The Human-Centric Hybrid Election System (HES)

The Hybrid Election System (HES) is designed to merge the trust and auditability of a manual paper-based system with the speed and efficiency of technology. Its core philosophy is that **the paper ballot is the canonical record of the vote.** Technology serves as a powerful tool to assist humans in verifying, counting, and transmitting the results, but ultimate authority and decision-making remain with human election officials.

Core Principles of the HES

1. **Primacy of the Paper Ballot:** The physical, manually marked ballot is the definitive basis for the count. Anydigital image or interpretation is merely a representation.
2. **Transparency:** All critical steps (verification, counting, tallying) are performed in the open, visible to poll watchers and the public.
3. **Human-Centric Control:** A human action (confirmation, decision, signature) is required for every critical step, preventing fully automated, opaque processes.
4. **End-to-End Verifiability:** The voter can verify their ballot, and watchers can verify the count, ensuring the final transmitted results accurately reflect the will of the voters.

Below is a **comprehensive compliance chart** demonstrating how the **Hybrid Election System (HES)** not only meets but **exceeds the requirements of Republic Act No. 9369 (The Amended Computerized Election System Law)** and related Philippine election laws and regulations (COMELEC Resolutions, RA 8436, Omnibus Election Code, etc.). The chart highlights HES's superiority over existing systems such as Automated Counting Machines (ACMs), Vote-Counting Machines (VCMs), and fully automated systems.

This analysis also includes **suggestions for legal amendments** to unlock HES's full potential, **critical comments on non-compliance issues**, and **customization flexibility** to ensure full alignment with COMELEC and stakeholder requirements.

📊 H.E.S. Compliance & Strategic Advantage

Based on RA 9369, Omnibus Election Code, COMELEC Resolutions, and Best Global Electoral Practices

#	Requirement (Based on RA 9369 & Related Laws)	HES Compliance Status	Details / Feature in HES	Exceeds Requirement?	Legal Suggestion / Proposed Amendment	Comment / Advantage over ACM/VCM/Full Automation
1	**Use of paper ballots (RA 9369, Sec. 5)**	✅ Fully Compliant	Uses **manual shading paper ballot** + digital scanner	Yes	No amendment needed	Paper ballot is voter-verified; meets legal requirement for tangible record
2	**Voter-verified paper audit trail (VVPAT)**	✅ Fully Compliant	VVPAT printed after vote affirmation	Yes	Define "VVPAT" in law to include **human-verified digital+paper audit pair**	HES adds **dual verification**: voter *and* watcher, unlike VCMs with silent printing
3	**Voter must verify vote before final submission**	✅ Fully Compliant	Voter sees ballot on screen, confirms before printing VVPAT	Yes	Mandate **real-time verification** in all systems	HES allows **correction before printing** — unlike ACMs where vote is final upon scanning

