown

PROPOSAL: RISK SHARING

RISK SHARING CONTRACTS

- Generators' output higher than a limit (climate is generous): consumers get a premium (lower prices).
- Generator's output lower than a limit (climate is adverse): consumers get a surplus (higher prices)



FORMULATION

$$\text{Min } E_s\,(surcharge_s - bonus_s)$$

s/to

$$Production_s + (buy_s - sell_s) = Contract_s \;\forall s \qquad \textit{contract balance}$$

$$buy_s < Lcflow \qquad \textit{cash flow limits}$$

$$E_s\,(buy_s) < CVAR \qquad \textit{conditioned value-at-risk constraints}$$

$$\vdots$$

TAILORED FOR EACH COUNTERPART

SOME RESULTS

Contract 40 Mwa, Price R$ 140/Mwh

Category	Item	Value
Risk Contract Variables	P^{risk} (R$/MWh)	130,74
	L_{min} (MWa)	36,92
Buyer's Expected Annual Cost (R$ million)	Conventional Contract	53,57
	Risk Contract	48,85
Seller's Expected Annual Revenues (R$ million)	Conventional Contract	49,61
	Risk Contract	44,89
	Risk Premium	2,16

Price reduction (Bonus)

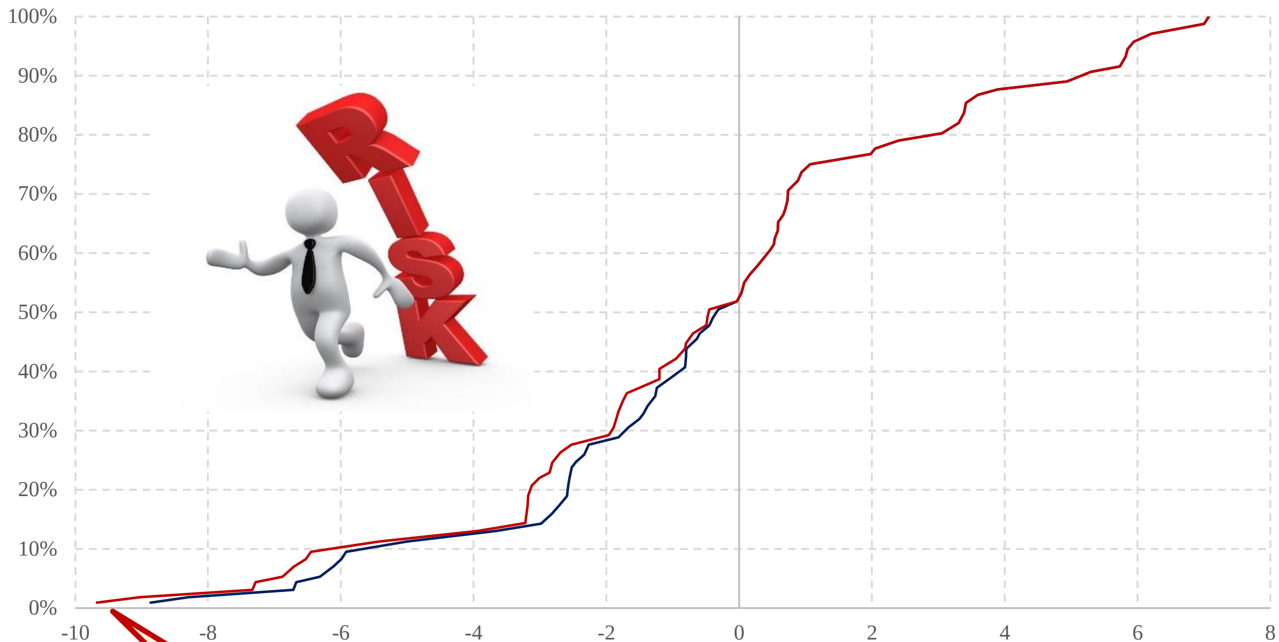
Lower limit threshold

9% consumer's discount

5,4 generator's losses

SOME RESULTS

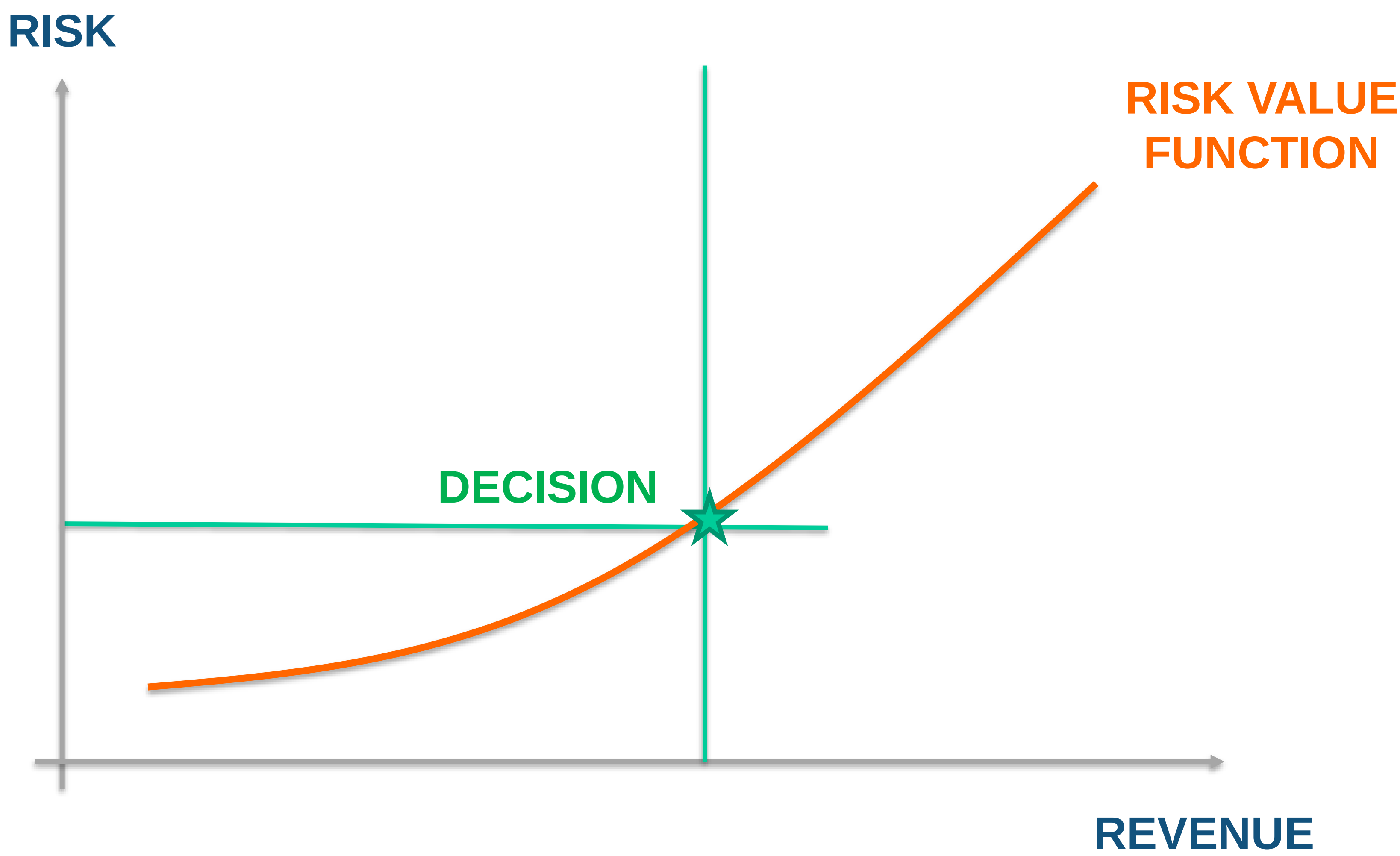
Contract 40 Mwa, Price R$ 140/Mwh



Higher Risks

RISK CONTRACT:
-R$9 MILLION CVAR

COMING SOON



CONCLUSIONS

Risk sharing contracts

- Better prices for consumers
- Lower risks for generators
- Customizable
- Although designer for expected scenarios, cover the unknown (protects both counterparts)

THANK YOU

Engenho Pesquisa, Desenvolvimento e Consultoria

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