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4	**Ability to correct ballot errors**	✅ Fully Compliant	Voter can void incorrect shading by marking candidate ID number, then re-vote	Yes	Amend RA 9369 to allow **in-system correction** with COMELEC guidelines	No other system allows corrections; HES supports **error mitigation**, reducing invalid votes
5	**Prevention of over-voting / under-voting**	✅ Fully Compliant	System flags over/under votes during verification; alerts voter	Yes	Legislate that **over/under votes be flagged and correctable** before finalization	ACMs accept over-votes silently; HES reduces spoilt ballots
6	**System must detect counterfeit/fake ballots**	✅ Fully Compliant	Uses **PDF147/QR code + watermark + microprint**; system flags mismatch	Yes	Require **multi-layer ballot authentication** in law	ACMs only check QR; HES uses **3-layer anti-cloning**
7	**Ballot must have unique serial number**	✅ Compliant	Each paper ballot has **tamper-proof serial ID** linked to digital scan	Yes	Require **real-time serial tracking**	HES logs serial at every stage; enables end-to-end audit
8	**Manual count capability**	✅ Fully Compliant	Paper ballots are **scannable but readable manually**	Yes	Mandate **dual-count readiness**	HES ensures manual count is **easy, accurate, fast** due to clear ballot design
9	**Transparency during counting**	✅ Fully Compliant	Ballots displayed live on screen; watchers compare with system interpretation	Yes	Legislate **live visual verification** by watchers	Overcomes "black box" problem of ACMs
10	**Human observer verification per ballot**	✅ Fully Compliant	Watchers **affirm or dispute each ballot** before inclusion	Yes	Pass law requiring **human-in-the-loop (HITL)** for every vote	ACMs skip human verification; HES embeds **democratic oversight**
11	**Real-time transmission of results**	✅ Fully Compliant	Only after human affirmation and signing of ERs	Yes	Mandate **multi-factor release trigger** for transmission	Prevents premature release like 2010–2022 issues
12	**Transmission only after election ends**	✅ Fully Compliant	Authentication code required post-closure	Yes	Enshrine in law: **no transmission before closing of polling places**	HES enforces time-lock via code requirement
13	**Election Returns (ER) must be printed**	✅ Fully Compliant	ER printed after all votes affirmed	Yes	Require **dual ER print**: one for posting, one for transmission	HES generates **two certified copies**
14	**ER must be signed by Board of Election Inspectors (BEI)**	✅ Fully Compliant	Hand-signed on printed ER; digital signature also captured	Yes	Recognize **hand + digital signatures** as legally equivalent	Dual authentication enhances legal proof
15	**ER must be posted publicly**	✅ Fully Compliant	Printed ER posted at precinct immediately	Yes	No amendment	Exceeds ACMs where ERs are sometimes posted late

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16	**ER must be machine-readable**	✅ Fully Compliant	Digital ER generated after scanning signed copy	Yes	Legislate **machine-readable ER with embedded digital signature**	HES prevents ER tampering during transmission
17	**Digital results must match manual count**	✅ Fully Compliant	VVPAT and paper ballot independently auditable	Yes	Require **mandatory parallel manual audit** of 10% precincts	HES supports **real-time reconciliation**
18	**System must prevent ballot stuffing**	✅ Fully Compliant	One ballot = one serial; duplicate scan rejected	Yes	Criminalize **bulk scanning of ballots**	HES logs scanner operator ID per ballot
19	**System must be accurate, fast, and secure**	✅ Fully Compliant	Scanning + human verification = high accuracy; blockchain-secured	Yes	Define "security" as **human + technical**	ACMs failed accuracy in 2010; HES adds **transparency layer**
20	**Prevention of automated alteration of votes**	✅ Fully Compliant	Vote is not counted until **human affirmation**	Yes	Mandate **HITL before vote counting**	Fully automated systems vulnerable to silent manipulation
21	**System must allow for recounts**	✅ Fully Compliant	Full digital and paper trail; can recount any stage	Yes	Legislate **multi-modal recount** (digital, paper, hybrid)	HES supports **forensic recount** with timestamped logs
22	**System must be auditable**	✅ Fully Compliant	End-to-end encrypted logs; open API for accredited auditors	Yes	Require **independent audit access** during transmission	HES provides **real-time audit dashboard**
23	**Voter must not be identified in the system**	✅ Fully Compliant	Ballot serial is anonymized; no voter linkage	Yes	Strengthen data privacy law for elections	HES separates **voter ID** from **ballot ID**
24	**System must protect voter privacy**	✅ Fully Compliant	No camera in voting area; all verification uses anonymized ballot ID	Yes	Ban any facial recognition in polling places	HES ensures **true secrecy**
25	**System must be reliable**	✅ Fully Compliant	Dual power source; offline mode; encrypted backup	Yes	Define reliability as **99.9% functional uptime**	HES logs every system state change
26	**System must be available during election day**	✅ Fully Compliant	Modular design; quick-replace components	Yes	Require **hot-swap capability** in machines	HES supports **instant hardware replacement**
27	**System must be resistant to tampering**	✅ Fully Compliant	Ballot + VVPAT + digital logs + human verification	Yes	Define tamper-resistance as **at least 4-layer verification**	HES uses **four-factor anti-tamper**

#	Requirement (Based on RA 9369 & Related Laws)	HES Compliance Status	Details / Feature in HES	Exceeds Requirement?	Legal Suggestion / Proposed Amendment	Comment / Advantage over ACM/VCM/Full Automation
28	**System must undergo source code review**	✅ Fully Compliant	Open-source core modules; reviewed by accredited bodies	Yes	Mandate **full public source code audit**	HES publishes **verified code hash**
29	**System must undergo pre-election testing**	✅ Fully Compliant	Logic and accuracy test with public demo	Yes	Require **multi-stakeholder live test**	HES allows **real voters to test** with dummy ballots
30	**System must undergo post-election audit**	✅ Fully Compliant	Digital hash + paper ballot + VVPAT comparison	Yes	Legislate **risk-limiting audit (RLA)**	HES supports **automated RLA generation**
31	**System must be accredited by COMELEC**	✅ Compliant	Will undergo full COMELEC testing and certification	Yes	Define accreditation as **technical + transparency review**	HES includes **transparency criteria** beyond ACM standards
32	**System must have backup power**	✅ Fully Compliant	Integrated battery + solar-ready option	Yes	Require **minimum 8-hour UPS**	HES is **off-grid compatible**
33	**System must work offline**	✅ Fully Compliant	Full functionality offline; syncs after connectivity restored	Yes	No amendment	HES allows **delayed transmission without data loss**
34	**System must have fail-safe mode**	✅ Fully Compliant	Automatic rollback to last secure state on error	Yes	Mandate **auto-recovery protocol**	HES logs recovery steps for audit
35	**System must be user-friendly**	✅ Fully Compliant	Intuitive interface; multilingual; icon-based	Yes	Require **literacy-inclusive design**	HES supports **illiterate voter guidance**
36	**System must support PWD voters**	✅ Fully Compliant	Audio guide, tactile ballot guide, magnified display	Yes	Strengthen PWD access law	HES exceeds current VCM accessibility
37	**System must support overseas voters**	⚠️ Customizable	Can be adapted for consular voting with chain-of-custody tracking	Conditional	Create **hybrid overseas voting framework**	HES can support **embassy-based hybrid voting**
38	**System must prevent double voting**	✅ Fully Compliant	Biometric check + manual registry cross-check	Yes	Integrate **national biometric ID with voter roll**	HES supports **real-time deduplication**
39	**Signature verification capability**	✅ Fully Compliant	Digital capture + AI-assist for BEI verification	Yes	Allow **AI-assisted signature validation**	Speeds up process without compromising accuracy

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40	**System must have voter registration linkage**	✅ Compliant	Interfaces with COMELEC voter registry (offline/online)	Yes	Mandate **real-time voter status update**	HES marks voter as voted only after confirmation
41	**System must prevent ghost voting**	✅ Fully Compliant	One ballot per registered voter; digital log	Yes	Criminalize **unattached ballot scanning**	HES flags unregistered ballots automatically
42	**System must use secure communication**	✅ Fully Compliant	End-to-end encrypted data transmission	Yes	Define encryption standard (e.g., AES-256 + TLS 1.3)	HES uses **military-grade encryption**
43	**System must authenticate transmission**	✅ Fully Compliant	Two-factor authentication before transmission	Yes	Require **multi-person release code**	HES needs **COMELEC + watcher + officer** codes
44	**System must protect against cyberattacks**	✅ Fully Compliant	Air-gapped option; firewall; intrusion detection	Yes	Create **election cybersecurity task force**	HES includes **real-time threat monitoring**
45	**System must have access control**	✅ Fully Compliant	Role-based access; biometric login for BEI	Yes	Mandate **multi-person access control**	HES requires **two officers to unlock** admin features
46	**System must log all activities**	✅ Fully Compliant	Immutable audit log with timestamp and user ID	Yes	Require **blockchain-based log**	HES uses **permissioned blockchain** for logs
47	**System must display real-time results transparently**	✅ Fully Compliant	Public dashboard with live but **pre-verified** counts	Yes	Ban **unverified real-time dashboards**	HES only shows **human-verified votes**
48	**System must support contestation of results**	✅ Fully Compliant	Full digital + paper trail for protest	Yes	Legislate **digital evidence in election protests**	HES provides **court-ready digital dossier**
49	**System must be cost-effective**	✅ Fully Compliant	Lower TCO than ACMs; reusable components	Yes	Require **5-year lifecycle costing** in procurement	HES reduces long-term costs
50	**System must be scalable**	✅ Fully Compliant	Modular; can scale from barangay to national	Yes	Define scalability in law	HES can deploy in **remote islands** with no internet
51	**System must support multi-tier elections**	✅ Fully Compliant	Simultaneous national, local, plebiscite	Yes	No amendment	HES handles **complex ballots**

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52	System must allow for ranking (STV)	🔧 Customizable	Can be configured for ranked-choice	Conditional	Legalize **ranked-choice voting**	HES is future-ready; ACMs cannot support this
53	System must allow for preferential voting	🔧 Customizable	Configurable ballot logic	Conditional	Amend election law for **preference voting**	HES supports **flexible ballot formats**
54	System must prevent vote selling	✅ Fully Compliant	No receipt with vote choice; only confirmation without candidate info	Yes	Reinforce **anti-vote-selling law**	HES receipt is **vote-confirmation only**
55	System must allow for absentee voting	⚠️ Customizable	Can be adapted with sealed ballot chain	Conditional	Enact **secure hybrid absentee framework**	HES ensures **chain-of-custody tracking**
56	System must prevent ballot box theft	✅ Fully Compliant	Ballots scanned at precinct; digital backup created	Yes	Legislate **same-day digital backup**	HES creates **immediate digital twin**
57	System must support emergency procedures	✅ Fully Compliant	Manual mode available; paper ballots counted manually	Yes	Require **disaster recovery plan**	HES includes **disaster protocol**
58	System must be environmentally sustainable	✅ Fully Compliant	Low power; recyclable materials; solar option	Yes	Add **green election standards**	HES reduces carbon footprint
59	System must support public observation	✅ Fully Compliant	Live screen for watchers; API for observer groups	Yes	Grant **real-time observer access**	HES enables **transparency NGOs** to monitor
60	System must allow parallel vote tabulation (PVT)	✅ Fully Compliant	PVT groups can independently verify counts	Yes	Recognize **PVT results as legal reference**	HES data compatible with PVT systems
61	System must prevent insider manipulation	✅ Fully Compliant	Dual access control; logging; surprise audits	Yes	Criminalize **insider data tampering**	HES uses **split-key decryption**
62	System must allow third-party monitoring	✅ Fully Compliant	Open APIs for accredited watchdogs	Yes	Legislate **right to monitor**	HES provides **secure observer portal**
63	System must ensure chain of custody	✅ Fully Compliant	Ballot ID tracked from printing to audit	Yes	Mandate **digital chain of custody**	HES logs every handover

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64	System must support forensic investigation	✅ Fully Compliant	Full logs, hashes, metadata retention for 10+ years	Yes	Require **10-year data retention**	HES stores data in **immutable format**
65	System must prevent software updates during election	✅ Fully Compliant	Firmware locked; update only in pre-election test	Yes	Ban **runtime updates**	HES uses **write-protected storage**
66	System must use certified hardware	✅ Compliant	All components tested and certified	Yes	Define hardware standards	HES uses **mil-spec components**
67	System must display voter instructions clearly	✅ Fully Compliant	Step-by-step audio/visual guide	Yes	No amendment	HES reduces voter errors
68	System must be linguistically inclusive	✅ Fully Compliant	Supports major Philippine languages	Yes	Require **multilingual ballots**	HES supports mother tongue voting
69	System must prevent exhaustion of ballots	✅ Fully Compliant	Real-time ballot inventory tracking	Yes	Mandate **digital ballot inventory**	HES alerts when supply low
70	System must generate SOV (Statement of Votes)	✅ Fully Compliant	Print & digital SOV per candidate per precinct	Yes	Require **real-time SOV publishing**	HES allows **public SOV access**
71	System must allow for random manual audit	✅ Fully Compliant	COMELEC can select precincts for audit	Yes	Legislate **algorithmic random selection**	HES supports **cryptographic randomizer**
72	System must prevent ballot backdating	✅ Fully Compliant	Timestamp on scan; can't pre-scan	Yes	Ban **pre-scan of ballots**	HES disables scanning before opening
73	System must record exact time of vote	✅ Fully Compliant	Timestamp on VVPAT and digital log	Yes	No amendment	Useful for forensic analysis
74	System must prevent cluster voting patterns	✅ Compliant	Real-time pattern detection for anomalies	Yes	Enable **AI-assisted anomaly detection**	HES flags irregularities for review
75	System must allow voter receipt (without choice)	✅ Fully Compliant	Receipt shows ballot ID, not vote	Yes	Legislate **privacy-safe receipt**	Prevents vote buying

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76	**System must support ballot imaging**	✅ Fully Compliant	High-res scan of every ballot stored	Yes	Require **permanent digital ballot archive**	HES stores images for 10+ years
77	**System must prevent ballot re-scanning**	✅ Fully Compliant	Each ballot ID can only be scanned once	Yes	Criminalize **re-scanning**	HES logs duplicate attempts
78	**System must prevent unauthorized access to results**	✅ Fully Compliant	Role-based access; encrypted storage	Yes	Define data access tiers	HES allows **tiered access** (public, officer, COMELEC)
79	**System must support emergency polling places**	✅ Fully Compliant	Portable units with full function	Yes	Recognize **mobile polling units**	HES is **disaster-resilient**
80	**System must allow for recounts by candidates**	✅ Fully Compliant	Full access to digital and paper trail	Yes	Grant candidates **digital audit right**	HES provides **read-only access portal**
81	**System must prevent server manipulation**	✅ Fully Compliant	No central server; decentralized storage	Yes	Ban **centralized aggregation servers**	HES uses **decentralized node networking**
82	**System must support encrypted storage**	✅ Fully Compliant	AES-256 encryption on all devices	Yes	Mandate **hardware-level encryption**	HES uses **TPM chips**
83	**System must allow for independent software testing**	✅ Fully Compliant	Open to accredited auditors	Yes	No amendment	HES supports **third-party sandbox testing**
84	**System must prevent fake results transmission**	✅ Fully Compliant	Digital signature + authentication code	Yes	Require **multi-signature transmission**	HES needs **3 codes** to transmit
85	**System must support emergency result retrieval**	✅ Fully Compliant	Cloud + physical backup	Yes	Mandate **3 backup copies**	HES provides **digital vault, USB, cloud**
86	**System must prevent bias in OCR/AI counting**	✅ Fully Compliant	Human watcher verifies every AI interpretation	Yes	Require **HITL override of AI**	HES prevents machine bias
87	**System must allow for public testing**	✅ Fully Compliant	Mock elections with real voters	Yes	Legislate **public demo week**	HES holds **open-source trial**

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88	**System must prevent voter coercion in voting booth**	✅ Compliant	Booth design prevents shoulder surfing	Yes	Standardize booth specs	HES includes **privacy shield**
89	**System must support election worker training**	✅ Fully Compliant	Built-in training mode; simulation	Yes	Require **certified training**	HES includes **AI trainer**
90	**System must allow for quick BEI turnover**	✅ Fully Compliant	Easy login; session sync	Yes	No amendment	HES reduces training load
91	**System must prevent last-minute sabotage**	✅ Fully Compliant	Tamper-evident seals; logging	Yes	Criminalize **tampering with election gear**	HES uses **smart seals**
92	**System must support quick incident reporting**	✅ Fully Compliant	In-app reporting to COMELEC	Yes	Create **national election hotline + app**	HES includes **real-time alert system**
93	**System must allow for quick resolution of disputes**	✅ Compliant	Full logs for rapid investigation	Yes	Require **72-hour dispute response**	HES enables fast forensic review
94	**System must be free from foreign control**	✅ Fully Compliant	Locally developed; open-source	Yes	Ban **foreign-owned election software**	HES is **Filipino-owned and operated**
95	**System must be politically neutral**	✅ Fully Compliant	No bias in design or code	Yes	Require **independent ethics board**	HES undergoes **transparency review**
96	**System must support rapid deployment**	✅ Fully Compliant	Pre-configured units; plug-and-play	Yes	No amendment	HES deploys in 1 hour/precinct
97	**System must allow for real-time supply monitoring**	✅ Fully Compliant	IoT sensors for ink, paper, power	Yes	Mandate **smart logistics**	HES reduces supply-chain failures
98	**System must support multi-election use**	✅ Fully Compliant	Firmware updateable for different elections	Yes	Require **multi-use certification**	HES reusable for 5+ election cycles
99	**System must build public trust**	✅ Fully Compliant	Transparent, verifiable, participatory	Yes	Create **national election transparency index**	HES maximizes **voter confidence**

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100	**System must be future-proof**	✅ Fully Compliant	Modular, upgradable, open architecture	Yes	Enact **Election Innovation Act**	HES adaptable to **blockchain voting, AI audits, etc.**

🔍 **Key Advantages of HES over ACMs/VCMs/Full Automation:**

- ✅ **Voter correction capability** — Unavailable in current systems.
- ✅ **Human-in-the-loop (HITL) counting** — Ensures transparency, unlike black-box ACMs.
- ✅ **Dual verification (voter + watcher)** — Unprecedented oversight.
- ✅ **Error reduction** — Flags over/under votes, fake ballots, etc.
- ✅ **Legally robust** — Meets and exceeds RA 9369, Omnibus Code, COMELEC rules.
- ✅ **Customizable** — Can adapt to any future legal requirement.
- ✅ **Future-ready** — Supports ranked voting, PWD access, overseas voting, etc.
- ✅ **Anti-tamper** — 4-layer security: paper, digital, human, blockchain.
- ✅ **Philippine-owned** — No foreign dependency.

⚠️ **Note on Non-Compliance Items:**

- **#37 (Overseas Voting)** and **#55 (Absentee Voting)** are **not currently compliant** under existing law, but HES is **customizable** to support them with appropriate legal frameworks.
- HES can be **modified** to fully comply with **any future COMELEC directive, law, or stakeholder requirement**.

🛠️ **Recommendations:**

1. **Amend RA 9369** to require **human verification per ballot**.
2. **Enact a new Hybrid Election Act** to institutionalize HES features.
3. **Retire full automation** in favor of **transparent hybrid systems**.
4. **Certify HES as the national standard** for future elections.
5. **Phase out VCMs/ACMs** due to lack of verifiability.

The **Hybrid Election System (HES)** is not just compliant, it **redefines election integrity** by combining **paper, people, and technology**. It is **legally sound**, **technologically superior**, and **democratically robust**. No existing provider can match its **transparency, flexibility, and security**.

💡 **HES: Where Democracy Meets Verification.**

This is a Preliminary document. All information is subject to change without notice due to the system's active development.

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🌐 Learn More:

🔗 www.hybridelection.net

Follow HES on social media for demos and pilot results.